

# Oracle® Data Provider for .NET

## Developer's Guide



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Oracle Data Provider for .NET Developer's Guide, 21c

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# Preface

This document is your primary source of introductory, installation, postinstallation configuration, and usage information for Oracle Data Provider for .NET.

Oracle Data Provider for .NET is an implementation of the Microsoft ADO.NET interface.

This Preface contains these topics:

- [Audience](#)
- [Documentation Accessibility](#)
- [Related Documents](#)
- [Passwords in Code Examples](#)
- [Conventions](#)

## Audience

*Oracle Data Provider for .NET Developer's Guide* is intended for programmers who are developing applications to access an Oracle database using Oracle Data Provider for .NET. This documentation is also valuable to systems analysts, project managers, and others interested in the development of database applications.

To use this document, you must be familiar with Microsoft .NET Framework classes and ADO.NET and have a working knowledge of application programming using Microsoft C#, Visual Basic .NET, or another .NET language.

Although the examples in the documentation and the samples in the sample directory are written in C#, developers can use these examples as models for writing code in other .NET languages.

Users should also be familiar with the use of Structured Query Language (SQL) to access information in relational database systems.

## Documentation Accessibility

For information about Oracle's commitment to accessibility, visit the Oracle Accessibility Program website at <http://www.oracle.com/pls/topic/lookup?ctx=acc&id=docacc>.

### Access to Oracle Support

Oracle customers that have purchased support have access to electronic support through My Oracle Support. For information, visit <http://www.oracle.com/pls/topic/lookup?ctx=acc&id=info> or visit <http://www.oracle.com/pls/topic/lookup?ctx=acc&id=trs> if you are hearing impaired.

## Related Documents

For more information, see these Oracle resources:

- *Oracle Database Installation Guide for Microsoft Windows*
- *Oracle Database Release Notes*
- *Oracle Database Administrator's Guide*
- *Oracle Database Development Guide*
- *Oracle Database SecureFiles and Large Objects Developer's Guide*
- *Oracle Real Application Clusters Administration and Deployment Guide*
- *Oracle Database New Features Guide*
- *Oracle Database Concepts*
- *Oracle Database Reference*
- *Oracle Database Extensions for .NET Developer's Guide for Microsoft Windows*
- *Oracle Database Object-Relational Developer's Guide*
- *Oracle Database SQL Language Reference*
- *Oracle Database Net Services Administrator's Guide*
- *Oracle Database Net Services Reference*
- *Oracle Call Interface Programmer's Guide*
- *Oracle Services for Microsoft Transaction Server Developer's Guide for Microsoft Windows*
- *Oracle Database Globalization Support Guide*
- *Oracle XML DB Developer's Guide*
- *Oracle XML Developer's Kit Programmer's Guide*
- *Oracle Database Security Guide*
- *Oracle Spatial Developer's Guide*
- *Oracle Data Guard Concepts and Administration*

To download free release notes, installation documentation, white papers, or other collateral, please visit the Oracle Technology Network (OTN). You must register online before using OTN; registration is free and can be done at

<http://www.oracle.com/technetwork/index.html>

If you already have a username and password for OTN, then you can go directly to the documentation section of the OTN Web site at

<http://docs.oracle.com/database/122/index.htm>

For additional information, see:

<https://msdn.microsoft.com/en-us/default.aspx>

and

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<http://msdn.microsoft.com/library>

## Passwords in Code Examples

For simplicity in demonstrating this product, code examples do not perform the password management techniques that a deployed system normally uses. In a production environment, follow the Oracle Database password management guidelines, and disable any sample accounts. See *Oracle Database Security Guide* for password management guidelines and other security recommendations.

## Conventions

The following text conventions are used in this document:

Convention	Meaning
<b>boldface</b>	Boldface type indicates graphical user interface elements associated with an action, or terms defined in text or the glossary.
<i>italic</i>	Italic type indicates book titles, emphasis, or placeholder variables for which you supply particular values.
monospace	Monospace type indicates commands within a paragraph, URLs, code in examples, text that appears on the screen, or text that you enter.

# Changes in This Release for Oracle Data Provider for .NET

This section describes new features added for each ODP.NET release. A summary of these new features by release are also available on [Oracle's Web site](#).

- [Changes in Oracle Data Provider for .NET Release 21c \(21.12\)](#)
- [Changes in Oracle Data Provider for .NET Release 21c \(21.8\)](#)
- [Changes in Oracle Data Provider for .NET Release 21c \(21.7\)](#)
- [Changes in Oracle Data Provider for .NET Release 21c \(21.6.1\)](#)
- [Changes in Oracle Data Provider for .NET Release 21c \(21.5\)](#)
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- [Changes in Oracle Data Provider for .NET \(21.1\)](#)
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- [Changes in Oracle Data Provider for .NET ODAC Release 19c \(19.3.2\)](#)
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- [Changes in Oracle Data Provider for .NET in ODAC Release 19c \(19.3\)](#)
- [Changes in Oracle Data Provider for .NET Release 19c \(19.3\)](#)
- [Changes in Oracle Data Provider for .NET in ODAC Release 18c \(18.3\)](#)
- [Changes in Oracle Data Provider for .NET Release 18c \(18.3\)](#)
- [Changes in Oracle Data Provider for .NET in ODAC 12.2c Release 1](#)
- [Changes in Oracle Data Provider for .NET Release 12.2.0.1](#)

## Changes in Oracle Data Provider for .NET Release 21c (21.12)

The following are the changes in Oracle Data Provider for .NET for Release 21c (21.12).

## New Features

The following features are new in this release:

- .NET 8 Runtime  
ODP.NET Core is certified for .NET 8.
- Entity Framework Core 8  
ODP.NET Entity Framework (EF) Core now supports Entity Framework Core 8 with Oracle databases. ODP.NET EF Core 21.12.1 or higher is required.

## Changes in Oracle Data Provider for .NET Release 21c (21.8)

The following are the changes in Oracle Data Provider for .NET for Release 21c (21.8).

## New Features

The following features are new in this release:

- .NET 7 Runtime  
ODP.NET Core is certified for .NET 7.
- Entity Framework Core 7  
ODP.NET Entity Framework (EF) Core now supports Entity Framework Core 7 with Oracle databases. Entity Framework Core is a cross-platform Microsoft object-relational mapper that enables .NET developers to work with relational databases using .NET objects.

## Changes in Oracle Data Provider for .NET Release 21c (21.7)

The following are the changes in Oracle Data Provider for .NET for Release 21c (21.7).

## New Features

The following feature is new in this release:

- Managed ODP.NET and ODP.NET Core -- Azure Active Directory  
Managed ODP.NET and ODP.NET Core 21.7 support Azure Active Directory (AAD) authentication when connecting to Oracle Database. ODP.NET will then use an access token to authenticate instead of an username and password.  
This feature benefits applications and services that use AAD for centralized user authentication with Oracle database. Those services can include Azure and Microsoft 365-based cloud services, such as Microsoft Power BI service, that rely on AAD for user management.

Using token-based authentication is more secure and simpler for the end user. It becomes unnecessary to specify credentials each time the user accesses a resource. Moreover, the resource never needs to handle and manage individual user credentials.

**See Also:**

[Using Azure Active Directory](#)

## Changes in Oracle Data Provider for .NET Release 21c (21.6.1)

The following are the changes in Oracle Data Provider for .NET for Release 21c (21.6.1).

### New Features

The following feature is new in this release:

- Managed ODP.NET and ODP.NET Core - Oracle Identity and Access Management Cloud Service Enhancements

ODP.NET adds more support for Oracle Identity and Access Management (IAM) cloud service for unified identity across Oracle cloud services for the managed and core drivers. ODP.NET can use the same Oracle IAM credentials for authentication and authorization.

This capability allows single sign-on and for identity to be propagated to all services Oracle IAM supports. A unified identity makes user management and account management easier for administrators and end users.

Managed ODP.NET adds support for IAM database password verifier, token, and database alternate password for token authentication.

ODP.NET Core already has support for IAM database password verifier and token. This new version adds database alternate password for token authentication in ODP.NET Core.

**See Also:**

[Connecting to Oracle Autonomous Database](#)

- ODP.NET Core - Multi-Platform Secure External Password Store

The Secure External Password Store (SEPS) is the use of a client-side wallet for securely storing the password credentials. ODP.NET Core can now be configured to use the external password store on any operating system it supports beyond just Windows.

An Oracle wallet is a container that securely stores authentication and signing credentials. Wallets can simplify large-scale deployments that rely on password credentials for database connections. Applications no longer need embedded user names and passwords, which reduces security risk.

**See Also:**[Using Secure External Password Store](#)

## Changes in Oracle Data Provider for .NET Release 21c (21.5)

The following are the changes in Oracle Data Provider for .NET for Release 21c (21.5).

### New Features

The following feature is new in this release:

- Unmanaged ODP.NET – One-way TLS/SSL with Built-in Truspoints (Walletless)  
Unmanaged ODP.NET now supports one-way Transport Layer Security/Secure Sockets Layer without wallets. Not having to provide a wallet can simplify database connectivity, such as with Oracle Autonomous Database.

## Changes in Oracle Data Provider for .NET Release 21c (21.4.1)

The following are the changes in Oracle Data Provider for .NET for Release 21c (21.4.1).

### New Features

The following features are new in this release:

- .NET 6 Runtime Certification  
ODP.NET Core is certified for .NET 6.
- Entity Framework Core 6  
ODP.NET Entity Framework (EF) Core now supports Entity Framework Core 6 with Oracle databases. Entity Framework Core is a cross-platform Microsoft object-relational mapper that enables .NET developers to work with relational databases using .NET objects.
- ODP.NET Core - Oracle Identity and Access Management Cloud Service  
ODP.NET supports Oracle Identity and Access Management (IAM) cloud service for unified identity across Oracle cloud services, including Oracle Cloud Database Services, with the core driver. ODP.NET can use the same Oracle IAM credentials for authentication and authorization.  
  
This capability allows single sign-on and for identity to be propagated to all services Oracle IAM supports. A unified identity makes user management and account management easier for administrators and end users.

**See Also:**[Connecting to Oracle Autonomous Database](#)

## Changes in Oracle Data Provider for .NET Release 21c (21.4)

The following are the changes in Oracle Data Provider for .NET for Release 21c (21.4).

### New Features

The following features are new in this release:

- Managed ODP.NET and ODP.NET Core – One-way TLS/SSL with Built-in Truspoints (Walletless)  
ODP.NET core and managed now support one-way Transport Layer Security/Secure Sockets Layer without wallets. Not having to provide a wallet can simplify database connectivity, such as with Oracle Autonomous Database.
- ODP.NET Core -- Ubuntu and Debian Linux  
ODP.NET Core add certification for additional Linux distributions: Ubuntu and Debian.

**See Also:**[System Requirements](#)

## Changes in Oracle Data Provider for .NET Release 21c (21.3)

The following are the changes in Oracle Data Provider for .NET for Release 21c (21.3).

### New Features

The following feature is new in this release:

- Managed ODP.NET and ODP.NET Core – User-Defined Types  
ODP.NET Core and managed providers now support user-defined types (UDT), including Oracle Collections (VARRAY and nested tables), Oracle Objects, and references (REF) to object types. These new features provide near-parity functionality with existing ODP.NET, Unmanaged Driver UDT functionality. This new enhancement allows the vast majority of unmanaged ODP.NET applications to migrate to managed ODP.NET or ODP.NET Core easily with minimal code changes necessary.

**See Also:**[Oracle User-Defined Types \(UDTs\) and .NET Custom Types](#)

- OracleConfiguration SqlnetURI Setting

ODP.NET `OracleConfiguration SqlnetURI` property is being renamed to `SqlNetURI`. This setting specifies the WebSocket universal resource identifier. The change reflects improved adherence to .NET's PascalCasing capitalization convention. If you currently use the property, then please modify your code accordingly.

## Deprecated Features

The following property and setting are deprecated in Oracle Data Provider for .NET for Release 21c:

- `OracleConfiguration DirectoryType` property
- Configuration file `DIRECTORY_TYPE` setting

The `OracleConfiguration DirectoryServerType` property replaces the `DirectoryType` property. The .NET configuration file `DIRECTORY_SERVER_TYPE` setting replaces the `DIRECTORY_TYPE` setting. All these properties have identical functionality. Oracle recommends developers to use and migrate to the new properties. The `DirectoryServerType` and `DIRECTORY_SERVER_TYPE` names better align with the `ldap.ora` parameter `DIRECTORY_SERVER_TYPE`, which provides equivalent functionality.

- [Deprecation of Oracle Database Extensions for .NET](#)

### See Also:

- *Oracle Database Upgrade Guide* for a complete list of deprecated features.

## Deprecation of Oracle Database Extensions for .NET

Oracle Database Extensions for .NET is deprecated in Oracle Database 21c. Oracle recommends that you either place .NET code in the middle tier, or use the External Procedures feature, or rewrite the code using PL/SQL or Java.

Oracle Database Extensions for .NET is a feature of Oracle Database on Microsoft Windows that enables you to use stored procedures and functions written in a language managed by .NET, such as C#.

Oracle Database hosts the Microsoft Common Language Runtime (CLR) in an external process, outside of the Oracle Database process. Application developers can write stored procedures and functions using any .NET compliant language, such as C# and VB.NET, and use these .NET stored procedures in the database, in the same manner as other PL/SQL or Java stored procedures. .NET stored procedures can be called from PL/SQL packages, procedures, functions, and triggers; from SQL statements; or from anywhere a PL/SQL procedure or function can be called.

Migration options include:

- Moving the .NET code (assemblies) into a middle tier
- Using the External Procedures feature to have the external process load and execute the .NET assembly

- Rewriting the stored procedures using PL/SQL or Java

## Changes in Oracle Data Provider for .NET (21.1)

The following are the changes in Oracle Data Provider for .NET (21.1).

### New Features

The following features are new in this release:

- Entity Framework Core 5

ODP.NET Entity Framework (EF) Core now supports Entity Framework Core 5 with Oracle databases. Entity Framework Core is a cross-platform Microsoft object-relational mapper that enables .NET developers to work with relational databases using .NET objects.

#### See Also:

[Oracle Data Provider for .NET Entity Framework Core](#)

- Oracle Database JSON Data Type

ODP.NET supports the native JavaScript Object Notation (JSON) data type in Oracle Database. The new JSON data type is optimized for query and DML processing, yielding database performance improvements processing JSON.

When using a .NET string or `OracleString`, JSON data can be bound as a parameter using the `OracleDbType.Json` enumeration value. ODP.NET Core, managed, and unmanaged all support these new JSON features.

- Client Initiated Continuous Query Notification

Client Initiated Continuous Query Notification (CICQN) is similar to the traditional Continuous Query Notification (CQN) feature available in ODP.NET. In CQN, applications receive client-side notifications when server side change occurs that would affect the client's query result set, the underlying schema objects, or the database state. This notification is out of process, occurring without an existing ODP.NET connection.

CICQN uses in-process notifications. ODP.NET creates one separate connection per pool for receiving notifications. The database server uses this specific connection to send change notifications to ODP.NET. CICQN is useful when out of process communications is not available between client and database server, such as in cloud deployments.

#### See Also:

[Client Initiated Continuous Query Notifications](#)

- Managed ODP.NET and ODP.NET Core – Sharding

ODP.NET Core and managed providers now support sharding. Oracle Sharding provides the ability to horizontally partition the data across multiple independent Oracle databases (shards). Based on a key specified in the connect string, ODP.NET can route the database requests to a particular shard. Oracle Sharding is a shared-nothing architecture

that allows near-linear scaling of the database across low-cost commodity database servers located in one or more local or global data centers. Other key benefits include global data distribution (store particular data close to consumers) and fault containment (failure of one shard does not affect the availability of other shards). Global Data Services manages the location of data among the shards and allows ODP.NET client requests to be routed to the appropriate shard in this distributed database system.

In addition to the same sharding functionality that unmanaged ODP.NET supports, ODP.NET managed and core also support pausing connection requests during chunk migrations. Users will not experience a timeout without giving the chunk migration sufficient times to move across shards.

 **See Also:**

[Database Sharding](#)

- **New Administrative Privileges**

ODP.NET now supports assignment of task-specific and least-privileged administrative privileges to enable database administrative duty separation. The newly added privileges include `SYSBACKUP` for backup and recovery, `SYSDBG` for Oracle Data Guard, `SYSKM` for encryption key management, and `SYSRAC` for Oracle Real Applications Clusters operations. Core, managed, and unmanaged ODP.NET support all these administrative privileges.

 **See Also:**

[OracleDBAPrivilege Enumeration](#)

- **Managed ODP.NET and ODP.NET Core-- Debug Tracing Redaction**

Managed ODP.NET and ODP.NET Core has introduced a new trace level, that can exclude SQL statements and network packet contents from being included in the trace file.

 **See Also:**

[Debug Tracing](#)

## Changes in Oracle Data Provider for .NET (19.15.1)

The following are the changes in Oracle Data Provider for .NET (19.15.1).

### New Features

The following feature is new in this release:

- Azure Active Directory

Starting with ODP.NET 21.7 and 19.15.1, ODP.NET supports Azure Active Directory (AAD) authentication when connecting to Oracle Database. ODP.NET will then use an access token to authenticate instead of a username and password.

This feature benefits applications and services that use AAD for centralized user authentication with Oracle database. Those services can include Azure and Microsoft 365-based cloud services, such as Microsoft Power BI service, that rely on AAD for user management.

Using token-based authentication is more secure and simpler for the end user. It becomes unnecessary to specify credentials each time the user accesses a resource. Moreover, the resource never needs to handle and manage individual user credentials.

 **See Also:**

[Using Azure Active Directory.](#)

## Changes in Oracle Data Provider for .NET (19.10)

The following are the changes in Oracle Data Provider for .NET (19.10).

### New Features

The following features are new in this release:

- .NET 5 Runtime Certification

ODP.NET Core is certified for .NET 5.

- Managed ODP.NET and ODP.NET Core -- Bulk Copy

ODP.NET Bulk Copy enables applications to efficiently load large amounts of data from a table in one database to another table in a different database. Managed ODP.NET and ODP.NET Core now support Bulk Copy and all its APIs.

ODP.NET Bulk Copy is the most optimized .NET solution when a large data set needs to be loaded into a table or between database tables in different databases.

 **See Also:**

[Bulk Copy](#)

- Oracle Provider Types Deserialization into DataSet and DataTable

Due to a change in all .NET versions to enhance application security, the allowed `DataSet` and `DataTable` data types that can be deserialized are now restricted. This change applies to .NET 5, .NET Core, and .NET Framework with new updates. If application `DataSets` and `DataTables` use ODP.NET data types with one of these newer .NET versions, then they may encounter an ODP.NET type initializer exception. To avoid this exception, developers can add ODP.NET-specific data types to the “allow” list to permit deserialization into `DataSet` or `DataTable`.

To do this, call the `OracleConfiguration.AddOracleTypesDeserialization` method or add the types individually via a .NET configuration file.

 **See Also:**[Deserializing ODP.NET Types into DataSet and DataTable](#)

- ODP.NET Core -- KeepAlive on non-Windows platforms

`KeepAlive` is supported on non-Windows operating systems, such as Oracle Linux. In previous releases, ODP.NET Core supported these `KeepAlive` properties for Windows platforms only. The properties include `KeepAlive`, `KeepAliveInterval`, and `KeepAliveTime`.

`KeepAlive` is used to prevent idle TCP connections from being closed, such as by a firewall or load balancer. In some cloud deployments, this idle TCP connection timeout cannot be changed. `KeepAlive` will keep the connection alive by periodically sending a probe packet with no data in it and the ACK flag turned on.

 **See Also:**[OracleConnection Properties](#)

- Suppress GetDecimal Invalid Cast Exception

The `SuppressGetDecimalInvalidCastException` property has been added to the `OracleDataReader` and `OracleDataAdapter` classes. When enabled and `GetDecimal` is called on the `OracleDataReader` object explicitly by the application or implicitly through the `Fill()` method on the `OracleDataAdapter` object, for example, it suppresses the `InvalidCastException` and returns a rounded-off 28 or 29 precision .NET decimal value, that represents the Oracle `NUMBER`.

 **See Also:**[SuppressGetDecimalInvalidCastException](#)

- ODP.NET Core -- LDAP for Non-Windows Platforms

ODP.NET Core now supports connecting with net service names mapped to connect descriptors in an LDAP-compliant directory server from all non-Windows operating systems the provider supports, such as Oracle Linux and Red Hat Enterprise Linux. Now ODP.NET Core apps on all platforms can use LDAP authentication to connect to Oracle Database.

## Changes in Oracle Data Provider for .NET (19.9)

The following are the changes in Oracle Data Provider for .NET (19.9).

### New Features

The following feature is new in this release:

- In-Band Fast Application Notification

In some scenarios, such as cloud deployments and when firewalls block notification messages between the database and client, out of band messages and using Oracle Notification Service may not be possible. ODP.NET can use in-band FAN notifications instead in these scenarios. In-band notifications rely on existing ODP.NET connections to communicate messages. ODP.NET will check for notifications every time a connection makes a database round trip, is checked in, or checked out. When a DOWN notification is received, ODP.NET will scan the pool for affected connections and close them.

This feature was introduced with managed ODP.NET and ODP.NET Core in 19.9. It was introduced in unmanaged ODP.NET in 19.10.

**See Also:**

[In-Band Fast Application Notification](#)

## Changes in Oracle Data Provider for .NET ODAC Release 19c (19.3.2)

The following are the changes in Oracle Data Provider for .NET for ODAC Release 19c (19.3.2).

### New Features

The following features are new in this release:

- Entity Framework Core 3.1

ODP.NET Entity Framework (EF) Core now supports Entity Framework Core 3.1 with Oracle databases. Entity Framework Core is a cross-platform Microsoft object-relational mapper that enables .NET developers to work with relational databases using .NET objects. This ODP.NET EF Core release adds support for relational views and materialized views. These views can be read-only or updatable.

Oracle EF Core 3.1 developers can now create and migrate data models in the Oracle Database. They can scaffold EF Core classes based on an Oracle Database schema objects. They can migrate and scaffold with Oracle views. Oracle EF Core is integrated with popular EF Core tools, such as the EF Core Package Manager Tools.

**See Also:**

[Oracle Data Provider for .NET Entity Framework Core](#)

## Changes in Oracle Data Provider for .NET (19.7)

The following are the changes in Oracle Data Provider for .NET (19.7).

### New Features

The following features are new in this release:

- Managed ODP.NET and ODP.NET Core -- Administer Storage using SYSASM Privilege

Oracle Automatic Storage Management (Oracle ASM) is a volume manager and a file system for Oracle database files. `SYSASM` is a system privilege that enables administrators to manage ASM instances. Managed ODP.NET and ODP.NET Core can now connect using the `SYSASM` administrative privilege to perform storage management of the Oracle Database.

ODP.NET can now perform database ASM administration when connecting with a `SYSASM` privileged connection.

 **See Also:**

[OracleDBAPrivilege Enumeration](#)

- WebSocket and WebSocket with SSL/TLS

WebSocket is a protocol that offers full-duplex communication channels over a single TCP connection. WebSocket with SSL/TLS offers a secure WebSocket connection. WebSocket is an extension to HTTP and is able to work with HTTP proxies and intermediaries. ODP.NET Core, managed, and unmanaged providers all support WebSocket and secure WebSocket protocols.

 **See Also:**

[Using WebSocket](#)

## Changes in Oracle Data Provider for .NET (19.6)

The following are the changes in Oracle Data Provider for .NET (19.6).

### New Features

The following features are new in this release:

- .NET Core 3.1 Certification  
ODP.NET Core is certified for .NET Core 3.1.
- Linux 8 Certification  
ODP.NET Core is certified on Oracle Linux 8 and Red Hat Enterprise Linux 8.
- Entity Framework 6.4 Certification  
Managed and unmanaged ODP.NET Entity Framework is certified for Entity Framework 6.4.

## Changes in Oracle Data Provider for .NET (19.5)

The following are the changes in Oracle Data Provider for .NET (19.5).

## New Features

The following features are new in this release:

- .NET Core 3 Certification  
ODP.NET Core is certified for .NET Core 3.
- Entity Framework Core 2.1 Certification  
ODP.NET Entity Framework Core is certified for EF Core 2.1.

## Changes in Oracle Data Provider for .NET in ODAC Release 19c (19.3)

The following are the changes in Oracle Data Provider for .NET for ODAC Release 19c (19.3).

## New Features

The following features are new in this release:

- Entity Framework Core  
ODP.NET Entity Framework (EF) Core is a database provider that allows Entity Framework Core to be used with Oracle databases. Entity Framework Core is a cross-platform Microsoft object-relational mapper that enables .NET developers to work with relational databases using .NET objects.

Oracle EF Core developers can now create and migrate data models in the Oracle Database. They can reverse engineer/scaffold EF Core classes based on an Oracle Database schema. Oracle EF Core is integrated with popular EF Core tools, such as the EF Core Package Manager Tools.



### See Also:

[Oracle Data Provider for .NET Entity Framework Core](#)

- Managed ODP.NET and ODP.NET Core -- More Configuration Options with New `OracleConnection` Properties  
`OracleConnection` class introduces additional properties to configure ODP.NET connections. The new properties are:
  - `KeepAlive`, `KeepAliveInterval`, and `KeepAliveTime` - specifies whether and the conditions under which to keep idle connections alive
  - `TnsAdmin` - specifies the `tnsnames.ora` and `sqlnet.ora` directory
  - `WalletLocation` - specifies the wallet directory location

 **Note:**[OracleConnection Class](#)

- Unmanaged ODP.NET -- Administer Storage using SYSASM Privilege

Oracle Automatic Storage Management (Oracle ASM) is a volume manager and a file system for Oracle database files. SYSASM is a system privilege that enables administrators to manage ASM instances. Unmanaged ODP.NET can now connect using the SYSASM administrative privilege to perform storage management of the Oracle Database.

ODP.NET can now perform database ASM administration when connecting with a SYSASM privileged connection.

 **Note:**[OracleDBAPrivilege Enumeration](#)

- Dynamically Enabled Tracing and Size Limits

To improve diagnostics ease of use and productivity, ODP.NET trace output can now be enabled and disabled at runtime using the `OracleConfiguration.TraceLevel` property. To keep trace files down to a manageable size, the `TraceFileMaxSize` property can be set.

Administrators can isolate tracing to only known times or events when problems occur. This feature helps keep trace files down to the minimum size needed to investigate issues. If a trace file does become large, ODP.NET will write to a new trace file once the maximum file limit that is set in `TraceFileMaxSize` is reached. These features are available with core, managed, and unmanaged providers.

 **See Also:**

- [Debug Tracing](#)
- [OracleConfiguration Debug Tracing Properties](#)

## Changes in Oracle Data Provider for .NET Release 19c (19.3)

The following are the changes in Oracle Data Provider for .NET for Release 19c (19.3).

### New Features

The following features are new in this release:

- .NET Framework 4.8 Certification

ODP.NET Core, Managed, and Unmanaged Drivers are certified with .NET Framework 4.8.

- ODP.NET, Managed Driver -- Configuration as Code

Managed ODP.NET now supports `OracleConfiguration`, `OracleDataSourceCollection`, and `OracleOnsServerCollection` classes.

These classes allow developers to configure managed ODP.NET within source code in lieu of .NET configuration and Oracle configuration files.

- ODP.NET Core -- Lightweight Directory Access Protocol (LDAP)

ODP.NET Core can use connect identifiers mapped to connect descriptors in an LDAP-compliant directory server, such as Oracle Internet Directory and Microsoft Active Directory. The provider supports the same LDAP features and settings as managed ODP.NET.

ODP.NET Core LDAP support is available on Windows operating systems only. It requires the `System.DirectoryServices` namespace.

 See Also:

[OracleConfiguration Directories Properties](#)

- ODP.NET Core -- Performance Counters

ODP.NET Core can publish key runtime connection counters to Windows Performance Monitor or a file. The provider supports the same counters, setup process, and settings as managed and unmanaged ODP.NET.

ODP.NET Core performance counters are available on Windows operating systems only. They require `System.Diagnostics` namespace in using performance counters programmatically.

 See Also:

[Connection Performance Counters](#)

- Easy Connect Plus

Oracle Easy Connect Plus provides a simple way to configure TCP/IP connections to the Oracle Database without having to use parameter files, such as `tnsnames.ora`, nor environment variables. Easy Connect Plus includes support for:

- TCP/IP with SSL/TLS
- Any SQL\*Net description level parameter can be used
- Multiple hosts and ports
- A straightforward name-value pair format

Easy Connect Plus supports more configurations and a wider breadth of ODP.NET applications than traditional Easy Connect, including clustered or cloud databases.

**See Also:**

[Easy Connect and Easy Connect Plus Naming Methods](#)

- More Secure Oracle Notification Service Connections

ODP.NET now enables Oracle Notification Service (ONS) communications to occur over TCP/IP with SSL/TLS (TCPS), which is more secure than just TCP/IP. As TCPS requires using a wallet for storing keys and certificates, ODP.NET can use one wallet for both ONS and ODP.NET connections or have separate wallets for each.

TCPS provides more secure ONS communication, gives administrators flexibility in how to configure their wallets, and enables cloud database connections.

## Changes in Oracle Data Provider for .NET in ODAC Release 18c (18.3)

The following are the changes in Oracle Data Provider for .NET for ODAC Release 18c (18.3).

### New Features

The following features are new in this release:

- .NET Core 2.1 Certification  
ODP.NET Core is certified for .NET Core 2.1 and higher.  
See Also [Installing Oracle Data Provider for .NET Core](#)

## Changes in Oracle Data Provider for .NET Release 18c (18.3)

The following are the changes in Oracle Data Provider for .NET for Release 18c (18.3).

### New Features

The following features are new in this release:

- .NET Framework 4.7.x Certification  
ODP.NET, Managed and Unmanaged Drivers are certified for all versions of .NET Framework 4.7.x, including 4.7.1 and 4.7.2.
- Secure Passwords with `OracleCredential`  
ODP.NET `OracleCredential` class allows application developers to store user names and passwords outside of the connection string without exposure in a memory dump.  
`OracleCredential` can be used with or without connection pooling.

This feature is available in the terminal releases of ODP.NET 11.2, 12.1, and 12.2 and with the first release of ODP.NET 18c.

See Also [Connection Pooling with OracleCredential](#)

## Desupported Features

Some features previously described in this document are desupported in Oracle Database 18c (18.3). See *Oracle Database Upgrade Guide* for a complete list of desupported features.

The following feature is no longer supported by Oracle:

- `Oracle.ManagedDataAccessDTC.dll`

## Changes in Oracle Data Provider for .NET in ODAC 12.2c Release 1

The following are the changes in Oracle Data Provider for .NET for ODAC 12.2c Release 1.

### New Features

The following features are new in this release:

- .NET Framework 4.7 Certification  
ODP.NET, Managed and Unmanaged Drivers are certified for .NET Framework 4.7.
- Entity Framework 6.2 Certification  
ODP.NET, Managed and Unmanaged Drivers are certified for Entity Framework 6.2.
- Database Resident Connection Pooling  
Database Resident Connection Pooling (DRCP) optimizes resource usage by pooling connections at the database server level. With DRCP, server connections can be shared across application that are executed on different client machines, especially in the case when connections are not always in use. DRCP can be used in conjunction with either managed or unmanaged ODP.NET client side pooling to improve scalability and lower resource usage at the database server level.  
See also [Database Resident Connection Pooling](#) for more information.
- Multitenant and Pluggable Databases Connection Pooling  
Oracle Multitenant is a database architecture that enables customers to easily consolidate multiple pluggable databases without changing their application. This architecture delivers all the benefits of managing many databases as one, yet retains the isolation and resource prioritization of separate databases.  
Managed and unmanaged ODP.NET now support hosting connections to multiple pluggable databases from the same connection pool. This feature enhances application performance and scalability, plus makes using multiple pluggable databases from the same application easier.  
See also [Oracle Multitenant and Pluggable Databases](#) for more information.
- Edition-Based Redefinition Connection Pooling

Edition-based redefinition enables applications to upgrade the database component while it is in use, thereby minimizing or eliminating down time. Managed and unmanaged ODP.NET now support using the same connection pool to connect to multiple Editions. This feature enhances performance and scalability while using different Editions from the same application, and also makes using multiple Editions from the same application easier.

See also [Edition-Based Redefinition](#) for more information.

- Connection Configuration Upon Open

Managed and unmanaged ODP.NET introduce the `ConnectionOpen` event handler, which allows developers to provide setup logic and change settings before ODP.NET connections are dispensed from the `Open()` method invocation. This feature is similar in concept to a logon trigger, but is most optimal for client side initialization settings. It works with both pooled and non-pooled connections. The event handler provides a centralized, standardized location for connection initialization.

See also [ConnectionOpen](#) for more information.

## Deprecated Features

The following feature is deprecated in ODAC 12.2c Release 1:

- `Oracle.ManagedDataAccessDTC.dll`

### See Also:

- [Microsoft Distributed Transaction Coordinator Integration](#)
- *Oracle Database Upgrade Guide* for a complete list of deprecated features.

## Changes in Oracle Data Provider for .NET Release 12.2.0.1

The following are the changes in Oracle Data Provider for .NET for Release 12.2.0.1.

### New Features

The following features are new in this release:

- .NET Framework 4.6.2 Certification

ODP.NET, Managed and Unmanaged Drivers are certified for .NET Framework 4.6.2.

See also [System Requirements](#) for more information.

- .NET Cloud Development and Deployment

ODP.NET, Managed and Unmanaged Drivers can be deployed easily to Oracle Cloud, private clouds, and third-party cloud environments through Web Deploy. All ODP.NET specific settings no longer require any operating system level configuration. These settings can be made in the .NET configuration files.

Managed and Unmanaged ODP.NET Drivers now share a unified configuration file format.

- Application Continuity

Application Continuity recovers incomplete requests from an ODP.NET, Unmanaged Driver perspective and masks many system failures, communication failures, hardware failures, and storage outages from the user.

See also "[Application Continuity](#)" for more information.

- Sharding and ODP.NET Routing

Starting from Release 12.2.0.1, ODP.NET, Unmanaged Driver and Oracle Database support sharding. Oracle Sharding provides the ability to horizontally partition the data across multiple independent Oracle databases (shards). Based on a key specified in the connect string, ODP.NET can route the database requests to a particular shard.

Oracle Sharding is a shared-nothing architecture that allows near-linear scaling of the database across low-cost commodity database servers located in one or more local or global data centers. Other key benefits include global data distribution (store particular data close to consumers) and fault containment (failure of one shard does not affect the availability of other shards). Global Data Services manages the location of data among the shards and allows ODP.NET client requests to be routed to the appropriate shard in this distributed database system.

See also "[Database Sharding](#)" for more information.

- Longer Schema Identifiers

Oracle Data Provider for .NET now supports schema object identifier names, such as tables, columns, views, stored procedures, and functions, up to 128 characters in length. This feature is available in both ODP.NET, Managed and Unmanaged Drivers.

- ODP.NET, Managed Driver – Data Integrity

ODP.NET, Managed Driver supports cryptographic hash functions to better ensure data integrity between the database server and the client. The algorithms supported include MD5, SHA-1, and SHA-2 (SHA-256, SHA-384, and SHA-512).

See also "[settings section](#)" and "[Network Data Encryption and Integrity](#)" for more information.

- ODP.NET, Managed Driver -- Transport Layer Security (TLS)

ODP.NET, Managed Driver has added support for TLS 1.1 and 1.2 in addition to existing support for TLS 1.0 and SSL 3.0.

- ODP.NET, Managed Driver -- Distinguished Name for SSL/TLS

ODP.NET, Managed Driver connections using SSL/TLS can ensure that the distinguished name (DN) is correct for the database server that it is trying to connect to.

- ODP.NET, Managed Driver - Boolean Data Type

ODP.NET, Managed Driver now supports the `OracleBoolean` data type when using the database's PL/SQL `Boolean` data type. The managed driver must be connected to Oracle Database 12c Release 2 (12.2) or higher. Booleans store `TRUE` or `FALSE` values.

The ODP.NET `OracleBoolean` data type eases parameter binding and data type mapping setup with Boolean values.

See also "[OracleBoolean Structure](#)" for more information.

## Desupported Features

Some features previously described in this document are desupported in Oracle Database 12c Release 2 (12.2). See *Oracle Database Upgrade Guide* for a complete list of desupported features in this release.

The following features are no longer supported by Oracle:

- `OracleLogicalTransactionStatus` **class**
- `OracleConnection.GetLogicalTransactionStatus` **method**
- `OracleConnection.LogicalTransactionId` **property**
- `OracleConnection.OracleLogicalTransaction` **property**
- `OracleLogicalTransaction.DataSource` **property**
- `OracleLogicalTransaction.GetOutcome()` **method**
- `OracleLogicalTransaction.GetOutcome(string, string, string)` **method**
- `OracleLogicalTransaction.UserId` **property**

# 1

## Introducing Oracle Data Provider for .NET

This chapter introduces Oracle Data Provider for .NET (ODP.NET), an implementation of a .NET data provider for Oracle Database.

This chapter contains these topics:

- [.NET Data Access in Oracle: Products and Documentation](#)
- [Overview of Oracle Data Provider for .NET \(ODP.NET\)](#)
- [Oracle Data Provider for .NET Assemblies](#)
- [Differences between the ODP.NET Drivers](#)
- [Getting Started With Developing ODP.NET Applications](#)

### .NET Data Access in Oracle: Products and Documentation

This section discusses Oracle Data Provider for .NET and Oracle Database components that use Oracle Data Provider for .NET for data access. It briefly describes what each component does and where to find additional documentation.

These Oracle products provide .NET integration on the Windows operating system:

### Oracle Data Provider for .NET (ODP.NET)

Oracle Data Provider for .NET provides fast data access from .NET clients to Oracle databases. ODP.NET enables .NET applications to take advantage of Oracle advanced features, such as Oracle Real Application Clusters (Oracle RAC) and XML DB. It is accessible through any .NET language, including C#, Visual Basic .NET, and C++ .NET.

ODP.NET consists of three drivers: ODP.NET, Managed Driver, ODP.NET, Unmanaged and ODP.NET Core. ODP.NET, Managed Driver is a fully managed ADO.NET provider, consisting of fewer DLLs and smaller install size than ODP.NET, Unmanaged Driver. The managed driver has the same exact application programming interfaces (APIs) as ODP.NET, Unmanaged Driver. However, the managed driver's APIs are a subset of the Unmanaged Driver's APIs.

ODP.NET Core is a multi-platform provider for Microsoft .NET Core. In functionality, it is very similar to ODP.NET, Managed Driver. However, ODP.NET Core has a subset of managed ODP.NET's APIs.

This guide describes Oracle Data Provider for .NET features, their use, installation, requirements, and classes. The guide distinguishes which classes and APIs are supported for the managed driver, unmanaged driver, .NET stored procedures, and .NET clients.

Additionally, Oracle Data Provider for .NET Dynamic Help, which is context-sensitive online help, contains the same reference sections available in *Oracle Data Provider for .NET Developer's Guide for Microsoft Windows*, this guide.

Oracle Data Provider for .NET Dynamic Help is integrated with Visual Studio Dynamic Help. With Dynamic Help, you can access Oracle Data Provider for .NET documentation within

Visual Studio by placing the cursor on an Oracle Data Provider for .NET keyword and pressing the F1 function key.

## Oracle Developer Tools for Visual Studio

Oracle Developer Tools is an add-in to Visual Studio that provides graphical user interface (GUI) access to Oracle functionality. It provides improved developer productivity and ease of use. Oracle Developer Tools provide the ability to build .NET stored procedures using Visual Basic .NET, C#, and other .NET languages.

Oracle Developer Tools for Visual Studio Help describes Oracle Developer Tools. This help is in the form of dynamic help, which installs as part of the product.

Additionally, the Oracle Developer Tools for Visual Studio Help includes the following documentation:

- *Oracle Database PL/SQL Language Reference*
- *Oracle Database SQL Language Reference*
- *Oracle Database Extensions for .NET Developer's Guide for Microsoft Windows*
- *Oracle Database Error Messages Reference*
- Access to Oracle Data Provider for .NET Dynamic Help
- Access to Oracle Providers for ASP.NET Dynamic Help

## Oracle Database Extensions for .NET

Oracle Database Extensions for .NET provides the following:

- Hosting of Microsoft Common Language Runtime (CLR) in an external process on the server side, to execute .NET stored procedures.
- ODP.NET data access on the server side, from within the .NET stored procedure.

*Oracle Data Provider for .NET Developer's Guide for Microsoft Windows* describes all ODP.NET classes. Classes that are not supported by Oracle Database Extensions for .NET are described as *Not Supported in a .NET Stored Procedure*.



### See Also:

- Oracle Developer Tools for Visual Studio Help
- *Oracle Database Extensions for .NET Developer's Guide for Microsoft Windows* for more information about Oracle Database Extensions for .NET features, their use, installation, and requirements.
- "[Oracle Data Provider for .NET Assemblies](#)" for class listings
- [Oracle Data Provider for .NET Stored Procedures](#)

## Oracle Providers for ASP.NET

Oracle Providers for ASP.NET offer ASP.NET developers an easy to use method to store state common to web applications within an Oracle database. These providers

are modeled on existing Microsoft ASP.NET providers, sharing similar schema and programming interfaces to provide .NET developers a familiar interface. Oracle supports the following providers:

- Cache Dependency Provider
- Membership Provider
- Profile Provider
- Role Provider
- Session State Provider
- Site Map Provider
- Web Events Provider
- Web Parts Personalization Provider

Oracle Providers for ASP.NET classes, their use, installation, and requirements are described in *Oracle Providers for ASP.NET Developer's Guide for Microsoft Windows*, which is also provided as dynamic help.

## Oracle Services for Microsoft Transaction Server

Oracle Services for Microsoft Transaction Server (OraMTS) permit Oracle databases to be used as resource managers in Microsoft application coordinated transactions. OraMTS acts as a proxy for the Oracle database to the Microsoft Distributed Transaction Coordinator (MSDTC). As a result, OraMTS provides client-side connection pooling and allows client components that leverage Oracle to participate in promotable and distributed transactions. In addition, OraMTS can operate with Oracle databases running on any operating system, given that the services themselves are run on Windows.



### See Also:

*Oracle Services for Microsoft Transaction Server Developer's Guide for Microsoft Windows* for description about OraMTS, which allows Oracle databases to be used as resource managers in distributed transactions.

## Oracle TimesTen In-Memory Database

ODP.NET support for Oracle TimesTen In-Memory Database (TimesTen) provides fast and efficient ADO.NET data access for applications that require the highest performance.

You can use ODP.NET with any of the following TimesTen installations:

- TimesTen Data Manager only (for direct connections)
- TimesTen Client only (for client/server connections, assuming a TimesTen Data Manager instance and TimesTen Server instance are accessible elsewhere)
- TimesTen Data Manager with TimesTen Server

For more information on ODP.NET features specific to a TimesTen environment, refer to the *Oracle Data Provider for .NET Oracle TimesTen In-Memory Database Support User's Guide*.



**Note:**

TimesTen does not support ODP.NET, Managed Driver and ODP.NET Core.

## Overview of Oracle Data Provider for .NET (ODP.NET)

Oracle Data Provider for .NET (ODP.NET) is an implementation of a .NET data provider for Oracle Database, using and inheriting from classes and interfaces available in the [Microsoft .NET Framework Class Library](#).

Following the .NET Framework, ODP.NET uses the ADO.NET model, which allows native providers to expose provider-specific features and data types. This is similar to Oracle Provider for OLE DB, where ADO (ActiveX Data Objects) provides an automation layer that exposes an easy programming model. ADO.NET provides a similar programming model, but without the automation layer, for better performance.

Oracle Data Provider for .NET uses Oracle native APIs to offer fast and reliable access to Oracle data and features from any .NET application. ODP.NET consists of three drivers: ODP.NET, Managed Driver, ODP.NET, Unmanaged Driver, and ODP.NET Core. ODP.NET, Managed Driver is a fully managed ADO.NET provider, consisting of fewer DLLs and smaller install size than ODP.NET, Unmanaged Driver. The managed driver has the same exact application programming interfaces (APIs) as ODP.NET, Unmanaged Driver. However, the managed driver's APIs are a subset of the Unmanaged Driver's APIs.

ODP.NET Core employs the same namespaces and application programming interfaces (APIs) as ODP.NET, Managed Driver. This parallel eases migration and developer learning curve from managed ODP.NET to ODP.NET Core. It does not support all managed ODP.NET functionality. ODP.NET Core supports a subset of managed ODP.NET APIs. These differences are listed later on in this documentation.

The ODP.NET classes described in this guide are contained in the `Oracle.DataAccess.dll` and `Oracle.ManagedDataAccess.dll` assembly.

- Client Applications: All ODP.NET classes are available for use in client applications.

As ODP.NET, Managed Driver does not support all classes and members in the ODP.NET, Unmanaged Driver, the unsupported managed driver classes and members will be labeled *Not Supported in ODP.NET, Managed Driver*.

ODP.NET Core does not support all classes and members in the ODP.NET, Managed Driver. The unsupported managed driver classes and members will be labeled *Not Supported in ODP.NET Core*.

- .NET Stored Procedures: Most ODP.NET classes can be used from within .NET stored procedures and functions. Those classes which cannot, are labeled *Not Supported in a .NET Stored Procedure*. Additionally, some classes contain members which may not be supported, and this is so indicated in the member tables that follow the class descriptions, and listed in Chapter 4 of this guide.

 **See Also:**

- [Table 6-1](#)
- ["Oracle Data Provider for .NET Assemblies"](#) for class lists
- [Oracle Data Provider for .NET Stored Procedures](#)
- *Oracle Database Extensions for .NET Developer's Guide for Microsoft Windows* for more information about .NET stored procedures and functions

## Oracle Data Provider for .NET Assemblies

This section contains the following topics:

- [Oracle Data Provider for .NET, Unmanaged Driver Assemblies](#)
- [Oracle Data Provider for .NET, Managed Driver and ODP.NET Core Assemblies](#)
- [Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces](#)
- [Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces](#)

### Oracle Data Provider for .NET, Unmanaged Driver Assemblies

The `Oracle.DataAccess.dll` [assembly](#) provides two namespaces:

- The `Oracle.DataAccess.Client` namespace contains ODP.NET classes and enumerations for the client-side provider.
- The `Oracle.DataAccess.Types` namespace contains the Oracle Data Provider for .NET data types (ODP.NET Types).

To use Code First or Entity Framework 6 or higher with ODP.NET, Unmanaged Driver, add `Oracle.DataAccess.EntityFramework.dll` as a project assembly reference. It contains the namespace `Oracle.DataAccess.EntityFramework`.

### Oracle Data Provider for .NET, Managed Driver and ODP.NET Core Assemblies

The `Oracle.ManagedDataAccess.dll` [assembly](#) provides two namespaces:

- The `Oracle.ManagedDataAccess.Client` namespace contains ODP.NET classes and enumerations for the client-side provider.
- The `Oracle.ManagedDataAccess.Types` namespace contains the Oracle Data Provider for .NET data types (ODP.NET Types).

ODP.NET, Managed Driver contains additional assemblies. These assemblies are optional to install if not using the specific functionality.

Applications do not need to explicitly add these assemblies to their project. ODP.NET, Managed Driver will access these assemblies by default if installed.

The one exception is `Oracle.ManagedDataAccess.EntityFramework.dll`. That DLL must be explicitly added to a project for its functionality to be used.

- `Oracle.ManagedDataAccess.EntityFramework.dll` - Only required when using Code First or Entity Framework 6 or higher. It contains the `Oracle.ManagedDataAccess.EntityFramework` namespace.
- `Oracle.ManagedDataAccessIOP.dll` - Only required when using Kerberos. The assembly has 32-bit and x64 versions depending on the .NET Framework's bitness in which it runs. The assembly makes calls to unmanaged assemblies. Applications do not need to explicitly add this assembly to their project as ODP.NET is already configured to access this assembly by default.

## Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces

The `Oracle.DataAccess.Client` and `Oracle.ManagedDataAccess.Client` namespaces contains implementations of core ADO.NET classes and enumerations for ODP.NET, as well as ODP.NET specific classes.

The following tables list ODP.NET classes, enumerations, and types that are supported by the `Oracle.DataAccess.Client` and `Oracle.ManagedDataAccess.Client` namespaces. The tables indicate which of them are not supported by ODP.NET, Managed Driver, ODP.NET Core and/or by .NET stored procedures. All are supported by ODP.NET, Unmanaged Driver.

## Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client

Table 1-1 lists the `Oracle.DataAccess.Client` and `Oracle.ManagedDataAccess.Client` classes and delegates.

**Table 1-1 Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client**

Class or Delegate	Supported in the ODP.NET, Managed Driver	Supported in the ODP.NET Core	Supported in .NET Stored Procedures	Description
<a href="#">OnChangeEventHandler Delegate</a>	-	-	No	The <code>OnChangeEventHandler</code> event delegate represents the signature of the method that handles the notification.
<a href="#">OracleAQAgent Class</a>	No	No	-	The <code>OracleAQAgent</code> class represents agents that may be senders or recipients of a message.
<a href="#">OracleAQDequeueOptions Class</a>	No	No	-	An <code>OracleAQDequeueOptions</code> object represents the options available when dequeuing a message from an <code>OracleAQQueue</code> object.

**Table 1-1 (Cont.) Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client**

Class or Delegate	Supported in the ODP.NET, Managed Driver	Supported in the ODP.NET Core	Supported in .NET Stored Procedures	Description
<a href="#">OracleAQEnqueueOptions Class</a>	No	No	-	The <code>OracleAQEnqueueOptions</code> class represents the options available when enqueueing a message to an <code>OracleAQQueue</code> .
<a href="#">OracleAQMessage Class</a>	No	No	-	An <code>OracleAQMessage</code> object represents a message to be enqueued and dequeued.
<a href="#">OracleAQMessageAvailableEventArgs Class</a>	No	No	-	The <code>OracleAQMessageAvailableEventArgs</code> class provides event data for the <code>OracleAQQueue.MessageAvailable</code> event.
<a href="#">OracleAQMessageAvailableEventHandler Delegate</a>	No	No	-	The <code>OracleAQMessageAvailableEventHandler</code> delegate represents the signature of the method that handles the <code>OracleAQQueue.MessageAvailable</code> event.
<a href="#">OracleAQQueue Class</a>	No	No	-	An <code>OracleAQQueue</code> object represents a queue.
<a href="#">OracleBulkCopy Class</a>	-	-	-	An <code>OracleBulkCopy</code> object efficiently bulk loads or copies data into an Oracle table from another data source.

**Table 1-1 (Cont.) Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client**

Class or Delegate	Supported in the ODP.NET, Managed Driver	Supported in the ODP.NET Core	Supported in .NET Stored Procedures	Description
<a href="#">OracleBulkCopyColumnMapping Class</a>	-	-	-	The <code>OracleBulkCopyColumnMapping</code> class defines the mapping between a column in the data source and a column in the destination database table.
<a href="#">OracleBulkCopyColumnMappingCollection Class</a>	-	-	-	The <code>OracleBulkCopyColumnMappingCollection</code> class represents a collection of <code>OracleBulkCopyColumnMapping</code> objects that are used to map columns in the data source to columns in a destination table.
<a href="#">OracleClientFactory Class</a>	-	No	-	An <code>OracleClientFactory</code> object allows applications to instantiate ODP.NET classes in a generic way.
<a href="#">OracleCommand Class</a>	-	-	-	An <code>OracleCommand</code> object represents a SQL command, a stored procedure or function, or a table name.
<a href="#">OracleCommandBuilder Class</a>	-	-	-	An <code>OracleCommandBuilder</code> object provides automatic SQL generation for the <code>OracleDataAdapter</code> when the database is updated.

Table 1-1 (Cont.) Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client

Class or Delegate	Supported in the ODP.NET, Managed Driver	Supported in the ODP.NET Core	Supported in .NET Stored Procedures	Description
<a href="#">OracleConfiguration Class</a>	-	-	-	An OracleConfiguration is a static class for setting ODP.NET Core configuration data using a single programming interface.
<a href="#">OracleConnection Class</a>	-	-	-	An OracleConnection object represents a connection to Oracle Database.
<a href="#">OracleConnectionOpenEventArgs Class</a>	-	-	-	An OracleConnectionOpenEventArgs object provides connection information for the OracleConnection.Open() method.
<a href="#">OracleConnectionOpenEventHandler Delegate</a>	-	-	-	The OracleConnectionOpenEventHandler delegate represents the signature of the method that handles OracleConnection.ConnectionOpen event.
<a href="#">OracleConnectionStringBuilder Class</a>	-	-	-	An OracleConnectionStringBuilder object allows applications to create or modify connection strings.
<a href="#">OracleCredential Class</a>	-	-	-	OracleCredential class provides a secure way to provide password while opening connection with Oracle Database using the ODP.NET driver

**Table 1-1 (Cont.) Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client**

Class or Delegate	Supported in the ODP.NET, Managed Driver	Supported in the ODP.NET Core	Supported in .NET Stored Procedures	Description
<a href="#">OracleDataAdapter Class</a>	-	-	-	An <code>OracleDataAdapter</code> object represents a data provider object that communicates with the <code>DataSet</code> .
<a href="#">OracleDatabase Class</a>	No	No	-	An <code>OracleDatabase</code> object represents an Oracle Database instance.
<a href="#">OracleDataReader Class</a>	-	-	-	An <code>OracleDataReader</code> object represents a forward-only, read-only, in-memory result set.
<a href="#">OracleDataSourceCollection Class</a>	-	-	-	An <code>OracleDataSourceCollection</code> object supports adding and deleting network service name (i.e. TNS) entries in the <code>OracleDataSourceCollection</code> .
<a href="#">OracleDataSourceEnumerator Class</a>	-	-	-	An <code>OracleDataSourceEnumerator</code> object allows applications to generically obtain a collection of data sources to connect to.
<a href="#">OracleDependency Class</a>	-	-	No	An <code>OracleDependency</code> class represents a dependency between an application and an Oracle database.
<a href="#">OracleError Class</a>	-	-	-	The <code>OracleError</code> object represents an error reported by an Oracle database.
<a href="#">OracleErrorCollection Class</a>	-	-	-	An <code>OracleErrorCollection</code> object represents a collection of <code>OracleErrors</code> .

Table 1-1 (Cont.) Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client

Class or Delegate	Supported in the ODP.NET, Managed Driver	Supported in the ODP.NET Core	Supported in .NET Stored Procedures	Description
<a href="#">OracleException Class</a>	-	-	-	The <code>OracleException</code> object represents an exception that is thrown when Oracle Data Provider for .NET encounters an error.
<a href="#">OracleFailoverEventArgs Class</a>	No	No	No	The <code>OracleFailoverEventArgs</code> class provides event data for the <code>OracleConnection.Failover</code> event.
<a href="#">OracleFailoverEventHandler Delegate</a>	No	No	No	The <code>OracleFailoverEventHandler</code> represents the signature of the method that handles the <code>OracleConnection.Failover</code> event.
<a href="#">OracleGlobalization Class</a>	-	-	-	The <code>OracleGlobalization</code> class is used to obtain and set the Oracle globalization settings of the session, thread, and local computer (read-only).
<a href="#">OracleHAEventArgs Class</a>	-	-	-	The <code>OracleHAEventArgs</code> class provides event data for the <code>OracleConnection.HAEvent</code> event.
<a href="#">OracleHAEventHandler Delegate</a>	-	-	-	The <code>OracleHAEventHandler</code> delegate represents the signature of the method that handles the <code>OracleConnection.HAEvent</code> event.

**Table 1-1 (Cont.) Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client**

Class or Delegate	Supported in the ODP.NET, Managed Driver	Supported in the ODP.NET Core	Supported in .NET Stored Procedures	Description
<a href="#">OracleInfoMessageEventArgs Class</a>	-	-	-	The <code>OracleInfoMessageEventArgs</code> object provides event data for the <code>OracleConnection.InfoMessage</code> event.
<a href="#">OracleInfoMessageEventHandler Delegate</a>	-	-	-	The <code>OracleInfoMessageEventHandler</code> delegate represents the signature of the method that handles the <code>OracleConnection.InfoMessage</code> event.
<a href="#">OracleLogicalTransaction Class</a>	-	-	-	The <code>OracleLogicalTransaction</code> class provides detailed information about the logical transaction status.
<a href="#">OracleNotificationEventArgs Class</a>	-	-	-	The <code>OracleNotificationEventArgs</code> class provides event data for a notification.
<a href="#">OracleNotificationRequest Class</a>	-	-	No	An <code>OracleNotificationRequest</code> class represents a notification request to be subscribed in the database.

Table 1-1 (Cont.) Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client

Class or Delegate	Supported in the ODP.NET, Managed Driver	Supported in the ODP.NET Core	Supported in .NET Stored Procedures	Description
<a href="#">OracleOnsServerCollection Class</a>	-	-	-	The <code>OracleOnsServerCollection</code> class supports adding to and deleting from a collection of logical servers with their corresponding list of nodes where the Oracle Notification Service (ONS) daemons are talking to their remote clients.
<a href="#">OracleParameter Class</a>	-	-	-	An <code>OracleParameter</code> object represents a parameter for an <code>OracleCommand</code> .
<a href="#">OracleParameterCollection Class</a>	-	-	-	An <code>OracleParameterCollection</code> object represents a collection of <code>OracleParameters</code> .
<a href="#">OraclePermission Class</a>	-	No	-	An <code>OraclePermission</code> object enables ODP.NET to enforce imperative security and helps ensure that a user has a security level adequate for accessing data.
<a href="#">OraclePermissionAttribute Class</a>	-	No	-	An <code>OraclePermissionAttribute</code> object enables ODP.NET to enforce declarative security and helps ensure that a user has a security level adequate for accessing data.

**Table 1-1 (Cont.) Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client**

Class or Delegate	Supported in the ODP.NET, Managed Driver	Supported in the ODP.NET Core	Supported in .NET Stored Procedures	Description
<a href="#">OracleRowsCopiedEventHandler Delegate</a>	No	No	-	The <code>OracleRowsCopiedEventHandler</code> delegate represents the method that handles the <code>OracleRowsCopied</code> event of an <code>OracleBulkCopy</code> object.
<a href="#">OracleRowsCopiedEventArgs Class</a>	No	No	-	The <code>OracleRowsCopiedEventArgs</code> class represents the set of arguments passed as part of event data for the <code>OracleRowsCopied</code> event.
<a href="#">OracleRowUpdatedEventArgs Class</a>	-	-	-	The <code>OracleRowUpdatedEventArgs</code> object provides event data for the <code>OracleDataAdapter.RowUpdated</code> event.
<a href="#">OracleRowUpdatedEventHandler Delegate</a>	-	-	-	The <code>OracleRowUpdatedEventHandler</code> delegate represents the signature of the method that handles the <code>OracleDataAdapter.RowUpdated</code> event.
<a href="#">OracleRowUpdatingEventArgs Class</a>	-	-	-	The <code>OracleRowUpdatingEventArgs</code> object provides event data for the <code>OracleDataAdapter.RowUpdating</code> event.

**Table 1-1 (Cont.) Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client**

Class or Delegate	Supported in the ODP.NET, Managed Driver	Supported in the ODP.NET Core	Supported in .NET Stored Procedures	Description
<a href="#">OracleRowUpdatingEventHandler Delegate</a>	-	-	-	The <code>OracleRowUpdatingEventHandler</code> delegate represents the signature of the method that handles the <code>OracleDataAdapter.RowUpdating</code> event.
<a href="#">OracleShardingKey Class</a>	-	-	-	An <code>OracleShardingKey</code> object can represent either a sharding key or a super sharding key.
<a href="#">OracleTransaction Class</a>	-	-	No	An <code>OracleTransaction</code> object represents a local transaction.
<a href="#">OracleXmlQueryProperties Class</a>	-	-	-	An <code>OracleXmlQueryProperties</code> object represents the XML properties used by the <code>OracleCommand</code> class when the <code>XmlCommandType</code> property is <code>Query</code> .
<a href="#">OracleXmlSaveProperties Class</a>	-	-	-	An <code>OracleXmlSaveProperties</code> object represents the XML properties used by the <code>OracleCommand</code> class when the <code>XmlCommandType</code> property is <code>Insert</code> , <code>Update</code> , or <code>Delete</code> .

## Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Enumerations

[Table 1-2](#) lists the client enumerations.

**Table 1-2 Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Enumerations**

Enumeration	Supported in the ODP.NET, Managed Driver and ODP.NET Core	Supported in .NET Stored Procedures	Description
<a href="#">FailoverEvent Enumeration</a>	No	No	<code>FailoverEvent</code> enumerated values are used to specify the state of the failover.
<a href="#">FailoverReturnCode Enumeration</a>	No	No	<code>FailoverReturnCode</code> enumerated values are passed back by the application to the ODP.NET provider to request a retry in case of a failover error, or to continue in case of a successful failover.
<a href="#">FailoverType Enumeration</a>	No	No	<code>FailoverType</code> enumerated values are used to indicate the type of failover event that was raised.
<a href="#">OracleAQDequeueMode Enumeration</a>	No	-	The <code>OracleAQDequeueMode</code> enumeration type specifies the dequeue mode.
<a href="#">OracleAQMessageDeliveryMode Enumeration</a>	No	-	The <code>OracleAQMessageDeliveryMode</code> enumeration type specifies the delivery mode of the message.
<a href="#">OracleAQMessageState Enumeration</a>	No	-	The <code>OracleAQMessageState</code> enumeration type identifies the state of the message at the time of dequeue.
<a href="#">OracleAQMessageType Enumeration</a>	No	-	The <code>OracleAQMessageType</code> enumeration type specifies the message payload type.
<a href="#">OracleAQNavigationMode Enumeration</a>	No	-	The <code>OracleAQNavigationMode</code> enumeration type specifies the navigation mode.
<a href="#">OracleAQNotificationGroupingType Enumeration</a>	No	-	The <code>OracleAQNotificationGroupingType</code> enumeration type specifies the notification grouping type.
<a href="#">OracleAQNotificationType Enumeration</a>	No	-	The <code>OracleAQNotificationType</code> enumeration type specifies the notification type of the received notification.

**Table 1-2 (Cont.) Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Enumerations**

Enumeration	Supported in the ODP.NET, Managed Driver and ODP.NET Core	Supported in .NET Stored Procedures	Description
<a href="#">OracleAQVisibilityMode Enumeration</a>	No	-	The <code>OracleAQVisibilityMode</code> enumeration type specifies whether the enqueue or dequeue operation is part of the current transaction.
<a href="#">OracleBulkCopyOptions Enumeration</a>	No	-	The <code>OracleBulkCopyOptions</code> enumeration specifies the values that can be combined with an instance of the <code>OracleBulkCopy</code> class and used as options to determine its behavior and the behavior of the <code>WriteToServer</code> methods for that instance.
<a href="#">OracleCollectionType Enumeration</a>	-	No	<code>OracleCollectionType</code> enumerated values specify whether or not the <code>OracleParameter</code> object represents a collection, and if so, specifies the collection type.
<a href="#">OracleConnectionType Enumeration</a>	No	-	<code>OracleConnectionType</code> enumerated values specify whether a particular connection object is associated with an Oracle database connection, a TimesTen database connection, or no physical connection at all.
<a href="#">OracleDBShutdownMode Enumeration</a>	No	-	<code>OracleDBShutdownMode</code> enumerated values specify the database shutdown options.
<a href="#">OracleDBStartupMode Enumeration</a>	No	-	<code>OracleDBStartupMode</code> enumerated values specify the database startup options.
<a href="#">OracleDbType Enumeration</a>	-	-	<code>OracleDbType</code> enumerated values are used to explicitly specify the <code>OracleDbType</code> of an <code>OracleParameter</code> .
<a href="#">OracleDRCPpurity Enumeration</a>	-	-	<code>OracleDRCPpurity</code> enumerated values specify the session purity.
<a href="#">OracleHAEventSource Enumeration</a>	-	-	The <code>OracleHAEventSource</code> enumeration indicates the source of the HA event.

**Table 1-2 (Cont.) Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Enumerations**

Enumeration	Supported in the ODP.NET, Managed Driver and ODP.NET Core	Supported in .NET Stored Procedures	Description
<a href="#">OracleHAEventStatus Enumeration</a>	-	-	The <code>OracleHAEventStatus</code> enumeration indicates the status of the HA event source.
<a href="#">OracleIdentityType Enumeration</a>	-	-	The <code>OracleIdentityType</code> enumeration specifies how Oracle identity column values are generated.
<a href="#">OracleNotificationInfo Enumeration</a>	-	No	<code>OracleNotificationInfo</code> enumerated values specify the database event that causes the notification.
<a href="#">OracleNotificationSource Enumeration</a>	-	No	<code>OracleNotificationSource</code> enumerated values specify the different sources that cause notification.
<a href="#">OracleNotificationType Enumeration</a>	-	No	<code>OracleNotificationType</code> enumerated values specify the different types that cause the notification.
<a href="#">OracleParameterStatus Enumeration</a>	-	-	The <code>OracleParameterStatus</code> enumeration type indicates whether a <code>NULL</code> value is fetched from a column, or truncation has occurred during the fetch, or a <code>NULL</code> value is to be inserted into a database column.
<a href="#">OracleRowidInfo Enumeration</a>	-	-	The <code>OracleRowidInfo</code> enumeration values specify whether <code>ROWID</code> information is included as part of the <code>ChangeNotificationEventArgs</code> or not.
<a href="#">OracleXmlCommandType Enumeration</a>	-	-	The <code>OracleXmlCommandType</code> enumeration specifies the values that are allowed for the <code>OracleXmlCommandType</code> property of the <code>OracleCommand</code> class.

## Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces

The `Oracle.DataAccess.Types` and `Oracle.ManagedDataAccess.Types` namespaces provides classes, structures, and exceptions for Oracle native types that can be used with Oracle Data Provider for .NET.

## Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Structures

[Table 1-3](#) lists the type structures.

**Table 1-3 Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Structures**

Structure	Description
<a href="#">OracleBinary Structure</a>	The <code>OracleBinary</code> structure represents a variable-length stream of binary data.
<a href="#">OracleBoolean Structure</a>	The <code>OracleBoolean</code> structure represents a logical value that is either TRUE or FALSE.
<a href="#">OracleDate Structure</a>	The <code>OracleDate</code> structure represents the Oracle DATE data type.
<a href="#">OracleDecimal Structure</a>	The <code>OracleDecimal</code> structure represents an Oracle NUMBER in the database or any Oracle numeric value.
<a href="#">OracleIntervalDS Structure</a>	The <code>OracleIntervalDS</code> structure represents the Oracle INTERVAL DAY TO SECOND data type.
<a href="#">OracleIntervalYM Structure</a>	The <code>OracleIntervalYM</code> structure represents the Oracle INTERVAL YEAR TO MONTH data type.
<a href="#">OracleString Structure</a>	The <code>OracleString</code> structure represents a variable-length stream of characters.
<a href="#">OracleTimeStamp Structure</a>	The <code>OracleTimeStamp</code> structure represents the Oracle TimeStamp data type.
<a href="#">OracleTimeStampLTZ Structure</a>	The <code>OracleTimeStampLTZ</code> structure represents the Oracle TIMESTAMP WITH LOCAL TIME ZONE data type.
<a href="#">OracleTimeStampTZ Structure</a>	The <code>OracleTimeStampTZ</code> structure represents the Oracle TIMESTAMP WITH TIME ZONE data type.

## Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Exceptions

Type Exceptions are thrown only by ODP.NET type structures. [Table 1-4](#) lists the type exceptions.

**Table 1-4 Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Exceptions**

Exception	Description
<a href="#">OracleTypeException Class</a>	The <code>OracleTypeException</code> object is the base exception class for handling exceptions that occur in the ODP.NET Types classes.
<a href="#">OracleNullValueException Class</a>	The <code>OracleNullValueException</code> represents an exception that is thrown when trying to access an ODP.NET Types structure that is null.
<a href="#">OracleTruncateException Class</a>	The <code>OracleTruncateException</code> class represents an exception that is thrown when truncation in an ODP.NET Types class occurs.

## Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Classes

Table 1-5 lists the type classes.

**Table 1-5 Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Classes**

Class	Description
<a href="#">OracleArrayMappingAttribute Class</a>	The <code>OracleArrayMappingAttribute</code> class is required to mark a custom class field or property with information that ODP.NET uses when a custom type represents an Oracle Collection type.
<a href="#">OracleBFile Class</a>	An <code>OracleBFile</code> is an object that has a reference to BFILE data. It provides methods for performing operations on BFILE objects.
<a href="#">OracleBlob Class</a>	An <code>OracleBlob</code> object is an object that has a reference to BLOB data. It provides methods for performing operations on BLOB objects.

Table 1-5 (Cont.) Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Classes

Class	Description
<a href="#">OracleClob Class</a>	An <code>OracleClob</code> is an object that has a reference to <code>CLOB</code> data. It provides methods for performing operations on <code>CLOB</code> objects.
<a href="#">OracleCustomTypeMappingAttribute Class</a>	The <code>OracleCustomTypeMappingAttribute</code> class is used to mark a custom type factory class or struct with information that is used by ODP.NET when a custom type is used to represent an Oracle UDT.
<a href="#">OracleObjectMappingAttribute Class</a>	The <code>OracleObjectMappingAttribute</code> class marks custom class fields or properties with information that ODP.NET uses when a custom type represents an Oracle Object type.
<a href="#">OracleRef Class</a>	An <code>OracleRef</code> instance represents an Oracle <code>REF</code> , which references a persistent, standalone, referenceable object that resides in the database. The <code>OracleRef</code> object provides methods to insert, update, and delete the Oracle <code>REF</code> .
<a href="#">OracleRefCursor Class</a>	An <code>OracleRefCursor</code> object represents an Oracle <code>REF CURSOR</code> .
<a href="#">OracleUdt Class</a>	The <code>OracleUdt</code> class defines static methods that are used when converting between Custom Types and Oracle UDTs and vice-versa.

**Table 1-5 (Cont.) Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Classes**

Class	Description
<a href="#">OracleXmlStream Class</a>	An <code>OracleXmlStream</code> object represents a sequential read-only stream of XML data stored in an <code>OracleXmlType</code> object.
<a href="#">OracleXmlType Class</a>	An <code>OracleXmlType</code> object represents an Oracle <code>XmlType</code> instance.

## Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Interfaces

[Table 1-6](#) lists the type interfaces.

**Table 1-6 Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Interfaces**

Interface	Description
<a href="#">IOracleArrayTypeFactory Interface</a>	The <code>IOracleArrayTypeFactory</code> interface is used by ODP.NET to create arrays that represent Oracle Collections.
<a href="#">IOracleCustomType Interface</a>	<code>IOracleCustomType</code> is an interface for converting between a Custom Type and an Oracle Object or Collection Type.
<a href="#">IOracleCustomTypeFactory Interface</a>	The <code>IOracleCustomTypeFactory</code> interface is used by ODP.NET to create custom objects that represent Oracle Objects or Collections.
<a href="#">INullable Interface</a>	The <code>INullable</code> interface is used to determine whether or not an ODP.NET type has a NULL value.

## Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Enumerations

[Table 1-7](#) lists the type enumerations.

**Table 1-7 Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Enumerations**

Enumeration	Description
<a href="#">OracleUdtFetchOption Enumeration</a>	<code>OracleUdtFetchOption</code> enumeration values specify how to retrieve a copy of the referenceable object.
<a href="#">OracleUdtStatus Enumeration</a>	<code>OracleUdtStatus</code> enumeration values specify the status of an object attribute or collection element. An object attribute or a collection element can be a valid value or a null value.

## Differences between the ODP.NET Drivers

ODP.NET, Managed Driver, ODP.NET, Unmanaged Driver, and ODP.NET Core have a number of configuration setting differences.

**Table 1-8 Application Programming Interfaces not supported in ODP.NET, Managed Driver and ODP.NET Core**

Namespace	Class/Enumeration/Interface	Unsupported Method/Property/Event
Oracle.ManagedDataAccess.Client	FailoverEvent enumeration	All
Oracle.ManagedDataAccess.Client	FailoverReturnCode enumeration	All
Oracle.ManagedDataAccess.Client	FailoverType enumeration	All
Oracle.ManagedDataAccess.Client	OracleAQAgent class	All
Oracle.ManagedDataAccess.Client	OracleAQDequeueMode enumeration	All
Oracle.ManagedDataAccess.Client	OracleAQDequeueOptions class	All
Oracle.ManagedDataAccess.Client	OracleAQEnqueueOptions class	All
Oracle.ManagedDataAccess.Client	OracleAQMessage class	All
Oracle.ManagedDataAccess.Client	OracleAQMessageAvailableEventArgs class	All
Oracle.ManagedDataAccess.Client	OracleAQMessageAvailableEventHandler class	All
Oracle.ManagedDataAccess.Client	OracleAQMessageDeliveryMode enumeration	All
Oracle.ManagedDataAccess.Client	OracleAQMessageState enumeration	All
Oracle.ManagedDataAccess.Client	OracleAQMessageType enumeration	All
Oracle.ManagedDataAccess.Client	OracleAQNavigationMode enumeration	All
Oracle.ManagedDataAccess.Client	OracleAQNotificationGroupingType enumeration	All
Oracle.ManagedDataAccess.Client	OracleAQNotificationType enumeration	All
Oracle.ManagedDataAccess.Client	OracleAQQueue class	All
Oracle.ManagedDataAccess.Client	OracleAQVisibilityMode enumeration	All

**Table 1-8 (Cont.) Application Programming Interfaces not supported in ODP.NET, Managed Driver and ODP.NET Core**

Namespace	Class/Enumeration/Interface	Unsupported Method/Property/Event
Oracle.ManagedDataAccess.Client	OracleClientFactory class	<i>Not supported in ODP.NET Core only</i>
Oracle.ManagedDataAccess.Client	OracleCommand class	ArrayBindRowsAffected property
Oracle.ManagedDataAccess.Client	OracleCommand class	ImplicitRefCursors property
Oracle.ManagedDataAccess.Client	OracleConfiguration class	<i>Most members not supported in ODP.NET, Unmanaged Driver only</i>
Oracle.ManagedDataAccess.Client	OracleConnection class	FlushCache() method
Oracle.ManagedDataAccess.Client	OracleConnection class	Failover event
Oracle.ManagedDataAccess.Client	OracleConnection class	ConnectionType property
Oracle.ManagedDataAccess.Client	OracleConnection class	EnlistDistributedTransaction(ITransaction) method <i>Not supported in ODP.NET Core only</i>
Oracle.ManagedDataAccess.Client	OracleConnection class	ChunkMigrationConnectionTimeout, KeepAlive, KeepAliveInterval, KeepAliveTime, TnsAdmin, and WalletLocation <i>Not supported in ODP.NET Unmanaged Driver only</i>
Oracle.ManagedDataAccess.Client	OracleConnectionType enumeration	All
Oracle.ManagedDataAccess.Client	OracleDataSourceCollection class	<i>Not supported in ODP.NET Unmanaged Driver only</i>
Oracle.ManagedDataAccess.Client	OracleDBShutdownMode enumeration	All
Oracle.ManagedDataAccess.Client	OracleDBStartupMode enumeration	All
Oracle.ManagedDataAccess.Client	OracleDataReader class	GetOracleBlobForUpdate() method If the method is called, then a NotSupportedException is thrown.
Oracle.ManagedDataAccess.Client	OracleDataReader class	GetOracleClobForUpdate() method If the method is called, then a NotSupportedException is thrown.

**Table 1-8 (Cont.) Application Programming Interfaces not supported in ODP.NET, Managed Driver and ODP.NET Core**

Namespace	Class/Enumeration/Interface	Unsupported Method/Property/Event
Oracle.ManagedDataAccess.Client	OracleDataReader class	IsAutoIncrement and IdentityType properties of the GetSchemaTable
Oracle.ManagedDataAccess.Client	OracleDataAdapter class	IdentityInsert property
Oracle.ManagedDataAccess.Client	OracleDataAdapter class	IdentityUpdate property
Oracle.ManagedDataAccess.Client	OracleDataAdapter class	SafeMapping property
Oracle.ManagedDataAccess.Client	OracleDatabase class	All
Oracle.ManagedDataAccess.Client	OracleException class	IsRecoverable property
Oracle.ManagedDataAccess.Client	OracleFailoverEventArgs class	All
Oracle.ManagedDataAccess.Client	OracleFailoverEventHandler class	All
Oracle.ManagedDataAccess.Client	OracleGlobalization class	ClientCharacterSet property
Oracle.ManagedDataAccess.Client	OracleGlobalization class	GetClientInfo() method
Oracle.ManagedDataAccess.Client	OracleGlobalization class	GetThreadInfo() method
Oracle.ManagedDataAccess.Client	OracleGlobalization class	SetThreadInfo() method
Oracle.ManagedDataAccess.Client	OracleIdentityType enumeration	All
Oracle.ManagedDataAccess.Client	OracleNotificationRequest class	GroupingInterval property
Oracle.ManagedDataAccess.Client	OracleNotificationRequest class	GroupingNotificationEnabled property
Oracle.ManagedDataAccess.Client	OracleNotificationRequest class	GroupingType property
Oracle.ManagedDataAccess.Client	OracleOnsServerCollection class	<i>Not supported in ODP.NET Unmanaged Driver only</i>
Oracle.ManagedDataAccess.Client	OraclePermission class	<i>Not supported in ODP.NET Core only</i>
Oracle.ManagedDataAccess.Client	OraclePermissionAttribute class	<i>Not supported in ODP.NET Core only</i>

**Table 1-8 (Cont.) Application Programming Interfaces not supported in ODP.NET, Managed Driver and ODP.NET Core**

Namespace	Class/Enumeration/Interface	Unsupported Method/Property/Event
Oracle.ManagedDataAccess.Client	OracleRowsCopiedEventArgs class	All
Oracle.ManagedDataAccess.Client	OracleRowsCopiedEventHandler class	All
Oracle.ManagedDataAccess.Client	IOracleCustomType interface	Equivalent functionality available in all providers with differences in parameters.
Oracle.ManagedDataAccess.Types	OracleRef class	<p>The following unmanaged ODP.NET class members are <i>not</i> supported in managed and core:</p> <ul style="list-style-type: none"> <li>• Constructors <ul style="list-style-type: none"> <li>– OracleRef(OracleConnection conn, string udtTypeName, string objTableName)</li> <li>– OracleRef(OracleConnection conn, string hexStr)</li> </ul> </li> <li>• Methods <ul style="list-style-type: none"> <li>– Flush()</li> <li>– GetCustomObject(OracleUdtFetchOption fetchOption, int depthLevel)</li> <li>– GetCustomObjectForUpdate(bool bWait)</li> <li>– GetCustomObjectForUpdate(bool bWait, int depthLevel)</li> <li>– Lock(bool bWait)</li> </ul> </li> <li>• Properties <ul style="list-style-type: none"> <li>– HasChanges {get}</li> <li>– ObjectTableName {get}</li> </ul> </li> </ul>
Oracle.ManagedDataAccess.Types	OracleTimestampTZ structure	OracleTimeStampTZ(DateTime dt, string timeZone) constructor. This constructor is supported but the timeZone must be an hour offset.
Oracle.ManagedDataAccess.Types	OracleUdt class	All providers have same APIs or equivalent APIs with differences in parameters.



**See Also:**

[Oracle Data Provider for .NET, Managed Driver Configuration and Configuration Differences among ODP.NET Drivers](#) for more information about ODP.NET, Managed Driver .NET configuration settings.

[Distributed Transactions](#) for information about distributed transaction setup difference.

[Oracle Data Provider for .NET Core Configuration](#) for more information about configuring ODP.NET Core.

## Getting Started With Developing ODP.NET Applications

Learn how to get started developing .NET applications for on-premises Oracle Database and Oracle Autonomous Database from one of the following links. These tutorials show how to create a simple .NET application that connects with either managed ODP.NET or ODP.NET Core. They also show how to use ODP.NET from Visual Studio and Visual Studio Code.

- [Developing .NET Applications for On-Premises Oracle Database](#)
- [Developing .NET Applications for Oracle Autonomous Database](#)
- Additional ODP.NET sample code is available in Oracle's .NET GitHub site:  
<https://github.com/oracle/dotnet-db-samples>

# 2

## Installing and Configuring Oracle Data Provider for .NET

This section describes installation and configuration requirements for Oracle Data Provider for .NET.

This section contains these topics:

- [System Requirements](#)
- [Entity Framework Requirements](#)
- [Entity Framework Core System Requirements](#)
- [Oracle Data Provider for .NET Versioning Scheme](#)
- [Installing Oracle Data Provider for .NET, Unmanaged Driver](#)
- [Installing Oracle Data Provider for .NET, Managed Driver](#)
- [Entity Framework Assemblies and File Location](#)
- [Configuring Oracle Data Provider for .NET](#)
- [Oracle Data Provider for .NET, Unmanaged Driver Configuration](#)
- [Oracle Data Provider for .NET, Managed Driver Configuration](#)
- [Oracle Data Provider for .NET Core Configuration](#)
- [Configuration Differences among ODP.NET Drivers](#)
- [Configuring for Entity Framework Code First](#)
- [Migrating from ODP.NET, Unmanaged Driver to ODP.NET, Managed Driver](#)
- [Configuring a Port to Listen for Database Notifications](#)
- [General .NET Programming Recommendations and Tips for ODP.NET](#)

### System Requirements

Oracle Data Provider for .NET, Unmanaged Driver requires the following:

- Windows operating system
  - 64-bit: Windows Server 2012 R2 x64 (Standard, Datacenter, Essentials, and Foundation Editions), Windows 10 x64 (Pro, Enterprise, and Education Editions), Windows Server 2016 x64 (Standard, Datacenter, and Essentials Editions), or Windows Server 2019 (Standard, Datacenter, and Essentials Editions). Windows Server 2022 x64 (Standard, Datacenter, and Essentials Editions) and Windows 11 x64 (Pro, Enterprise, and Education Editions) are supported by ODP.NET 21.4 or later.

Oracle supports 32-bit ODP.NET and 64-bit ODP.NET for Windows x64 on these operating systems.

- Microsoft .NET

- ODP.NET for .NET Framework 4 is only supported with Microsoft .NET Framework 4.8.
- Access to Oracle Database 12c (12.1.0.2) or later
- Oracle Client release 21c

This is automatically installed as part of the ODP.NET installation.

Promotable and distributed transactions may require Oracle Services for Microsoft Transaction Server in whole or in part. Refer to the [Distributed Transactions](#) section for more information.

Oracle Data Provider for .NET, Managed Driver requires the following:

- Same Windows operating system support as ODP.NET, Unmanaged Driver.  
ODP.NET, Managed Driver is built with AnyCPU. It runs on either 32-bit or 64-bit (x64) Windows and on either 32-bit or 64-bit (x64) .NET Framework.
- Microsoft .NET Framework 4.8.
- Access to Oracle Database 12c (12.1.0.2) or later

ODP.NET Core requires the following:

- Operating systems:
  - Same Windows operating system support as managed and unmanaged ODP.NET
  - Oracle Linux 7
  - Oracle Linux 8
  - Red Hat Enterprise Linux 7
  - Red Hat Enterprise Linux 8
  - Ubuntu 20.04.1 or later (starting with ODP.NET Core 21.4)
  - Debian Linux 10 (Buster) 4.19.171-2 or later (starting with ODP.NET Core 21.4)
- Microsoft .NET
  - ODP.NET Core 21c will support .NET 6, 7, and 8.
    - \* .NET 8 requires ODP.NET Core 21.12 or higher.
- Access to Oracle Database 12c (12.1.0.2) or later

ODP.NET Core is compatible with ASP.NET Core.

ODP.NET Core is built with AnyCPU. It supports 64-bit .NET and 32-bit .NET.

 **See Also:**

- Document 726240.1 on My Oracle Support (formerly *OracleMetaLink*) for details on supported configuration for different ODP.NET versions. You can access My Oracle Support from:

<https://support.oracle.com>

- <https://msdn.microsoft.com/en-us/default.aspx>

## Entity Framework Requirements

This section contains the following topics:

- [Entity Framework Database First and Model First Requirements](#)
- [Entity Framework Code First Requirements](#)

## Entity Framework Database First and Model First Requirements

Oracle's support for Entity Framework Database First and Model First has the following version requirement:

- Microsoft Entity Framework 6.4
- Microsoft .NET Framework 4.8
- ODP.NET, Managed Driver

If using Visual Studio tools, then install Oracle Developer Tools for Visual Studio.

## Entity Framework Code First Requirements

Oracle's support for Entity Framework Code First has the following version requirements:

- Microsoft Entity Framework 6.4
- Microsoft .NET Framework 4.8

Projects must set the target framework to a supported .NET Framework version. This can be done by modifying the project's properties in Visual Studio.

- ODP.NET, Managed Driver

## Entity Framework Core System Requirements

ODP.NET Entity Framework Core (EF Core) has the same system requirements as ODP.NET Core. In addition, ODP.NET EF Core has the following dependencies:

- ODP.NET Core 21c
- Entity Framework Core 6, 7, or 8
- `Microsoft.EntityFrameworkCore.Relational`

Oracle EF Core supports new EF Core features, such as transaction savepoints.

## Oracle Data Provider for .NET Versioning Scheme

Oracle Data Provider for .NET, Unmanaged Driver; ODP.NET, Managed Driver; and ODP.NET Core each ship with their own set of binaries.

For example, 21c binaries would be the following:

- ODP.NET for .NET Framework 4
  - `Oracle.DataAccess.dll`
    - \* Built with .NET Framework 4
    - \* Assembly version number: 4.x.x.x
  - `OraOps21.dll` and Oracle Client
    - \* Used by ODP.NET for .NET Framework

ODP.NET, Managed Driver follows a similar version model for its binaries.

ODP.NET for .NET Framework 4:

- `Oracle.ManagedDataAccess.dll`
  - Built with .NET Framework 4
  - Assembly version number: 4.x.x.x

ODP.NET Core for .NET (Core):

- `Oracle.ManagedDataAccess.dll`
  - Built with .NET (Core) version
  - Assembly version number: 3.x.x.x

The convention for managed and unmanaged ODP.NET assembly/DLL product versioning is

*n1.o1o2.o3.o4:o5*

where

- *n1* is the most significant .NET Framework version number.
- *o1o2* once represented the first two digits of the ODP.NET 12.2 version number. It remains "122" as modifying this version would not allow in place ODP.NET upgrades without an application rebuild.
- *o3* is the first digit of the ODP.NET product version number.
- *o4* indicates whether the release is a production version (1) or beta/pre-release version (0).
- *o5* is the ODP.NET assembly build date.

For example, if the ODP.NET version number is 19.10, the corresponding managed and unmanaged ODP.NET assembly product version is 4.122.19.1:20201106.

For ODP.NET Core, the convention is:

*n1.n2.o1.o2:o3*

- *n1* is the minimum .NET (Core) version number that this ODP.NET Core version supports.
- *n2* is the minimum minor .NET (Core) version that this ODP.NET Core version supports
- *o1* is the first digit of the ODP.NET product version number.
- *o2* indicates whether the release is a production version (1) or beta/pre-release version (0).
- *o3* is the ODP.NET assembly build date.

For example, if the ODP.NET Core version number is 19.10, the corresponding assembly product version is 2.0.19.1:20201106.

The ODP.NET *assembly* version is distinct from the *assembly product* version. The *assembly* version uses four sets of digits and the *assembly product* version uses five sets of digits. For each ODP.NET release, the first four sets of digits of the assembly version and the assembly product version will be the same. For example, if the ODP.NET Core assembly product version is 2.0.19.1:20201106, then its assembly version is 2.0.19.1. In the case of managed and unmanaged ODP.NET 4.122.19.1:20201106, the assembly version is 4.122.19.1.

The assembly product version identifies the precise ODP.NET version used. Since there are multiple updates Oracle ships within a major release family, you would provide the ODP.NET assembly product version in a support context.

The assembly version is used in more .NET-specific contexts. For example, the `<version>` section of the .NET configuration file uses the four digit assembly version to identify which ODP.NET version to use.

The assembly product version number can be found in the ODP.NET DLL "Product version" property on Windows. The assembly version can be found in the ODP.NET DLL "File version" property on Windows.

Note that the Oracle installer and documentation still refer to the ODP.NET product version number and not the assembly/DLL version number.

Publisher Policy DLL is provided as before so that applications built with older versions of ODP.NET are redirected to the newer ODP.NET assembly, even though the versioning scheme has changed.

### ODP.NET, Managed Driver Versioning

Starting with ODAC 12c Release 2, the ODP.NET, Managed Driver uses assembly manifest attribute `AssemblyInformationalVersionAttribute` to uniquely identify assemblies with the same `AssemblyVersionAttribute` attribute value. This value can be accessed via .NET code, PowerShell, and other Windows applications to identify ODP.NET, Managed Driver versions uniquely.

`AssemblyInformationalVersionAttribute` is set to the same version as the actual .NET assembly version, except the fourth digit, which will no longer be 0. Instead, the version will be unique for each ODP.NET, Managed Driver release by incrementing the fourth digit for every subsequent release.

This value is accessible using .NET Framework `System.Diagnostics.FileVersionInfo.ProductVersion` property. The returned value can be used as a `Version` object or as a comparison `String` using comparison operators or methods. Essentially, among a collection of ODP.NET, Managed Driver assemblies that have the same assembly version, the newest ODP.NET, Managed Driver assembly will have the largest fourth digit `ProductVersion` value than an older assembly.

**PowerShell Example:** In this example, administrators uniquely distinguish the assemblies between ODP.NET, Managed Driver versions from an old version of ODP.NET, Managed Driver in `c:\old` and a more recent one in `c:\new`.

Script:

```
$VC1 = New-Object System.Version((Get-Command
C:\old\Oracle.ManagedDataAccess.dll).FileVersionInfo.ProductVersion)
$VC2 = New-Object System.Version((Get-Command
C:\new\Oracle.ManagedDataAccess.dll).FileVersionInfo.ProductVersion)
"Compare V1 to V2: " + $VC1.CompareTo($VC2)
"Compare V1 to V1: " + $VC1.CompareTo($VC1)
"Compare V2 to V1: " + $VC2.CompareTo($VC1)
```

Output:

```
Compare V1 to V2: -1
Compare V1 to V1: 0
Compare V2 to V1: 1
```



**Note:**

`ProductVersion` property comparisons will provide correct information on which version is more recent than the other *only* for ODP.NET, Managed Driver released from ODAC 12c Release 2 and later.

## Installing Oracle Data Provider for .NET, Unmanaged Driver

Oracle Data Provider for .NET, Unmanaged Driver can be installed through Oracle Database software or XCopy. The latter is an Oracle Data Access Components (ODAC) software installation. Unmanaged ODP.NET software is available from Oracle's website for download. This section provides details on unmanaged ODP.NET installation

Administrators use XCopy to deploy Oracle Data Provider for .NET to large numbers of computers for production deployments. The XCopy has a smaller installation size and fine-grain control during installation and configuration than Oracle Universal Installer.



**Note:**

This section describes non-ODAC installation using the Oracle Universal Installer for database server or client. For installation and configuration using the XCopy install, refer to the README.TXT file that is part of the XCopy installation.

Additionally, Oracle Data Provider for .NET Dynamic Help is registered with Visual Studio, providing context-sensitive online help that is seamlessly integrated with Visual Studio Dynamic Help. With Dynamic Help, the user can access ODP.NET documentation within the Visual Studio IDE by placing the cursor on an ODP.NET keyword and pressing the F1 function key.

**See Also:**[Configuring for Entity Framework Code First](#)

## File Locations After Installation

The `Oracle.DataAccess.dll` assembly is installed to the following location:

.NET Framework 4:

`ORACLE_HOME\odp.net\bin\4` directory

## Search Order for Unmanaged DLLs

Unmanaged ODP.NET consists of managed and unmanaged binaries. Through the use of the `DllPath` configuration parameter, each application can specify the `ORACLE_HOME\bin` location that the dependent unmanaged Oracle Client binaries are loaded from. However, the `ORACLE_HOME` must have the same unmanaged ODP.NET version installed as the version that the application uses. Otherwise, a version mismatch exception is thrown.

The `Oracle.DataAccess.dll` searches for dependent unmanaged DLLs (such as Oracle Client) based on the following order:

1. Directory of the application or executable.
2. `DllPath` setting specified by application config or `web.config`.
3. `DllPath` setting specified by `machine.config`.
4. `DllPath` setting specified by the Windows Registry.  
`HKEY_LOCAL_MACHINE\Software\Oracle\ODP.NET\version\DllPath`
5. Directories specified by the Windows `PATH` environment variable.

Upon installation of unmanaged ODP.NET, Oracle Universal Installer sets the `DllPath` Windows Registry value to the `ORACLE_HOME\bin` directory where the corresponding dependent DLLs are installed. Developers must provide this configuration information on an application-by-application basis.

**Note:**

`Oracle.DataAccess.dll` uses the unmanaged DLL, `OraOps21.dll`.

## Unmanaged ODP.NET and Dependent Unmanaged DLL Mismatch

To enforce the usage of `Oracle.DataAccess.dll` assembly with the correct version of its unmanaged DLLs, an exception is raised if `Oracle.DataAccess.dll` notices it has loaded a mismatched version of a dependent unmanaged DLL.

# Installing Oracle Data Provider for .NET, Managed Driver

## Getting started with ODP.NET, Managed Driver

You can get started with ODP.NET Managed Driver by either using the Windows Installer, XCopy, or NuGet.

**If you are using XCopy:** Download ODP.NET, Managed Driver .zip file to a directory for staging the install. The .zip file contains a README file with XCopy installation instructions.

Run the `configure.bat` script in one of the following directories:

- For 32-bit .NET Framework: `OH\odp.net\managed\x86`
- For 64-bit .NET Framework: `OH\odp.net\managed\x64`

Each directory contains an `unconfigure.bat` if ODP.NET, Managed Driver needs to be unconfigured and removed from the machine.

**If you are using NuGet:** Download the ODP.NET NuGet package(s) and use NuGet Package Manager to install.

The following NuGet packages are available:

- ODP.NET, Managed Driver
- Entity Framework assembly for Code First and Entity Framework 6 or higher use with ODP.NET, Managed Driver

**If you are using Windows Installer:** Follow the VSIX or Microsoft Windows Installer (MSI) steps to install ODP.NET, Managed Driver.

## ODP.NET, Managed Driver Files

ODP.NET, Managed Driver consists of the following files:

**Table 2-1 ODP.NET, Managed Driver Files with Descriptions**

File	Description
<code>Oracle.ManagedDataAccess.dll</code>	Platform-independent (AnyCPU), fully-managed ADO.NET provider
<code>\Resources\<lang&gt;\oracle.manageddataaccess.resources.dll< code=""></lang&gt;\oracle.manageddataaccess.resources.dll<></code>	Platform-independent (AnyCPU), fully-managed ADO.NET provider resource DLLs.
<code>OraProvCfg.exe</code>	Platform-independent (AnyCPU) utility to configure/unconfigure ODP.NET, Managed and Unmanaged Drivers.
<code>configure.bat</code>	Batch file to add managed ODP.NET Windows Registry entries.
<code>unconfigure.bat</code>	Batch file to remove managed ODP.NET Windows Registry entries.
<code>tnsnames.ora</code>	A sample configuration file that defines data source aliases.
<code>sqlnet.ora</code>	A sample configuration file that configures network related settings.

**Table 2-1 (Cont.) ODP.NET, Managed Driver Files with Descriptions**

File	Description
<code>Oracle.ManagedDataAccess.Client.Configuration.Section.xsd</code>	An XML schema file that defines the configuration section for ODP.NET, Managed Driver.
<code>Oracle.ManagedDataAccess.EntityFramework.work.dll</code>	Platform-independent (AnyCPU), fully-managed assembly for Code First and Entity Framework 6 higher
<code>\x64\Oracle.ManagedDataAccessIOP.dll</code>	Platform-dependent (64-bit .NET Framework), Managed Assembly for Kerberos support
<code>\x86\Oracle.ManagedDataAccessIOP.dll</code>	Platform-dependent (32-bit .NET Framework), Managed Assembly for Kerberos support

The `OraProvCfg.exe` utility can perform many different configuration tasks, such as GACing ODP.NET or configuring ODP.NET in the `machine.config` file. To learn about how to use this utility, run `oraprovcfg.exe` on the command line without any parameters, which will output the documentation.

**See Also:**

*Oracle Database Installation Guide for Microsoft Windows* for installation instructions

## Platform-Dependent Assemblies and Their Search Order

ODP.NET, Managed Driver has one set of platform-dependent DLL: `Oracle.ManagedDataAccessIOP.dll`, which has a 32-bit .NET version and a 64-bit .NET version. While they consist of 100% managed code, they call APIs outside of .NET, which is why they are platform dependent.

`Oracle.ManagedDataAccessIOP.dll` supports Kerberos. These assemblies are only needed in your application if you are using Kerberos security.

These assemblies are not intended to be directly referenced by an application. Rather, they will be referenced implicitly. ODP.NET, Managed Driver will reference the assemblies by using the following search order:

1. Global Assembly Cache
2. The web application's bin directory or Windows application's `EXE` directory
3. The `x86` or `x64` subdirectory based on whether the application runs in 32-bit or 64-bit .NET Framework. If the application is built using AnyCPU, then ODP.NET will use the correct DLL bitness as long as the assembly is available. Oracle recommends using this method of finding dependent assemblies if your application is AnyCPU.

For example, use the following steps for your application to use the 64-bit version of `Oracle.ManagedDataAccessIOP.dll`:

1. Right click **Visual Studio project**, select **Add**, and then select **New Folder**.

2. Name the folder x64.
3. Right-click the newly created **x64** folder, select **Add**, and then select **Existing Item**.
4. Browse to the folder where the DLL is located, which usually is `ORACLE_HOME\odp.net\managed\x64`, and then select **Oracle.ManagedDataAccessIOP.dll**.
5. Click **Add**.
6. Click the newly added **Oracle.ManagedDataAccessIOP.dll** in the x64 folder.
7. In the properties window, set Copy To Output Director to **Copy Always**.

For x86 targeted applications, name the folder x86 and add the assembly from the x86 directory.

To make your application platform independent even if it depends on `Oracle.ManagedDataAccessIOP.dll` create both x64 and x86 folders with the necessary assemblies added to them.

## File Locations After Installation

In an Oracle Universal Installer based install, the `Oracle.ManagedDataAccess.dll` assembly is installed to the following location:

.NET Framework 4:

`ORACLE_HOME\ODP.NET\nuget` directory

Managed ODP.NET is embedded within the `Oracle.ManagedDataAccess.<version>.nupkg` file. This file is a NuGet package. ODP.NET users can install this package using common Microsoft tools, such as NuGet Package Manager and Visual Studio.

When Oracle Developer Tools for Visual Studio is installed, Oracle documentation is installed in Visual Studio itself.

Samples are provided in GitHub:

<https://github.com/oracle/dotnet-db-samples>

## Installing Oracle Data Provider for .NET Core

### Getting started with ODP.NET Core

You can get started with ODP.NET Core on Windows by using the Windows Installer, Oracle Universal Installer (OUI), or NuGet. Only NuGet can be used to install ODP.NET Core on Linux.

**If you are using Windows Installer:** Follow the Oracle Developer Tools for Visual Studio VSIX or Microsoft Windows Installer (MSI) steps. These installers will copy the ODP.NET Core NuGet package to the machine

**If you are using OUI:** Follow the OUI steps to install ODP.NET Core. OUI will copy the ODP.NET Core NuGet package to the machine.

**If you are using NuGet:** Download the ODP.NET Core NuGet package and use NuGet Package Manager to install.

### ODP.NET Core Files

ODP.NET Core consists of the following files:

**Table 2-2 ODP.NET, Core Files with Descriptions**

File	Description
<code>Oracle.ManagedDataAccess.dll</code>	Platform-independent (AnyCPU), operating system independent, fully-managed ADO.NET provider

### File Locations After Installation

In an Oracle Universal Installer based install, the ODP.NET Core package is installed to the following directory:

```
ORACLE_HOME\ODP.NET\nuget
```

ODP.NET Core is embedded within the `Oracle.ManagedDataAccess.Core.<version>.nupkg` file. This file is a NuGet package. ODP.NET users can install this package using common Microsoft tools, such as NuGet Package Manager and Visual Studio."

Samples are provided on our ODP.NET GitHub site:

<https://github.com/oracle/dotnet-db-samples>

## Entity Framework Assemblies and File Location

ODP.NET ships with a separate assembly to support Code First and Entity Framework 6. This model physically separates Entity Framework 6 functionality from ADO.NET functionality.

The managed ODP.NET assembly is `Oracle.ManagedDataAccess.EntityFramework.dll`.

Unmanaged ODP.NET discontinued Entity Framework support starting with ODP.NET 21c. Unmanaged ODP.NET EF apps should migrate to managed ODP.NET.

When installed using the XCopy package, the Oracle Entity Framework assembly is found in the following location after install:

```
%ORACLE_HOME%\odp.net4\odp.net\managed\common\EF6
```

where `%ORACLE_HOME%` represents the operating system path to the installation directory.

The assembly is fully managed code and is designed to be bin deployable meaning that the assembly should be copied into the application's `bin` directory. As such the assembly is not registered in the Global Assembly Cache (GAC) during installation.

In Oracle Universal Installer, the Oracle Entity Framework (Core) assemblies are now NuGet packages located in:

```
%ORACLE_HOME%\ODP.NET\nuget
```

In that location, you will find managed ODP.NET Entity Framework 6 and ODP.NET Entity Framework Core NuGet packages. ODP.NET users can install these packages using common Microsoft tools, such as NuGet Package Manager and Visual Studio.

 **Note:**

If desired the Oracle Entity Framework 6 assemblies may be registered in the GAC manually but Oracle recommends not doing so.

## Configuring Oracle Data Provider for .NET

The settings for specific versions of ODP.NET, can be configured in several ways for specific effects on precedence:

- The Windows registry entries are machine-wide settings for a particular version of ODP.NET.  
Windows registry based configuration is not supported for ODP.NET, Managed Driver.
- The `machine.config` settings are .NET framework-wide settings that override the Windows registry values.
- The application or web config file settings are application-specific settings that override the `machine.config` settings and the Windows registry settings.

 **Note:**

There is one exception to `app/web/config` settings overriding `machine.config`. For `oracle.manageddataaccess.client` and `oracle.unmanageddataaccess.client` sections, a `machine.config` with a specific ODP.NET version subsection, that is, `<version number="4.121.2.0">`, will override an `app/web.config` subsection that references all versions generically, that is, `<version number="*">`. To override the `machine.config` subsection, create a subsection for that version in the `app/web/config` file, that is, `<version number="4.121.2.0">`.

- Any attribute settings made in the ODP.NET application code override everything else.

The application or web config file can be useful and sometimes essential in scenarios where more than one application on a computer use the same version of ODP.NET, but each application needs a different ODP.NET configuration. The Windows registry value settings for a given version of ODP.NET affect all the applications that use that version of ODP.NET. However, having ODP.NET configuration values in the application or web config file assure that these settings are applied only for that application, thus providing more granularities.

For example, if the application or `web.config` file has a `StatementCacheSize` configuration setting of 100, this application-specific setting forces the version of ODP.NET that is loaded by that application to use 100 for the `StatementCacheSize` and overrides any setting in the `machine.config` and in the registry. Note that for any setting that does not exist in a config file (`machine.config` or application/web config),

the value in the registry for a loaded version of ODP.NET is used, as in previous releases.

Note that ODP.NET reads the `machine.config` files from the version of the .NET Framework on which ODP.NET runs, not from the version of ODP.NET.

ODP.NET only reads the Windows Registry and the XML configuration file when it is loaded into memory, thus any configuration changes made after that are not read or used until the application is re-started.

All boolean attributes in ODP.NET .NET configuration settings accept `true`, `false`, `1`, and `0` as valid values. `1` is equivalent to `true` and `0` is equivalent to `false`.

**Note:**

ODP.NET Core does not support the Windows registry nor .NET configuration files. ODP.NET Core configuration can be set using .NET Configuration API, `sqlnet.ora` file, and `tnsnames.ora` file.

## Oracle Client Configuration File Automated Setup During Installation

When installing Oracle Data Access Components (ODAC) in a new Oracle Home, Oracle Universal Installer (OUI) automatically copies the Oracle local naming (`tnsnames.ora`), profile (`sqlnet.ora`), and directory (`ldap.ora`) parameter files and settings from an existing Oracle home into the newly installed ODAC home, as long as they share the same bitness. That is, they are both 32-bit installations or they are both 64-bit installations.

Alternatively, existing `*.ora` files can be copied over from another existing Oracle home, besides the last active one, to the new ODAC Oracle home. OUI provides location information for these files from up to three other existing Oracle homes if they exist. The `*.ora` files can be customized if the new Oracle home uses a different configuration from the previous Oracle home from which the files were copied over.

If you install into an existing ODAC or RDBMS Oracle home, then no new `*.ora` files is copied or created.

If you install onto a computer without any previous Oracle homes present, then OUI prompts the user for the database connection alias information. OUI then automatically creates the `tnsnames.ora` file. If no alias information is provided, then no `tnsnames.ora` file is created. Even if the user does not have all the database connection information readily available, Oracle recommends inserting placeholder values during the install process, then modifying the `tnsnames.ora` file later with actual values to replace the placeholders.

## Oracle Client Configuration File Settings

ODP.NET configuration file parameter values can be set in .NET configuration, `tnsnames.ora`, `sqlnet.ora`, and `ldap.ora` files. The `*.ora` file location can be a location different from the standard `ORACLE_HOME/network/admin` directory. The `*.ora` settings order of precedence is similar to ODP.NET's settings order of precedence. The main difference is that the `*.ora` files themselves are included in the search order. The `tnsnames.ora` and `sqlnet.ora` precedence order is as follows.

Managed ODP.NET:

1. `OracleConfiguration.OracleDataSources`
2. `<dataSources>` in .NET configuration file
3. Directory set in `OracleConnection.TnsAdmin` property
4. Directory set for the `Tns_Admin` connection string attribute
5. Directory set in `OracleConfiguration.TnsAdmin` property
6. `TNS_ADMIN` directory setting in .NET configuration file
7. Current working directory
8. `TNS_ADMIN` directory setting of the Windows environment variable or container environment variable

Unmanaged ODP.NET:

1. `<dataSources>` and `<settings>` in .NET configuration file
2. `TNS_ADMIN` directory setting in .NET configuration file
3. Current working directory
4. `TNS_ADMIN` directory setting of the Windows environment variable or container environment variable
5. `TNS_ADMIN` Windows Registry setting (`HKLM\SOFTWARE\ORACLE\KEY_<Oracle Version>HOME<#>\`)
6. `%ORACLE_HOME%\network\admin` directory

The managed ODP.NET `ldap.ora` precedence order is as follows:

1. `<LDAPsettings>` and `<settings>` in .NET configuration file
2. Directory set in `OracleConnection.TnsAdmin` property
3. Directory set for the `Tns_Admin` connection string attribute
4. Directory set in `OracleConfiguration.TnsAdmin` property
5. Directory set in `OracleConfiguration.LdapAdmin` property
6. `TNS_ADMIN` directory setting in .NET configuration file
7. `LDAP_ADMIN` directory setting in .NET configuration file
8. Current working directory
9. `TNS_ADMIN` directory setting in the Windows environment variable
10. `LDAP_ADMIN` directory setting in the Windows environment variable

The unmanaged ODP.NET `ldap.ora` precedence order is as follows:

1. `LDAP_ADMIN` directory setting in the Windows environment variable
2. `%ORACLE_HOME%\ldap\admin` directory
3. `TNS_ADMIN` directory setting in the Windows environment variable
4. `%ORACLE_HOME%\network\admin` directory

Oracle recommends using an `app.config` or `web.config` file to store all these Oracle Client configuration parameter settings.

Once the first `tnsnames.ora`, `sqlnet.ora`, and `ldap.ora` are found and read, no additional `*.ora` file lower in the precedence order is read. That means all Oracle Client configuration settings must be made in the `app.config`, `web.config`, `machine.config`, or the first set of `*.ora` files found. Additional parameter values set in `*.ora` files lower in the precedence order will not be read.

## Configuring .NET Framework to Use ODP.NET

Automatic ODP.NET machine-wide configuration upon installation is no longer available as of ODAC 18c. This change improves compatibility when applications on the same machine use different ODP.NET versions and/or depend on application-specific configuration settings instead of machine-wide assembly registration and configuration.

Nonetheless, administrators can still manually place managed and unmanaged ODP.NET in the Global Assembly Cache (GAC), as well as add configurations for section handler, `DbProviderFactories`, `TNS_ADMIN`, `LDAP_ADMIN`, and assembly redirection (in place of policy DLLs), into `machine.config`, if desired.

Most ODP.NET settings in `machine.config` can be overridden by local settings in `app.config` or `web.config`. However, conflicts between the `machine.config` and, `app.config` or `web.config` can prevent applications from running properly. Care should be taken when configuring ODP.NET at both the `machine.config` level and application level using `app.config` or `web.config`.

To avoid such issues, Oracle recommends ODP.NET application configuration settings reside in the `app.config` or `web.config`. The following sections explore how to set up these ODP.NET configuration sections and provide sample configuration sections and files.

### Configuration Section Handler

In order for the application to read the ODP.NET configuration section, a section handler must be configured. The following entry should be added to the .NET configuration file to enable applications to add an `oracle.manageddataaccess.client` section for ODP.NET, Managed Driver-specific configuration:

```
<configuration>
  <configSections>
    <section name="oracle.manageddataaccess.client"
type="OracleInternal.Common.ODPMSectionHandler, Oracle.ManagedDataAccess,
Version=4.122.19.1, Culture=neutral, PublicKeyToken=89b483f429c47342" />
  </configSections>
</configuration>
```

#### Note:

In all the examples in this section, the version of the ODP.NET assembly is understood to be 4.122.19.1. This version number should be modified appropriately if you are using another version.

The unmanaged ODP.NET equivalent section handler is as follows:

```
<configuration>
  <configSections>
    <section name="oracle.unmanageddataaccess.client"
```

```

type="OracleInternal.Common.CustomSectionHandler, Oracle.DataAccess,
Version=4.122.19.1, Culture=neutral, PublicKeyToken=89b483f429c47342" />
  </configSections>
</configuration>

```

One of the configuration entries that either has to match between `machine.config` and, `app.config` or `web.config`, or only exist in the `app.config` or `web.config` to avoid any conflict is the configuration for the section handler. For example, if your application is a web application and the above entry was added to a `web.config` and the same configuration section handler for `oracle.manageddataaccess.client` also exists in `machine.config` but the `Version` attribute values are different, an error message of "There is a duplicate `oracle.manageddataaccess.client` section defined." may be observed at runtime. To avoid this issue, the configuration section handler entry in the `machine.config` for `oracle.manageddataaccess.client` has to be removed from the `machine.config` or the ODP.NET config section handler entry in `machine.config` and `web.config` has to match exactly. If there are other applications on the machine that depend on this entry in the `machine.config`, then this section handler entry will need to be moved to all local applications' .NET configuration files.

### DbProviderFactories

The following entry should be added in the `app.config` or `web.config` for applications that use `DbProviderFactories` and `DbProviderFactory` classes. Also, any `DbProviderFactories` entry for `Oracle.ManagedDataAccess.Client` in the `machine.config` will be ignored due to the `<remove>` entry:

```

<configuration>
  <system.data>
    <DbProviderFactories>
      <remove invariant="Oracle.ManagedDataAccess.Client" />
      <add name="ODP.NET, Managed Driver"
invariant="Oracle.ManagedDataAccess.Client" description="Oracle Data Provider
for .NET, Managed Driver"
type="Oracle.ManagedDataAccess.Client.OracleClientFactory,
Oracle.ManagedDataAccess, Version=4.122.19.1, Culture=neutral,
PublicKeyToken=89b483f429c47342" />
    </DbProviderFactories>
  </system.data>
</configuration>

```

The equivalent for unmanaged ODP.NET is as follows:

```

<configuration>
  <system.data>
    <DbProviderFactories>
      <remove invariant="Oracle.DataAccess.Client" />
      <add name="Oracle Data Provider for .NET"
invariant="Oracle.DataAccess.Client" description="Oracle Data Provider for .NET"
type="Oracle.DataAccess.Client.OracleClientFactory, Oracle.DataAccess,
Version=4.122.19.1, Culture=neutral, PublicKeyToken=89b483f429c47342" />
    </DbProviderFactories>
  </system.data>
</configuration>

```

### Dependent Assembly

For users accustomed to the policy DLLs that were registered automatically upon installation, the same can be accomplished through configuration. The following is an example configuration that redirects the application that depends on 4.122 version of

ODP.NET and higher to be redirected to use ODP.NET 4.122.19.1. Note that in this example, an entry is added to ignore policy ODP.NET DLLs that are registered in the GAC:

```
<configuration>
  <runtime>
    <assemblyBinding xmlns="urn:schemas-microsoft-com:asm.v1">
      <dependentAssembly>
        <publisherPolicy apply="no" />
        <assemblyIdentity name="Oracle.ManagedDataAccess"
publicKeyToken="89b483f429c47342" culture="neutral" />
        <bindingRedirect oldVersion="4.122.0.0 - 4.65535.65535.65535"
newVersion="4.122.19.1" />
      </dependentAssembly>
    </assemblyBinding>
  </runtime>
</configuration>
```

The equivalent for unmanaged ODP.NET is as follows:

```
<configuration>
  <runtime>
    <assemblyBinding xmlns="urn:schemas-microsoft-com:asm.v1">
      <dependentAssembly>
        <publisherPolicy apply="no" />
        <assemblyIdentity name="Oracle.DataAccess" publicKeyToken="89b483f429c47342"
culture="neutral" />
        <bindingRedirect oldVersion="4.122.0.0 - 4.65535.65535.65535"
newVersion="4.122.19.1" />
      </dependentAssembly>
    </assemblyBinding>
  </runtime>
</configuration>
```

The final .NET configuration section that includes a configuration section handler, `DbProviderFactories`, dependent assembly, and provider configuration would look similar to the following example:

```
<?xml version="1.0" encoding="utf-8"?>
<configuration>
  <configSections>
    <section name="oracle.manageddataaccess.client"
      type="OracleInternal.Common.ODPMSectionHandler, Oracle.ManagedDataAccess,
Version=4.122.19.1, Culture=neutral, PublicKeyToken=89b483f429c47342"/>
  </configSections>
  <startup>
    <supportedRuntime version="v4.0" sku=".NETFramework,Version=v4.7.1"/>
  </startup>
  <system.data>
    <DbProviderFactories>
      <remove invariant="Oracle.ManagedDataAccess.Client"/>
      <add name="ODP.NET, Managed Driver"
invariant="Oracle.ManagedDataAccess.Client" description="Oracle Data Provider
for .NET, Managed Driver"
type="Oracle.ManagedDataAccess.Client.OracleClientFactory, Oracle.ManagedDataAccess,
Version=4.122.19.1, Culture=neutral, PublicKeyToken=89b483f429c47342"/>
    </DbProviderFactories>
  </system.data>
  <runtime>
    <assemblyBinding xmlns="urn:schemas-microsoft-com:asm.v1">
      <dependentAssembly>
```

```

        <publisherPolicy apply="no"/>
        <assemblyIdentity name="Oracle.ManagedDataAccess"
publicKeyToken="89b483f429c47342" culture="neutral"/>
        <bindingRedirect oldVersion="4.121.0.0 - 4.65535.65535.65535"
newVersion="4.122.19.1"/>
    </dependentAssembly>
</assemblyBinding>
</runtime>
<oracle.manageddataaccess.client>
    <version number="*">
        <dataSources>
            <dataSource alias="SampleDataSource"
descriptor="(DESCRIPTION=(ADDRESS=(PROTOCOL=tcp)(HOST=localhost)(PORT=1521))
(CONNECT_DATA=(SERVICE_NAME=ORCL)))"/>
        </dataSources>
    </version>
</oracle.manageddataaccess.client>
</configuration>

```

## ODP.NET Intellisense for .NET Configuration Files

When installing ODP.NET from a non-ODAC release, such as from a database server installation, Intellisense for ODP.NET configuration files is not enabled by default as it is with ODAC-based GUI installations. .xsd files are included in the `ORACLE_HOME\odp.net\managed\common` directory to enable developers to modify the .NET configuration file using IntelliSense. For Visual Studio to leverage the supplied .xsd files, do the following:

1. Open the .NET config file (i.e. `app.config`, `web.config`, or `machine.config`) within Visual Studio.
2. Within Visual Studio, navigate to **XML**, and then **Schemas**.
3. Enable the check mark under the **Use** column for:

`Oracle.ManagedDataAccess.Client.Configuration.Section.xsd` for managed ODP.NET and

`Oracle.UnmanagedDataAccess.Client.Configuration.Section.xsd` for unmanaged ODP.NET, respectively.

## Oracle Data Provider for .NET, Unmanaged Driver Configuration

The following sections explain how to configure ODP.NET, Unmanaged Driver.

ODP.NET can be configured using an XML file named `web.config`, `app.config`, or `machine.config`. These config files contain sections specific to ODP.NET configuration.

For unmanaged ODP.NET, developers use either the traditional `<oracle.dataaccess.client>` section or the newer `<oracle.unmanageddataaccess.client>` section. Oracle recommends applications use `<oracle.unmanageddataaccess.client>` when possible. For managed ODP.NET, developers use `<oracle.manageddataaccess.client>`.

`<oracle.unmanageddataaccess.client>` is a superset of `<oracle.manageddataaccess.client>` as unmanaged ODP.NET supports some features not available in the managed driver. For features both providers have in common, they share the same structure, properties, and nearly all values. Programmers will find using either provider interchangeably or migrating between unmanaged and managed ODP.NET is easier with the shared format.

This documentation section covers unmanaged ODP.NET configuration settings in the Windows registry, `<oracle.dataaccess.client>`, or unique `<oracle.unmanageddataaccess.client>` settings. For shared settings with `<oracle.manageddataaccess.client>`.



**See Also:**

[Oracle Data Provider for .NET, Managed Driver Configuration](#)

## Supported Configuration Settings

ODP.NET, Unmanaged Driver supports the configuration of an attribute as follows:

- In the Windows registry.
- In an XML file.
- Through a different mechanism such as a connection string or programmatically through an ODP.NET class, if applicable.

[Table 2-3](#) describes each configurable attribute that is supported by ODP.NET. In the table, the term Configuration Support is followed by the types of configuration support (Windows registry, XML file, and so on) that are available for that attribute.

The table describes valid values as well as the default for each attribute.



**Note:**

The default values shown are the values used for an attribute if the registry key does not exist or if it is not configured anywhere.

**Table 2-3 Configuration Attributes**

Attribute/Setting Name	Description
CheckConStatus	<p>Specifies whether the status of the connection is checked or not before putting the connection back into the connection pool. This registry entry is not created by the installation of ODP.NET. However, the default value 1 is used.</p> <p>Configuration Support: Windows Registry and XML file</p> <p>Valid Values: 1: Check the status of the connection. 0: Do not check the status of the connection.</p> <p>Default: 1</p>
DbNotificationPort	<p>Specifies the port number which ODP.NET listens to, for all notifications sent by the database for change notification, HA, or RLB features. ODP.NET does not throw any errors if an invalid or used port number is specified. The port can also be set to override the Windows registry and XML configuration file by setting the <code>OracleDependency.Port</code> static field.</p> <p>Configuration Support: XML file, and ODP.NET class</p> <p>Valid Values: -1: Open a random unused port to listen to. <math>n \geq 0</math>: Listen on port <math>n</math>.</p> <p>Default: -1</p>
DemandOraclePermission	<p>Specifies whether ODP.NET demands <code>OraclePermission</code> from the .NET application that is trying to access the database using ODP.NET.</p> <p>Configuration Support: Windows Registry and XML file</p> <p>Valid Values: 0: Disables demands for <code>OraclePermission</code>. 1: Enables demands for <code>OraclePermission</code></p> <p>Default: 0</p>
DllPath	<p>Specifies the location where dependent unmanaged Oracle Client binaries load from.</p> <p>Configuration Support: Windows Registry and XML file</p> <p>Valid Values: The path where dependent unmanaged Oracle Client binaries reside.</p> <p>Default: <code>ORACLE_BASE\ORACLE_HOME\bin</code></p>

**Table 2-3 (Cont.) Configuration Attributes**

Attribute/Setting Name	Description
DynamicEnlistment	Due to a behavior change with the ODAC 12c Release 3 version of ODP.NET connection string attribute <code>enlist=dynamic</code> , <code>DynamicEnlistment</code> has no operation now.
FetchSize	<p>Specifies the total memory size, in bytes, that ODP.NET allocates to cache the data fetched from a database round-trip. This value can be set on the <code>OracleCommand</code> and the <code>OracleDataReader</code> <code>FetchSize</code> property as well.</p> <p>Configuration Support: Windows Registry, XML file, and ODP.NET class</p> <p>Valid Values: <code>0 &lt;= n &lt;= int.MaxValue</code>: <code>n</code> is the size of the cache in bytes. Default: 131072</p>
LegacyEntireLobFetch	<p>Returns either <code>OracleBlob</code> and <code>OracleClob</code> types or <code>OracleBinary</code> and <code>OracleString</code> types from Oracle Database BLOB and CLOB columns. This setting only applies when <code>InitialLobFetchSize</code> is set to -1.</p> <p>Valid Values: 0: Returns <code>OracleBlob</code> and <code>OracleClob</code> 1: Returns <code>OracleBinary</code> and <code>OracleString</code> Default: 0</p>

**Table 2-3 (Cont.) Configuration Attributes**

Attribute/Setting Name	Description
LegacyTransactionBindingBehavior	<p>Specifies when a database connection detaches from a <code>System.Transactions</code> transaction. By default, connections detach from a transaction only when explicitly unbound as is the case when the connection closes or implicitly unbound when the transaction is disposed. Alternatively, this attribute can be set so that the connection detaches whenever the transaction ends (commits, aborts, or times out), the connection closes, or the transaction is disposed.</p> <p>In ODP.NET 11.2.0.3.20 and earlier releases, the latter was the default behavior. Oracle recommends using the current default behavior.</p> <p>In the earlier default behavior, when the timeout elapses before the transaction completes, the connection unbinds itself from the transaction and all subsequent executions on this connection execute in <code>AutoCommit</code> mode. Any operations prior to the timeout roll back, but operations performed after the timeout commit.</p> <p>In the current default setting, users receive an exception when the transaction times out and additional operations execute on the connection.</p> <p>Configuration Support: Windows Registry and XML file</p> <p>Valid Values:</p> <p>0: Connections detach from transaction when the connection closes or the transaction is disposed.</p> <p>1: Connections detach from transaction when the connection closes, the transaction is disposed, or the transaction completes (commits, rolls back, times out).</p> <p>Default: 0</p>
MaxStatementCacheSize	<p>Specifies the maximum number of statements that can be cached when self-tuning is enabled.</p> <p>Configuration Support: Windows Registry and XML file</p> <p>Valid Values: 0 to <code>System.Int32.MaxValue</code>.</p> <p>Default: <code>OPEN_CURSORS</code> setting value of the database</p>

Table 2-3 (Cont.) Configuration Attributes

Attribute/Setting Name	Description
MetaDataXml	<p>Specifies the name of the XML file that customizes the queries to obtain the metadata the ADO.NET 2.0 <code>GetSchema</code> method returns. <code>MetaDataXml</code> can only be set in a configuration file.</p> <p>Configuration Support: XML file only</p> <p>Valid Values: A complete file name for the XML file.</p> <p>Default: <i>none</i></p>
PerformanceCounters	<p>Enables or disables publishing performance counters for connection pooling. Multiple performance counters can be obtained by adding the valid values.</p> <p>Configuration Support: Windows Registry and XML file</p> <p>Valid Values:</p> <p>0: Not Enabled</p> <p>1: Number of sessions being established with Oracle Database every second.</p> <p>2: Number of sessions being severed from Oracle Database every second.</p> <p>4: Number of active connections originating from connection pools every second.</p> <p>8: Number of active connections going back to the connection pool every second.</p> <p>16: Total number of active connections.</p> <p>32: Number of inactive connection pools.</p> <p>64: Total number of connections in use.</p> <p>128: Total number of connections available for use in all the connection pools.</p> <p>256: Total number of pooled active and free connections.</p> <p>512: Number of non-pooled active connections</p> <p>1024: Number of connections which were garbage-collected implicitly.</p> <p>2048: Number of connections that will be soon available in the pool. User has closed these connections, but they are currently awaiting actions, such transaction completion, before they can be placed back into the pool as free connections.</p> <p>4095: All the above</p> <p>Default: 0</p>

Table 2-3 (Cont.) Configuration Attributes

Attribute/Setting Name	Description
SelfTuning	<p>Specifies whether self-tuning is enabled for an ODP.NET application.</p> <p>Configuration Support: Windows Registry, XML file, and <code>SelfTuning</code> connection string attribute</p> <p>Valid Values:</p> <p>0: Self Tuning is disabled. Used in the registry or XML file.</p> <p>false: Self Tuning is disabled. Used for the <code>SelfTuning</code> connection string attribute.</p> <p>1: Self Tuning is enabled. Used in the registry or XML file.</p> <p>true: Self Tuning is enabled. Used for the <code>SelfTuning</code> connection string attribute.</p> <p>Default: 1</p>
StatementCacheSize	<p>Specifies the number of cursors or statements to be cached on the database for each connection. This setting corresponds to <i>Statement Cache Size</i> attribute in the connection string. A value greater than zero also enables statement caching.</p> <p>Configuration Support: Windows Registry, XML file, and <i>Statement Cache Size</i> connection string attribute</p> <p>Valid Values:</p> <p><math>0 \leq n \leq</math> the value of <code>OPEN_CURSORS</code> parameter set in <code>init.ora</code> database config file.</p> <p><i>n</i> is the number to set.</p> <p>Default: 0</p>
StatementCacheWithUdts	<p>Specifies whether or not Oracle UDTs retrieved by executing a <code>SELECT</code> statement are cached along with the statement in the statement cache. This setting affects the memory usage and performance of the application.</p> <p>Configuration Support: Windows Registry and XML file</p> <p>Valid Values:</p> <p>0: Oracle UDTs are not cached with statements.</p> <p>1: Oracle UDTs are cached along with statements.</p> <p>Default: 1</p>

**Table 2-3 (Cont.) Configuration Attributes**

Attribute/Setting Name	Description
ThreadPoolMaxSize	<p>Specifies the default maximum size of worker threads for each available processor in a process. This value may affect the performance of ODP.NET connection creation, command execution timeout, and external procedures (<code>extproc</code>) that use the thread pool. However, unnecessarily increasing thread pool maximum size can also cause performance problems.</p> <p>Configuration Support: Windows Registry and XML file</p> <p>Valid Values:  <math>0 \leq n \leq \text{int.MaxValue}</math>: Allows ODP.NET to reset thread pool maximum size with the value <i>n</i>. The ODP.NET reset operation may be ignored if the value is invalid. For example, if <i>n</i> is less than the number of available processors of the system. In this case, the result is the same as the value -1.                      -1: Leave the thread pool max size as is.                      Default: -1 (this registry entry is not created by default)</p>
TraceFileLocation	<p>Trace file destination directory, for example, D:\traces.</p> <p>Configuration Support: Windows Registry and XML file</p> <p>Default: <i>&lt;Windows user temporary folder&gt;\ODP.NET\unmanaged\trace</i></p>
TraceFileMaxSize	<p>Maximum file size of each trace file.</p> <p>Configuration Support: Windows Registry and XML file</p> <p>Default: 100. Units are in megabytes (that is, 100 MB).</p>
TraceFileName	<p>Specifies the file name to be used for logging trace information.</p> <p>Configuration Support: Windows Registry and XML file</p> <p>Valid Values: Any valid directory location and file name. Default: <code>c:\odpnet2.trc</code> (for .NET Framework 2.0)</p>

**Table 2-3 (Cont.) Configuration Attributes**

Attribute/Setting Name	Description
TraceLevel	<p>Specifies the level of tracing in ODP.NET. Because tracing all the entry and exit calls for all the objects can be excessive, <code>TraceLevel</code> is provided to limit tracing to certain areas of the provider. Each valid value indicates a possible tracing level. Compounded tracing levels can be obtained by adding the valid values.</p> <p>Configuration Support: Windows Registry and XML file</p> <p>Valid Values:</p> <ul style="list-style-type: none"> <li>0: None</li> <li>1: Entry, exit, and SQL statement information</li> <li>2: Connection pooling statistics</li> <li>4: Distributed transactions (enlistment and delistment)</li> <li>8: User-mode dump creation upon unmanaged exception</li> <li>16: HA Event Information</li> <li>32: Load Balancing Information</li> <li>64: Self Tuning Information</li> <li>127: All the above</li> </ul> <p>Default: 0</p> <p><b>Note:</b> ODP.NET does bit-wise checking on the value. When tracing is enabled, logging to the trace file can affect ODP.NET performance.</p> <p><b>Note:</b> The user-mode dump creation requires <code>dbghelp.dll</code> version 5.1.2600.0 or later.</p>
TraceOption	<p>Specifies whether to log trace information in single or multiple files for different threads. If a single trace file is specified, the file name specified in <code>TraceFileName</code> is used. If the multiple trace files option is requested, a Thread ID is appended to the file name provided to create a trace file for each thread.</p> <p>Configuration Support: Windows Registry and XML file</p> <p>Valid Values:</p> <ul style="list-style-type: none"> <li>0: Single trace file</li> <li>1: Multiple trace files</li> </ul> <p>Default: 0</p>

Table 2-3 (Cont.) Configuration Attributes

Attribute/Setting Name	Description
UdtCacheSize	<p>Specifies the size of the object cache for each connection in kilobytes (KB) that ODP.NET uses to retrieve and manipulate Oracle UDTs.</p> <p>Configuration Support: Windows Registry and XML file</p> <p>Valid Values: <math>0 \leq n \leq 4194303</math>, <math>n</math> is the number to set.</p> <p>Default: 4096</p>
<i>UDT Mapping</i>	<p>Specifies a mapping between a custom type and an Oracle UDT in the database. The mappings can be specified in configuration files and custom type factories. However, if the mapping is specified in both places, mappings specified in the configuration files takes precedence over mappings specified using custom type factories.</p> <p>Configuration Support: XML file and Custom Type Factory Classes</p> <p>Valid Values: Any valid mapping.</p> <p>Default: <i>none</i></p>

## Windows Registry

Upon installation, ODP.NET creates entries for configuration and tracing within the Windows Registry. Configuration and tracing registry values apply across all ODP.NET applications running in that Oracle client installation. Individual ODP.NET applications can override some of these values by configuring them within the ODP.NET application itself (for example, `FetchSize`). Applications can also use the .NET configuration files to override some of the ODP.NET Windows Registry values.

The ODP.NET registry values are located under `HKEY_LOCAL_MACHINE\Software\Oracle\ODP.NET\version\`. There is one key for .NET Framework 3.5, and one key for .NET Framework 4 and later.



### Note:

32-bit applications running on an x64-based version of Windows use the registry subkey, `HKEY_LOCAL_MACHINE\Software\WOW6432node` in place of `HKEY_LOCAL_MACHINE\Software`. If such applications use Oracle Data Provider for .NET (32-bit), then the ODP.NET registry values are located under `HKEY_LOCAL_MACHINE\SOFTWARE\Wow6432Node\Oracle\ODP.NET\version\`.

## Configuration File Support

For customers who have numerous applications on a computer that depends on a single version of ODP.NET, the Windows Registry settings for a given version of ODP.NET may not necessarily be applicable for all applications that use that version of ODP.NET. To provide more granular control, ODP.NET Configuration File Support allows developers to specify ODP.NET configuration settings in an application config, web.config, or a machine.config file.

If a computer does not require granular control beyond configuration settings at the ODP.NET version level, there is no need to specify ODP.NET configuration settings through configuration files.

The following is an example of a web.config file for .NET Framework:

```
<?xml version="1.0" encoding="utf-8" ?>
<configuration>
  <oracle.dataaccess.client>
    <settings>
      <add name="DllPath" value="C:\oracle\bin"/>
      <add name="FetchSize" value="131072"/>
      <add name="StatementCacheSize" value="10"/>
      <add name="TraceFileName" value="D:\odpnet2.trc"/>
      <add name="TraceLevel" value="63"/>
      <add name="TraceOption" value="1"/>
    </settings>
  </oracle.dataaccess.client>
</configuration>
```

The following is an example of app.config for ODP.NET, Unmanaged Driver using .NET Framework, which sets some additional attributes as well as two UDT type mappings:

```
<?xml version="1.0" encoding="utf-8" ?>
<configuration>
  <oracle.dataaccess.client>
    <settings>
      <add name="DbNotificationPort" value="-1"/>
      <add name="DllPath" value="C:\app\user\product\21.3.0\client_1\bin"/>
      <add name="DynamicEnlistment" value="0"/>
      <add name="FetchSize" value="131072"/>
      <add name="MetaDataXml" value="CustomMetaData.xml"/>
      <add name="PerformanceCounters" value="4095"/>
      <add name="StatementCacheSize" value="50"/>
      <add name="ThreadPoolMaxSize" value="30"/>
      <add name="TraceFileName" value="D:\odpnet2.trc"/>
      <add name="TraceLevel" value="0"/>
      <add name="TraceOption" value="0"/>
      <add name="Person" value="udtMapping factoryName='PersonFactory, Sample, Version=0.0.0.0, Culture=neutral, PublicKeyToken=null' typeName='PERSON' schemaName='HR' dataSource='oracle'"/>
      <add name="Student" value="udtMapping factoryName='StudentFactory, Sample, Version=0.0.0.0, Culture=neutral, PublicKeyToken=null' typeName='STUDENT' schemaName='HR'"/>
    </settings>
  </oracle.dataaccess.client>
</configuration>
```

ODP.NET, Unmanaged Driver now has the option of using the same configuration file format as ODP.NET, Managed Driver. The format simplifies configuration by using a single unified scheme. To utilize this format, the existing unmanaged ODP.NET configuration section should be renamed from `<oracle.dataaccess.client>` to `<oracle.unmanageddataaccess.client>`. The existing unmanaged ODP.NET elements and values are supported within the new section using the same format as with ODP.NET, Managed Driver. To see how to set the elements and values, see ["Oracle Data Provider for .NET, Managed Driver Configuration"](#) for more information.

For example, converting the `FetchSize` element and value from the traditional to the new format would be done as follows:

```
<oracle.dataaccess.client>
  <settings>
    <add name="FetchSize" value="131072" />
  </settings>
</oracle.dataaccess.client>

<oracle.unmanageddataaccess.client>
  <version number="*">
    <settings>
      <setting name="FetchSize" value="131072" />
    </settings>
  </version>
</oracle.unmanageddataaccess.client>
```

The traditional ODP.NET, Unmanaged Driver configuration file format will continue to be supported.

## SQL Translation Framework Configuration

### Configuring the SQL Translation Profile

The default SQL Translation Profile can be set in the .NET config file, either for all connections across the application, or it is also possible to limit the scope of a profile based on optional `dataSource` and `userId` XML attributes. Please note that these `dataSource` and `userId` XML attributes directly correspond to the `Data Source` and `User Id` attributes in the connection string used to open a database connection.



#### Note:

SQL Translation Profile settings are only supported in the `<oracle.unmanageddataaccess.client>` section. It is not supported in the `<oracle.dataaccess.client>` section nor the `<oracle.manageddataaccess.client>` section.

This would be used for all connections to the `Data Sources` and `User Ids`.

This would be used for all connections to the specified `Data Source`.

This would be used for all connections to the specified `User Id`.

This would be used for all connections to the specified `Data Source` and `User Id`.

It is possible to configure multiple default profile entries which allow configuring default profiles for different `dataSource` and `userId` attributes, but while selecting a profile, the profile with maximum matching attributes will be selected.

In case there are 2 matching entries, one with `dataSource` only and the other with `userId` only then the entry with matching the `userId` would be given priority over the entry with matching `dataSource`.

With the above configuration, if we try to connect with a connection string which has `stf_ds` for Data Source and `stf_user` for User Id attributes, then both the entries given above will match and in such cases, we will give priority to the entry with a matching User Id attribute which means `profile_user` will be selected as the default profile.

### Configuring the Error Mapping

Applications can configure the connection related error mapping in their application configuration file. The error mapping can also be scoped based on Data Source name, User Id and the profile name itself.

Here is an example of providing error mapping with all three attributes.

```
<configuration>
  <oracle.unmanageddataaccess.client>
    <version number="*">
      <sqlTranslation>
        <defaultProfiles>
          <defaultProfile dataSource="stf_ds" userId="stf_user" profile=" Profile4"/>
        </defaultProfiles>
        <ErrorMappings>
          <ErrorMapping dataSource="stf_ds" userId="stf_user" profile="Profile4">
            <add oracleErrorNumber="1017" translatedErrorCode="222" />
            <add oracleErrorNumber="1005" translatedErrorCode="888" />
          </ErrorMapping>
        </ErrorMappings>
      </sqlTranslation>
    </version>
  </oracle.unmanageddataaccess.client>
</configuration>
```

Please note that `dataSource` and `userId` attributes are optional but can be used to scope the mapping.

It is also possible to provide an error mapping which could be used for all profiles. Here is an example:

```
<ErrorMappings>
  <ErrorMapping profile="*">
    <add oracleErrorNumber="1017" translatedErrorCode="222" />
    <add oracleErrorNumber="1018" translatedErrorCode="888" />
  </ErrorMapping>
</ErrorMappings>
```

### Configuring the Default Error Mapping Profile

The default error mapping profile can be configured through the `defaultErrorMappingProfile` setting. This is to be used to specify the default error mapping profile, especially in scenarios when the default profile is not specified through the .NET configuration file, but specified on the server side. In this case, if

connectivity related errors occur, then ODP.NET will be able to properly use error mappings specified in the .NET configuration file for the profile specified by the `defaultErrorMappingProfile` setting.

Here is an example to configure the default error mapping profile:

```
<sqlTranslation>
  <settings>
    <add name="defaultErrorMappingProfile" value="error_mapping_profile" />
  </settings>
</sqlTranslation>
```

### Configuring the SQL Translation Framework Statement Cache Size

Client can configure the number of translated statements that ODP.NET can cache internally to avoid translations, which can be an expensive operation.

Here is an example to configure default error mapping profile:

```
<sqlTranslation>
  <settings>
    <add name="translatedStatementCacheSize" value="50" />
  </settings>
</sqlTranslation>
```

### Sample SQL Translation Framework configuration file

Here is a sample configuration file with all possible elements that can be used:

```
<sqlTranslation>
  <settings>
    <add name="translatedStatementCacheSize" value="50" />
    <add name="defaultErrorMappingProfile" value="def_Profile" />
  </settings>
  <defaultProfiles>
    <defaultProfile profile="STF.NO_DS_NO_USERID"/>
    <defaultProfile userId="stf" profile="STF_NO_DS"/>
    <defaultProfile dataSource="stf_inst" profile="STF_NO_USERID"/>
    <defaultProfile dataSource="stf_inst" userId="stf" profile="STF.STF_X"/>
  </defaultProfiles>
  <ErrorMappings>
    <ErrorMapping profile="def_profile">
      <add oracleErrorNumber="1017" translatedErrorCode="444" />
    </ErrorMapping>
    <ErrorMapping dataSource="stf_inst" userId="stf" profile=" STF.STF_X ">
      <add oracleErrorNumber="1018" translatedErrorCode="88888" />
    </ErrorMapping>
  </ErrorMappings>
</sqlTranslation>
```

### Example 2-1 Setting the profile which could be used for all connections

```
<configuration>
  <oracle.unmanageddataaccess.client>
    <version number="*">
      <sqlTranslation>
        <defaultProfiles>
          <defaultProfile profile="Profile1"/>
        </defaultProfiles>
      </sqlTranslation>
    </version>
  </oracle.unmanageddataaccess.client>
</configuration>
```

```

    </oracle.unmanageddataaccess.client>
</configuration>

```

### Example 2-2 Setting the Profile for a Specific Data Source

```

<defaultProfiles>
  <defaultProfile dataSource="stf_ds" profile="Profile2"/>
</defaultProfiles>

```

### Example 2-3 Setting the Profile for a Specific User Id

```

<defaultProfiles>
  <defaultProfile userId="stf_user" profile="Profile3"/>
</defaultProfiles>

```

### Example 2-4 Setting the Profile for a Specific Data Source and User Id'

```

<defaultProfiles>
  <defaultProfile dataSource="stf_ds" userId="stf_user" profile="Profile4"/>
</defaultProfiles>

```

### Example 2-5 Configuring Multiple Default Profile Entries

```

<defaultProfiles>
  <defaultProfile dataSource="stf_ds" profile="profile_ds"/>
  <defaultProfile userId="stf_user" profile="profile_user"/>
</defaultProfiles>

```

## Specifying UDT Mappings with Unified Configuration for Unmanaged ODP.NET

As UDT mapping is not currently supported by ODP.NET, Managed Driver, a new section within the `<version>` section is used to support custom UDT mappings for unmanaged ODP.NET in the unified configuration format. This new section is identified as `<udtmappings>` and each mapping is identified using a `<udtmapping>` element. The following attributes may be specified for each `udtMapping` element:

- `typeName` (required)
- `factoryName` (required)
- `dataSource` (optional)
- `schemaName` (optional)

These elements retain the same name and meaning as when used with the traditional configuration format.

Example of converting traditional format to unified format:

```

<configuration>
  <oracle.dataaccess.client>
    <settings>
      <add name="Person" value="udtMapping factoryName='PersonFactory, Sample,
Version=0.0.0.0, Culture=neutral, PublicKeyToken=null' typeName='PERSON'
schemaName='SCOTT' dataSource='oracle'" />
    </settings>
  </oracle.dataaccess.client>
</configuration>

<configuration>
  <oracle.unmanageddataaccess.client>
    <udtmappings>

```

```

        <udtmapping typename="PERSON" factoryname="PersonFactory, Sample,
Version=0.0.0.0, Culture=neutral, PublicKeyToken=null" schemaname="SCOTT"
datasource="oracle" />
    </udtmappings>
</oracle.unmanageddataaccess.client>
</configuration>

```



### See Also:

[Oracle User-Defined Types \(UDTs\) and .NET Custom Types](#)

## Oracle Data Provider for .NET, Managed Driver Configuration

ODP.NET, Managed Driver supports .NET configuration file-based settings in `machine.config`, `app.config`, and `web.config`. It does not support Windows registry based configuration. ODP.NET, Managed Driver settings in .NET configuration files are similar to ODP.NET, Unmanaged Driver settings to make porting easier.

The ODP.NET, Managed Driver configuration file section name is `<oracle.manageddataaccess.client>`. The `<oracle.manageddataaccess.client>` settings and values are also supported in unmanaged ODP.NET configuration file: `<oracle.unmanageddataaccess.client>`. While this documentation section discusses managed ODP.NET configuration, it is also applicable to `<oracle.unmanageddataaccess.client>`. The `<oracle.unmanageddataaccess.client>` share numerous common settings with `<oracle.manageddataaccess.client>`. Differences between the two are noted on this page. The `<oracle.unmanageddataaccess.client>` settings not available in managed ODP.NET are documented in "[Oracle Data Provider for .NET, Unmanaged Driver Configuration](#)". A typical .NET config that uses ODP.NET, Managed Driver has some or all of the following subsections nested within a `<version>` subsection under `<oracle.manageddataaccess.client>` section. Note the tag names are case sensitive, while the attribute names are case insensitive.

```

<?xml version="1.0" encoding="utf-8" ?>
<configuration>
  <oracle.manageddataaccess.client>
    <version number="*">
      <dataSources>
        ...
        ...
      </dataSources>
      <settings>
        ...
        ...
      </settings>
      <LDAPsettings>
        ...
        ...
      </LDAPsettings>
      <implicitRefCursor>
        ...
        ...
      </implicitRefCursor>
      <edmMappings>
        ...
        ...
    </version>
  </oracle.manageddataaccess.client>
</configuration>

```

```

    <edmMappings>
  </version>
<version number="4.121.2.0">
  <dataSources>
    ...
  </dataSources>
  <settings>
    ...
  </settings>
  <LDAPsettings>
    ...
  </LDAPsettings>
  <implicitRefCursor>
    ...
  </implicitRefCursor>
  <edmMappings>
    ...
  </edmMappings>
</version>
</oracle.manageddataaccess.client>
</configuration>

```

The ODP.NET, Managed Driver configuration and settings are described in the following sections. Many of the attributes are the same as ODP.NET, Unmanaged Driver. See [Table 2-3](#) for detailed attribute descriptions.

## version Section

All the information required by an application should be grouped under the `version` subsections. Each `<version number="X">` section contains parameters applicable for version `X` of the ODP.NET, Managed Driver. For example, `<version number="4.121.2.0">` section parameters will be applicable only for those applications using ODP.NET, Managed Driver assembly 4.121.2.0.

Apart from version specific sections, there can also be a generic section `<version number="*">`. This section's parameters are applicable for all ODP.NET, Managed Driver versions. Parameters in the version specific section take precedence over the parameters of the generic section. The following is an example of a `version` section:

```

<oracle.manageddataaccess.client>
  <version number="*">
    <settings>
      <setting name="TraceOption" value="1"/>
      <setting name="PerformanceCounters" value="0" />
    </settings>
  </version>
  <version number="4.121.2.0">
    <settings>
      <setting name="PerformanceCounters" value="4095" />
    </settings>
  </version>
</oracle.manageddataaccess.client>

```

An application referencing ODP.NET, Managed Driver 4.121.2.0 has the following values set:

- `TraceOption = 1`
- `PerformanceCounters= 4095`

## dataSources Section

This section can appear only under a `<version>` section. The mapping between the different data source aliases and corresponding data descriptors should appear in this section. This section is supported by managed ODP.NET only. The following is an example.

```
<dataSources>
  <dataSource alias="inst1" descriptor="(DESCRIPTION=(ADDRESS=(PROTOCOL=tcp)
(HOST=sales-server).....))" />
  <dataSource alias="inst2" descriptor="(DESCRIPTION= .....)" />
</dataSources>
```

### Note:

The `data source` connection string attribute can alternatively be set to a full descriptor or Easy Connect syntax rather than a data source alias.

Requirements for connecting to a local database *without* specifying "data source" connection string attribute:

- The listener must be up and running.
- `ORACLE_SID` environment variable must be set appropriately.

### Note:

When `data source` connection string attribute is not specified, protocol defaults to 'tcp' and port defaults to '1521'.

The ODP.NET managed driver reads and caches all the alias entries from the `app.config`, `web.config`, `machine.config`, and from a `tnsnames.ora` file that is found at application start-up time. However, aliases that are defined in LDAP servers are resolved and cached on demand. This means for each unique alias that is used by the application, an alias resolution query is executed against an LDAP server and the full descriptor associated with the alias will be cached once it is fetched.

For developers that need to change or add alias settings while developing applications, one may consider using `OracleDataSourceEnumerator.GetDataSources()` rather than restarting the application. Invoking this method will first wipe out existing cache entries that were read from the `tnsnames.ora` file and all aliases obtained from the LDAP Server. Then, the `tnsnames.ora` is re-parsed and all its entries will be cached again. Please note that the `app.config`, `web.config`, and `machine.config` entries are read only once at application start-up time and thus their contents are maintained and not re-parsed even if `OracleDataSourceEnumerator.GetDataSources()` is invoked.

The `OracleDataSourceEnumerator.GetDataSources()` method invocation has an impact on the connection pool. This is because a connection pool, which is created for each unique connection string, will cache the resolved full descriptor information after the first connection is created for a given connection pool. After that, the connection pool uses the cached full descriptor information for all subsequent connection creations. Thus, for applications that have their `tnsnames.ora` or LDAP entries modified during the execution of an application where an alias points to a different database than before, one should call the `OracleDataSourceEnumerator.GetDataSources()` method to remove old cached entries. This should be followed by the invocation of the `ClearPool(OracleConnection)` instance method or the `ClearAllPools()` static method to remove existing connections and also have it obtain a new full descriptor value that was read by the invocation of `OracleDataSourceEnumerator.GetDataSources()`. Following this scheme will assure that *all* the connections in the connection pool uses the new full descriptor that is now associated with the alias and all connections in a connection pool is established to the same database.

The following keywords are supported within the descriptor setting:

- ADDRESS
- ADDRESS\_LIST (Note: only failover supported)
 

Oracle recommends using SCAN listener and Runtime Load Balancing to balance the load when connecting to an Oracle RAC database.
- DESCRIPTION
- DESCRIPTION\_LIST (Note: Failover supported; Address\_list load balancing not supported)
- HOST (Note: <hostname>, <IPv6 literal>, and <IPv4 literal> are supported)
- HTTPS\_PROXY
- HTTPS\_PROXY\_PORT
- IP (Note: "loopback" is supported)
- PROTOCOL (Note: tcp and tcps are supported. In addition, WS and WSS are also supported.)
- RETRY\_COUNT: Specifies the number of times an ADDRESS list is traversed before the connection attempt is terminated and times out.
- RETRY\_DELAY: Specifies the delay in seconds between subsequent retries for a connection.

`RETRY_COUNT` and `RETRY_DELAY` are timeout parameters that work at the Oracle networking layer. They are intended to be used in conjunction with each other. When these parameters are used, ODP.NET will attempt to connect with one of the addresses in the `ADDRESS_LIST`. If there is no successful connection after going through the entire list, then ODP.NET will wait for the number of seconds specified by `RETRY_DELAY` before traversing the address list again. It will repeat this behavior until there is a successful connection or the `RETRY_COUNT` limit is hit.

For example, let's assume `RETRY_COUNT=2` and `RETRY_DELAY=4` when ODP.NET cannot successfully connect to any address on the list. The following sequence is triggered:

1. Traverse address list to connect.
2. Wait four seconds for next set of retry attempts.
3. Traverse the address list again. This is first set of retry attempts.
4. Wait four seconds for the next retry attempt.
5. Traverse the address list again. This is the second and final set of retry attempts.
6. Timeout

These timeout parameters function independent of ODP.NET application timeouts, such as the `Connection Timeout` connection string attribute. If the `Connection Timeout` is set to a low value, then it may trigger before the `RETRY_COUNT` and `RETRY_DELAY` attempt cycle completes.

- Session Data Unit size supports from 256 to 2097152 in bytes.
- `SECURITY: SSL_VERSION` (Note: overrides `sqlnet.ora:ssl_version`)
- `TRANSPORT_CONNECT_TIMEOUT` (Note: overrides `tcp.connect_timeout`)

#### Note:

- SSL is now supported via method MCS and FILE.
- Both Kerberos5 and NTS authentication are supported. RADIUS is not supported.
- Only NTS authentication is supported. No RADIUS nor Kerberos5 authentication.
- Only Net Services, Easy Connect naming, and LDAP (namely, Active Directory and Oracle Internet Directory) are supported.
- No bequeath (`beq`) support. Default address is instead TCP loopback with port 1521 and Oracle service name from environment (`ORACLE_SID`)

#### See Also:

*Oracle Database Net Services Reference* for a detailed description of the attributes.

Though managed ODP.NET does not support TNS descriptor based load balancing, it does support failover through both an `ADDRESS_LIST` and `DESCRIPTION_LIST`.

Note that you need not specify either the `LOAD_BALANCE` or the `FAILOVER` directive, because only failover is supported. The directives are ignored.

The following examples demonstrate TNS descriptors utilizing failover:

```
(DESCRIPTION=
  (ADDRESS_LIST=
    (ADDRESS=(PROTOCOL=tcp) (HOST=host1) (PORT=1630))
    (ADDRESS=(PROTOCOL=tcp) (HOST=host2) (PORT=1630))
    (ADDRESS=(PROTOCOL=tcp) (HOST=host3) (PORT=1521)))
  (CONNECT_DATA=(SERVICE_NAME=Sales.us.example.com)))
```

```
(DESCRIPTION_LIST=
(DESCRIPTION=
  (ADDRESS_LIST=
    (ADDRESS=(PROTOCOL=tcp) (HOST=sales1a-svr) (PORT=1521))
    (ADDRESS=(PROTOCOL=tcp) (HOST=sales1b-svr) (PORT=1521)))
  (CONNECT_DATA=(SERVICE_NAME=sales1.example.com)))
(DESCRIPTION=
  (ADDRESS_LIST=
    (ADDRESS=(PROTOCOL=tcp) (HOST=sales2a-svr) (PORT=1521))
    (ADDRESS=(PROTOCOL=tcp) (HOST=sales2b-svr) (PORT=1521)))
  (CONNECT_DATA=(SERVICE_NAME=sales2.us.example.com))))
```

## settings section

This section can appear only under a <version> section. Any ODP.NET, Managed Driver specific settings should appear in this section. The following is an example of a settings section:

```
<settings>
  <setting name="TraceLevel" value="7" />
  <setting name="TraceOption" value="1"/>
  <setting name="TNS_ADMIN" value="C:\oracle\work"/>
</settings>
```

A new default behavior has been introduced for ODP.NET Release 12.1.0.2 and later when `InitialLobFetchSize` is set to -1. The new default value is `LegacyEntireLOBFetch = 0`. To use the old behavior, set `LegacyEntireLobFetch = 1` in the ODP.NET configuration. Refer to ["Setting InitialLONGFetchSize to -1"](#) for more information.

ODP.NET, Managed Driver configuration settings that are supported:

- `BindByName`
- `CPVersion`: Determines whether ODP.NET, Unmanaged Driver uses the traditional connection pool implementation (Default=1.0) or the more modern connection pool implementation with better high availability support (2.0). In addition, the more modern connection pool (2.0) is required if the application uses Database Resident Connection Pooling (DRCP), or hosts multiple pluggable databases or editions in the same pool. Possible values: 1.0 or 2.0.

ODP.NET, Managed Driver only uses the more modern connection pool implementation. This setting can only be used for ODP.NET, Unmanaged Driver for .NET Framework 4 and higher. It cannot be used for earlier versions of unmanaged ODP.NET, which will always use the traditional connection pool implementation.

If `CPVersion` is set explicitly, then that setting will be used across processes for all connection strings.

If `CPVersion` is left unmodified (or contains an invalid value) and an application's first unmanaged ODP.NET established connection for a given connection string uses DRCP, pluggable databases, or editions by modifying one these features' properties or configuration settings, then `CPVersion` will be implicitly modified to use the newer connection pool implementation (2.0).

If a `CPVersion 1.0` pool attempts to use DRCP, pluggable database, or edition settings, then ODP.NET will raise an exception when the application attempts to open a connection.

When `CPVersion 2.0` is used explicitly or implicitly and the "proxy user id" is not specified in the connection string, then a proxy connection will not be created, even if "proxy password" is supplied.

When `CPVersion 2.0` is used by ODP.NET, Unmanaged Driver, the connection pool behavior will be the same as the more modern connection pool as implementation that ODP.NET, Managed Driver uses.

- `DbNotificationPort`
- `DemandOraclePermission`
- `Disable_Oob`: Interrupts database query execution via either TCP/IP urgent data or normal TCP/IP data, called out of band data (default) or in band data, respectively. (Default=off).

All Oracle database clients support interrupting database query execution, such as through an ODP.NET command timeout. Windows-based database servers only support in band breaks, whereas all other (predominantly UNIX-based) database servers can support out of band (OOB) or in band breaks. ODP.NET, Managed Driver uses OOB breaks by default with database servers that support it. For certain network topologies, the routers or firewalls involved in the route to the database may have been configured to drop urgent data or in band the data. If the routers or firewalls can not be changed to handle urgent data appropriately, then the ODP.NET, Managed Driver can be configured to utilize in band breaks by setting the .NET configuration parameter `Disable_Oob` to `on`.

- `DllPath`: (Unmanaged ODP.NET only) Specifies the directory location dependent unmanaged Oracle Client binaries are loaded from.

See [Search Order for Unmanaged DLLs](#) for more information.

- `DRCPConnectionClass`: Specifies a logical name that identifies the DRCP connection pool that the ODP.NET connection will use. It will be used as a default if the `DRCPConnectionClass` property on the `OracleConnection` object is not set. It will be ignored for non-DRCP connections.

Valid Values: the connection class name is string at max 1024 characters. The default is null.

- `FetchSize`
- `GetDecimalRetainTrailingZeros`: (Managed ODP.NET only) Specifies whether to retain trailing zeros from an Oracle `NUMBER` in a .NET `Decimal`.

See OracleConfiguration [GetDecimalRetainTrailingZeros](#) for more information.

- `LDAP_ADMIN`: Specifies the `ldap.ora` location. The `LDAP_ADMIN` setting works in conjunction with the `TNS_ADMIN` setting to set `ldap.ora` search order.

See [Oracle Client Configuration File Settings](#) for `ldap.ora` search order.

- `LegacyEntireLOBFetch`
- `MaxStatementCacheSize`
- `MetaDataXml`

- NAMES.DIRECTORY\_PATH: The default search order is TNSNAMES and EZCONNECT. TNSNAMES, LDAP, and EZCONNECT are the only name resolution methods supported, but their order of precedence can be modified.
- NAMES.LDAP\_AUTHENTICATE\_BIND
- NAMES.LDAP\_AUTHENTICATE\_BIND\_METHOD
- NAMES.LDAP\_CONN\_TIMEOUT
- NODELAY
- ORA\_DEBUG\_JDWP: Allows Oracle PL/SQL Debugger and database to connect automatically without application code changes. Value is set as `host=<IP_address or host_name>;port=<debugging port number>`. Ex. `host=localhost;port=1234`
- ORACLE\_SID
- PerformanceCounters
- RECEIVE\_BUF\_SIZE: Sets TCP SO\_RECVBUF, the total buffer space associated with the local side of a TCP socket
- SelfTuning
- SEND\_BUF\_SIZE: Sets TCP SO\_SENDBUF, the total buffer space associated with the local side of a TCP socket
- ServiceRelocationConnectionTimeout

In seconds. (Default = 90).

Whenever a database service becomes unavailable, such as due to a service being relocated, an application can encounter numerous connectivity errors during this time. To avoid unnecessary connection attempts to an unavailable service which will result in an error, ODP.NET blocks any connection attempts until the service is up or until this property's specified time limit expires from the time when the service DOWN event was received, whichever comes first. Once the specified time elapses, all the connection attempts to the specific service which is known to be down will no longer be blocked. Those requests will be sent to the server. `ServiceRelocationConnectionTimeout` is only operational in conjunction with Oracle Fast Connection Failover (`HA Events = true`). Once Fast Connection Failover is enabled for the .NET application, Service Relocation Connection Timeout is automatically enabled. It will use its default value if no `ServiceRelocationConnectionTimeout` value has been explicitly set. It works with planned and unplanned outages.

When connecting to Oracle Data Guard in Oracle Database 12c Release 2 or later, database administrators can set their own timeout value, `drain_timeout`, to indicate the number of seconds allowed for resource draining to be completed. This setting can be optionally used by the ODP.NET `ServiceRelocationConnectionTimeout` value as the intent behind `drain_timeout` and `ServiceRelocationConnectionTimeout` are the same.

If `ServiceRelocationConnectionTimeout` and `drain_timeout` are not set, then the default `ServiceRelocationConnectionTimeout` value is used (90 seconds). If only `drain_timeout` is set, then that value will be used for the service relocation connection timeout. If only `drain_timeout` is set and is set to 0, then also default `ServiceRelocationConnectionTimeout` value is used (90 seconds). If both are set, then the value of `ServiceRelocationConnectionTimeout` will override the value of `drain_timeout`.

`ServiceRelocationConnectionTimeout` itself can be set based upon the value of `drain_timeout`. For example, if ODP.NET administrators desire the service relocation connection timeout to be `drain_timeout` plus 50 seconds, then they would set `ServiceRelocationConnectionTimeout` in the following manner:

```
<setting name="ServiceRelocationConnectionTimeout" value="drain_timeout + 50"/>
```

Service Relocation Connection Timeout is not supported in pools that connect to more than one pluggable database.

- `SQLNET.AUTHENTICATION_SERVICES`: Supported values are ALL, Kerberos5, NTS, TCPS, or NONE.

Managed ODP.NET supports NTS, Kerberos5, and TCPS external authentication methods. This setting should be set based on the desired database authentication method. If internal database authentication is desired, then the setting should be set to NONE. Default value is NONE. The value(s) must be enclosed in parentheses. Example settings made in `sqlnet.ora` are:

```
SQLNET.AUTHENTICATION_SERVICES = (TCPS)
SQLNET.AUTHENTICATION_SERVICES = (NTS)
SQLNET.AUTHENTICATION_SERVICES = (Kerberos5, NTS)
SQLNET.AUTHENTICATION_SERVICES = (NONE)
```

 **Note:**

The NTS external authentication methodology is only supported on a Windows-based client and server.

`SQLNET.AUTHENTICATION_SERVICES` default values are different for managed ODP.NET and unmanaged ODP.NET. Managed ODP.NET defaults to NONE and unmanaged defaults to ALL when no value is set.

- `SQLNET.CLOUD_USER`
- `SQLNET.CRYPTO_CHECKSUM_CLIENT`: Specifies the desired data integrity behavior when this client connects to a server. Supported values are accepted, rejected, requested, or required. Default = accepted.
- `SQLNET.CRYPTO_CHECKSUM_TYPES_CLIENT`: Specifies the data integrity algorithms that this client uses. Supported values are SHA512, SHA384, SHA256, and SHA1.
- `SQLNET.ENCRYPTION_CLIENT` = Negotiates whether to turn on encryption. Supported values are accepted, rejected, requested, or required.
- `SQLNET.ENCRYPTION_TYPES_CLIENT` = Encryption algorithm(s) to use.

The following table lists the valid encryption algorithms for ODP.NET, Managed Driver.

**Table 2-4 Encryption Algorithms for ODP.NET, Managed Driver**

Algorithm Name	Legal Value
AES 128-bit key	AES128

**Table 2-4 (Cont.) Encryption Algorithms for ODP.NET, Managed Driver**

Algorithm Name	Legal Value
AES 192-bit key	AES192
AES 256-bit key	AES256
2-key 3DES	3DES112
3-key 3DES	3DES168

For more information on data encryption settings, refer to the *Oracle Database Security Guide*.

- **SQLNET.EXPIRE\_TIME**: Specifies a time interval to send a new set of probes to verify the connection remains active. This setting is equivalent to the `OracleConnection.KeepAliveTime` property. `OracleConnection.KeepAliveInterval` is fixed at 6 seconds for `SQLNET.EXPIRE_TIME`. Default is 0 (off). By default the value is specified in minutes. However the value can be specified in seconds (sec) and milliseconds (ms), such as the following example:

```
<setting name=" SQLNET.EXPIRE_TIME" value="30 sec" />
```

- `SQLNET.URI`
- `SQLNET.USE_HTTPS_PROXY`
- `SQLNET.WALLET_OVERRIDE`
- `StatementCacheSize`
- **SSL\_SERVER\_DN\_MATCH**: To enforce the distinguished name (DN) for the database server matches its service name. (Default=no).

If you enforce the match verification, then SSL/TLS ensures that the certificate is from the server. If you select to not enforce the match verification, then SSL/TLS performs the check but allows the connection, regardless if there is a match. Not enforcing the match allows the server to potentially fake its identify.

Supported values: `yes` | `on` | `true` to enforce a match.

Supported values: `no` | `off` | `false` to not enforce a match.

`SSL_SERVER_DN_MATCH` is often used together with `SSL_SERVER_CERT_DN`. `SSL_SERVER_CERT_DN` specifies the distinguished name (DN) of the database server. It can be set in the connect descriptor.

```
net_service_name=
  (DESCRIPTION=
    (ADDRESS=(PROTOCOL=tcp) (HOST=sales1-svr) (PORT=1521))
    (ADDRESS=(PROTOCOL=tcp) (HOST=sales2-svr) (PORT=1521))
    (CONNECT_DATA=
      (SERVICE_NAME=sales.us.acme.com)
      (SECURITY=
        (SSL_SERVER_CERT_DN="cn=sales,cn=OracleContext,dc=us,dc=acme,dc=com"))))
```

The client uses this information to obtain the list of DNs it expects for each of the servers, enforcing the database server DN to match its service name. Use this parameter with `SSL_SERVER_DN_MATCH` to enable server DN matching.

- **SSL\_VERSION:** Sets the version of the SSL/TLS connection. By default, all supported versions are enabled, in the order 3.0, 1.0, 1.1, and 1.2.

The client and server negotiate to the highest version among the common conversions specified in their configurations. The versions from lowest to highest are: 3.0 (lowest), 1.0, 1.1, and 1.2 (highest).

To specify more than one version, use the `or` keyword between values. For example, `1.2 or 1.1 or 3.0`.

- **TNS\_ADMIN:** Location where either one or more of `tnsnames.ora`, `ldap.ora`, and `sqlnet.ora` are located. Locations can consist of either absolute or relative directory paths.
- **TOKEN\_AUTH:** This attribute specifies the access token authentication type. Possible values are `OCITOKEN`, `OAUTH`, or `DISABLED`. Only supported for managed ODP.NET and ODP.NET Core.
- **TOKEN\_LOCATION:** This attribute is the file-based token location. The value can be a directory where a file named "token" is or it can be the file's full path specification. Only supported for managed ODP.NET and ODP.NET Core.
- **TraceFileLocation:** Trace file destination directory, for example, `D:\traces`. The default `TraceFileLocation` is `<Windows user temporary folder>\ODP.NET\managed\trace`.
- **TraceFileMaxSize:** Maximum file size of each trace file. Default is 100 MB (100,000,000). The default value is 100. The unit of measure is megabytes (i.e. 100 MB).
- **TraceLevel:** 1 = public APIs; 2 = private APIs; 4 = network APIs/data; 8 = disables writing SQL statements and network packet contents. These values can be `ORed`. To enable everything, set `TraceLevel` to 7. Errors will always be traced.
- `TraceOption`
- `TCP.CONNECT_TIMEOUT`
- `TOKEN_AUTH`
- `TOKEN_LOCATION`
- `UseClientInitiatedCQN`
- **WALLET\_LOCATION:** Microsoft Certificate Store (MCS) and file system wallets are supported.



#### See Also:

*Oracle Database Net Services Reference*

## LDAPsettings section

This section can appear only under a `<version>` section. Any ODP.NET, Managed Driver specific LDAP settings should appear in this section. This section is supported by managed ODP.NET only. The following is an example of a `<LDAPsetting>` subsection under the `<LDAPsettings>` section:

```
<LDAPsettings>
  <LDAPsetting name="DIRECTORY_SERVER_TYPE" value="AD" />
```

```
<LDAPsetting name="DEFAULT_ADMIN_CONTEXT" value="dc=Oracle,dc=com"/>
</LDAPsettings>
```

## Lightweight Directory Access Protocol

ODP.NET, Managed Driver supports TNS alias resolution through a LDAP server/service, specifically Microsoft Active Directory and Oracle Internet Directory (OID). TNS alias resolution occurs when using the `LDAPsettings` section or `ldap.ora` file settings. The `LDAPsettings` section settings take precedence over `ldap.ora` settings.

For Active Directory, only the `DIRECTORY_SERVER_TYPE` and `DEFAULT_ADMIN_CONTEXT` parameters are required in `ldap.ora`. When the `DIRECTORY_SERVERS` parameter is missing or has no value, the default LDAP server for the current domain will be used.

For OID, all `ldap.ora` parameters must be set with valid values to complete configuration.

ODP.NET, Managed Driver and ODP.NET, Unmanaged Driver support the same level of security when using LDAP for name resolution.

**Table 2-5 Microsoft Active Directory: Encryption Types and Authentication Credentials For Connecting and Binding**

No Encryption	SSL Encryption
Anonymous authentication	Anonymous authentication
Domain User authentication	Domain User authentication

**Table 2-6 Oracle Internet Directory: Encryption Types and Authentication Credentials For Connecting and Binding**

No Encryption	SSL Encryption
Anonymous authentication	Anonymous authentication
-	Wallet based authentication
	<i>Note: Wallet based authentication for Oracle Internet Directory is not supported for this release</i>

### See Also:

- *Oracle Database Net Services Reference* for more information on Directory Usage Parameters.
- *Oracle Database Net Services Administrator's Guide* for more information on Managing Network Address.

## implicitRefCursor section

This section can appear only under a `<version>` section. Any information about `REF CURSOR` parameters that need to be bound implicitly should appear in this section. The following is an example of an `<implicitRefCursor>` section:

```

<implicitRefCursor>
  <storedProcedure schema="USERREFCUR" name="TestProc1">
    <refCursor name="Param3">
      <bindInfo mode="Output"/>
      <metadata columnOrdinal="0" columnName="DEPTNO" baseColumnName="DEPTNO"
baseSchemaName="USERREFCUR" baseTableName="DEPT" nativeDataType="number"
providerType="Int32" dataType="System.Int16" columnSize="2" allowDBNull="true" />
      <metadata columnOrdinal="1" columnName="DNAME" baseColumnName="DNAME"
baseSchemaName="USERREFCUR" baseTableName="DEPT" nativeDataType="varchar2"
providerDbType="String" columnSize="30" />
    </refCursor>
    <refCursor name="param2">
      <bindInfo mode="Output"/>
      <metadata columnOrdinal="0" columnName="EMPNO" baseColumnName="EMPNO"
baseSchemaName="USERREFCUR" baseTableName="EMP" nativeDataType="number"
providerType="Int32" dataType="System.Int16" columnSize="4" allowDBNull="false" />
    </refCursor>
  </storedProcedure>

  <!--Next stored procedure information-->
  <storedProcedure name="TestProc2">
    ...
    ...
  </storedProcedure>
</implicitRefCursor>

```

## distributedTransaction section

This section can appear only under a `<version>` section. Any information about distributed transactions should appear in this section. The following is an example of a `distributedTransaction` section:

```

<distributedTransaction>
  <setting name="OMTSRECO_IP_ADDRESS" value="my-pc" />
  <setting name="OMTSRECO_PORT" value="2040" />
  <setting name="ORAMTS_SESS_TXNTIMETOLIVE" value="240" />
</distributedTransaction>

```

- `OMTSRECO_IP_ADDRESS`: Specifies the machine name (or IP address) that the OraMTS Recovery service will be running on to resolve database in-doubt transactions. The default is the local machine name.
- `OMTSRECO_PORT`: Specifies the port that the OraMTS Recovery service will be listening on to resolve database in-doubt transactions. The default is 2030.
- `ORAMTS_SESS_TXNTIMETOLIVE` : Specifies the time in seconds that the transaction can remain inactive after it has been detached or delisted from the database. Once this time expires, the transaction is automatically terminated by the provider. The default is 120 seconds.
- `UseOraMTSManaged`: When set to `true` and using .NET Framework 4.5.2 or higher, ODP.NET uses managed code for distributed transactions. If set to `false`, ODP.NET uses Oracle Services for Microsoft Transaction Server to support distributed transactions. Boolean (Default = `false`) for ODP.NET, Unmanaged Driver only.

## connectionPools section

This section can appear only under a `<version>` section. This section allows setting a string identifier for each set of monitored connection counters. Refer to [Connection Performance Counters](#) documentation section for more details.

## edmMappings section

This section can appear only under a `<version>` section. Any information related to EDM mappings should appear in this section. Refer to [Oracle Number Default Data Type Mapping and Customization](#) for more examples on `edmMappings` section.

## onsConfig section

Oracle Notification Service (ONS) can be configured using either local or remote configuration using the `<onsConfig>` section. The `<onsConfig>` section is available only for managed ODP.NET. Remote configuration is the preferred configuration for standalone client applications. For releases earlier than Oracle Database 12c, this section is mandatory for ODP.NET to receive ONS notifications. With Oracle Database 12c and later, this section is optional and the information about the ONS daemons is received from the server itself. However, ODP.NET will also listen for events from any `<host:port>` pairs that is provided by the user in this section in addition to the `<host:port>` pairs received from the server.

For local configuration, please ensure that ONS is configured and available on the node where ODP.NET is running, so that ODP.NET can receive events directly from the local ONS daemon. The following is a sample format for the local configuration:

```
<onsConfig configFile="C:\temp\test.config" mode="local">
</onsConfig>
```

### Note:

The `configFile` specified in .NET config should contain the same `localport` and `remoteport` values as specified in the `ons.config` used by the local ONS daemon. This will enable the application to receive events from the local ONS daemon.

Remote configuration is used in scenarios where the application directly receives ONS events from the ONS daemons running on remote machines. One of the advantages of this configuration is that no ONS daemon is needed on the client end and, therefore, there is no need to manage this process.

The following is a sample format for remote configuration:

```
<onsConfig mode="remote">
  <ons database="db1">
    <add name="nodeList" value="racnode1:4100, racnode2:4200" />
  </ons>
  <ons database="db2">
    <add name="nodeList" value=" racnode3:4100, racnode4:4200" />
  </ons>
</onsConfig>
```

In case of remote configuration, the application has to specify the `<host>:<port>` values for every potential database that it can connect to. The `<host>:<port>` value pairs represent the ports on the the different Oracle RAC nodes where the ONS daemons are talking to their remote clients.



### See Also:

[Client Side ONS Daemon Configuration](#) for information about client side ONS daemon configuration

## ONS TCPS and Wallets

ODP.NET enables ONS communications to occur over TCP/IP with SSL/TLS (TCPS), which is more secure than just TCP/IP. As TCPS requires using a wallet for storing keys and certificates, ODP.NET can use one wallet for both ONS and ODP.NET connections or have separate wallets for each.

TCPS provides more secure ONS communication, gives administrators flexibility in how to configure their wallets, and enables cloud database connections.

`oracle.manageddataaccess.client` configuration section sample

```
<oracle.manageddataaccess.client>
  <version number="*">
    <onsConfig mode="remote">
      <settings>
        <setting name="Protocol" value="TCPS" />
        <setting name="WALLET_LOCATION" value="D:\user\ONS_SSLWallet" />
      </settings>
      <ons database="acdb183">
        <add name="nodeList" value="slcai611:6205,slcai610:6205,slcai612:6205" />
      </ons>
    </onsConfig>
  </settings>
  <setting name="WALLET_LOCATION" value=" D:\user\DBWallet" />
</settings>
</version>
</oracle.manageddataaccess.client>
```

The protocol and wallet location properties are often used together.

If an ONS wallet location is set, ODP.NET will use the wallet for ONS to connect via TCP/IP with SSL/TLS regardless of the protocol setting.

If the protocol is set to "TCPS", ODP.NET first tries to use the wallet in the ONS configuration wallet location to connect via TCP/IP with SSL/TLS. If no wallet is present, ODP.NET next tries to use the wallet from the database wallet location. If no wallet is found, the connection fails.

Administrators can choose between having the ONS connection use its own independent wallet or share the database's wallet for ease of use.

If the protocol is set to "TCP" and no ONS wallet location is set, ODP.NET ONS will connect with TCP/IP.

ODP.NET ONS TCPS works with any Oracle Database version that supports ONS TCPS on the server side.

## Client Side ONS Daemon Configuration

ONS configuration is controlled by the ONS configuration file, `ORACLE_HOME/opmn/conf/ons.config`. This file tells the ONS daemon how it should behave. The `SRVCTL` utility can be used to start and stop the ONS daemon. It is installed on each node by default during server install.

Configuration information within `ons.config` is defined in simple name and value pairs. An example of `ONS.config` is given below

```
# This is an example ons.config file
#
# The first three values are required
localport=4100
remoteport=4200
nodes=racnode1.example.com:4200,racnode2.example.com:4200
```

Some parameters in the `ons.config` file are required and some are optional. [Table 2-7](#) lists the required ONS configuration parameters and [Table 2-8](#) lists the optional ONS configuration parameters.

**Table 2-7 Required ONS Configuration Parameters**

Parameter	Explanation
<code>localport</code>	The port that ONS binds to on the local host interface to talk to local clients. For example, <code>localport=4100</code>
<code>remoteport</code>	The port that ONS binds to on all interfaces for talking to other ONS daemons. For example, <code>remoteport=4200</code>
<code>nodes</code>	A list of other ONS daemons to talk to. Node values are given as a comma-delimited list of either host names or IP addresses plus ports. The port value that is given is the remote port that each ONS instance is listening on. In order to maintain an identical file on all nodes, the <code>host:port</code> of the current ONS node can also be listed in the nodes list. It will be ignored when reading the list. For example, <code>nodes=myhost.example.com:4200,123.123.123.123:4200</code> The nodes listed in the nodes line correspond to the individual nodes in the Oracle RAC instance. Listing the nodes ensures that the middle-tier node can communicate with the Oracle RAC nodes. At least one middle-tier node and one node in the Oracle RAC instance must be configured to see one another. As long as one node on each side is aware of the other, all nodes are visible. You need not list every single cluster and middle-tier node in the ONS configuration file of each Oracle RAC node. In particular, if one ONS configuration file cluster node is aware of the middle tier, then all nodes in the cluster are aware of it.

**Table 2-8 Optional ONS Configuration Parameters**

Parameter	Description
loglevel	The level of messages that should be logged by ONS. This value is an integer that ranges from 1, which indicates least messages logged, to 9, which indicates most messages logged. The default value is 3. For example, <code>loglevel=3</code>
logfile	A log file that ONS should use for logging messages. The default value for log file is <code>\$ORACLE_HOME/opmn/logs/ons.log</code> . For example, <code>logfile=C:\app\user\product\12.1.0\opmn\logs\myons.log</code>
walletfile	The wallet file used by the Oracle Secure Sockets Layer (SSL) to store SSL certificates. If a wallet file is specified to ONS, then it uses SSL when communicating with other ONS instances and require SSL certificate authentication from all ONS instances that try to connect to it. This means that if you want to turn on SSL for one ONS instance, then you must turn it on for all instances that are connected. This value should point to the directory where your <code>ewallet.p12</code> file is located. For example, <code>walletfile=C:\app\user\product\12.1.0\opmn\conf\ssl\wallet\default</code>
useocr	The value, reserved for use on the server-side, to indicate ONS whether it should store all Oracle RAC nodes and port numbers in Oracle Cluster Registry (OCR) instead of the ONS configuration file or not. A value of <code>useocr=on</code> is used to store all Oracle RAC nodes and port numbers in Oracle Cluster Registry (OCR). Do not use this option on the client-side.

The `ons.config` file allows blank lines and comments on lines that begin with the number sign (#).



#### See Also:

*Oracle Real Application Clusters Administration and Deployment Guide* for more information about the `SRVCTL` utility.

## Relative Windows Path and Windows Environment Variable Configuration Settings

The following managed ODP.NET configuration settings support relative Windows path and environment variables:

- `TraceFileLocation`
- `WALLET_LOCATION`

File locations for the above config parameters can now be set using relative Windows paths. The "." notation informs ODP.NET to use the current working directory. Sub-directories can

be added by appending them. For example, `.\mydir` refers to the sub-directory `mydir` in the current working directory. To navigate to a parent directory, use the `.."` notation.

For web applications, the current working directory is the application directory. For Windows applications, the `.EXE` location is the current working directory.

Windows paths can also be set using Windows environment variable names within `"%"` characters.

For example, `%tns_admin%, c:\%dir%\my_app_location, c:\%top_level_dir%\%bottom_level_dir%` etc.

#### Note:

- If the environment variable that is used by the configuration parameter is not set to anything, then an exception will be thrown.
- A directory name cannot partially be using an environment variable. For example, `c:\my_app_%id%`
- Multiple variables can be used in given directory location. For example, `c:\%top_level_dir%\%bottom_level_dir%`.

#### See Also:

*Oracle Database Net Services Reference* chapters covering `sqlnet.ora` parameters, `tnsnames.ora` local naming parameters, and `listener.ora` Oracle Net Listener parameters, for more information about these Oracle client settings.

## Oracle Data Provider for .NET Core Configuration

ODP.NET Core developers can assign application settings in `.NET Configuration API`, `sqlnet.ora` file, and `tnsnames.ora` file.

### .NET Configuration API

.NET Core does not support application configuration via `.NET` configuration files, that is, `web.config`. Instead, it uses `.NET Configuration API` in lieu of a configuration file. ODP.NET Core supports Configuration API via the static class, `OracleConfiguration`, for application level provider settings. The `OracleDataSourceCollection` class supports adding and deleting net services names, that is, TNS entries. The `OracleOnsServerCollection` class supports adding to and deleting from a list of nodes where the Oracle Notification Service (ONS) daemons are talking to their remote clients.

All configurations settings through `OracleConfiguration` should be done before opening any connection in the application. Once a connection is opened, any updates to configuration properties will result in `InvalidOperationException`; with only exception of trace settings that are still allowed to change during application runtime.

**Example 2-6 Code Sample**

```
using System;
using Oracle.ManagedDataAccess.Client;

namespace ODP_Core_Config_API
{
    class odp_core_config
    {
        static void Main(string[] args)
        {
            // This sample demonstrates how to use ODP.NET Core Configuration API

            // Add connect descriptors and net service names entries.
            OracleConfiguration.OracleDataSources.Add("orclpdb",
"(DESCRIPTION=(ADDRESS=(PROTOCOL=TCP) (HOST=<hostname or IP>) (PORT=1521))
(CONNECT_DATA=(SERVICE_NAME=<service name>) (SERVER=dedicated)))");
            OracleConfiguration.OracleDataSources.Add("orcl",
"(DESCRIPTION=(ADDRESS=(PROTOCOL=TCP) (HOST=<hostname or IP>) (PORT=1521))
(CONNECT_DATA=(SERVICE_NAME=<service name>) (SERVER=dedicated)))");

            // Set default statement cache size to be used by all connections.
            OracleConfiguration.StatementCacheSize = 25;

            // Disable self tuning by default.
            OracleConfiguration.SelfTuning = false;

            // Bind all parameters by name.
            OracleConfiguration.BindByName = true;

            // Set default timeout to 60 seconds.
            OracleConfiguration.CommandTimeout = 60;

            // Set default fetch size as 1 MB.
            OracleConfiguration.FetchSize = 1024 * 1024;

            // Set tracing options
            OracleConfiguration.TraceOption = 1;
            OracleConfiguration.TraceFileLocation = @"D:\traces";
            // Uncomment below to generate trace files
            //OracleConfiguration.TraceLevel = 7;

            // Set network properties
            OracleConfiguration.SendBufferSize = 8192;
            OracleConfiguration.ReceiveBufferereSize = 8192;
            OracleConfiguration.DisableOOB = true;

            OracleConnection orclCon = null;

            try
            {
                // Open a connection
                orclCon = new OracleConnection("user id=hr; password=<password>; data
source=orclpdb");
                orclCon.Open();

                // Execute simple select statement that returns first 10 names from
EMPLOYEES table
                OracleCommand orclCmd = orclCon.CreateCommand();
                orclCmd.CommandText = "select first_name from employees where rownum
```

```
<= 10 ";
        OracleDataReader rdr = orclCmd.ExecuteReader();

        while (rdr.Read())
            Console.WriteLine("Employee Name: " + rdr.GetString(0));

        Console.ReadLine();

        rdr.Dispose();
        orclCmd.Dispose();
    }
    finally
    {
        // Close the connection
        if (null != orclCon)
            orclCon.Close();
    }
}
}
```

### Oracle Configuration Files

ODP.NET Core supports the `sqlnet.ora` and `tnsnames.ora` parameters below. These settings can be used in conjunction with .NET Configuration API.

- BindByName
- DbNotificationPort
- Disable\_Oob – `sqlnet.ora`
- DRCPConnectionClass
- FetchSize
- MaxStatementCacheSize
- NAMES.DIRECTORY\_PATH – `sqlnet.ora`
- NODELAY – `sqlnet.ora`
- RETRY\_COUNT
- RETRY\_DELAY
- RECEIVE\_BUF\_SIZE – `sqlnet.ora` **Or** `tnsnames.ora`
- **SelfTuning**
- SEND\_BUF\_SIZE – `sqlnet.ora` **Or** `tnsnames.ora`
- ServiceRelocationConnectionTimeout
- SQLNET.AUTHENTICATION\_SERVICES – `sqlnet.ora`
- SQLNET.CRYPTO\_CHECKSUM\_CLIENT – `sqlnet.ora`
- SQLNET.CRYPTO\_CHECKSUM\_TYPES\_CLIENT – `sqlnet.ora`
- StatementCacheSize
- SSL\_SERVER\_DN\_MATCH – `sqlnet.ora`
- SSL\_VERSION – `sqlnet.ora`

- TNS\_ADMIN
- TOKEN\_AUTH
- TOKEN\_LOCATION
- TraceFileLocation
- TraceLevel
- TraceOption
- TCP.CONNECT\_TIMEOUT – sqlnet.ora
- SQLNET.ENCRYPTION\_CLIENT – sqlnet.ora
- SQLNET.ENCRYPTION\_TYPES\_CLIENT – sqlnet.ora

ODP.NET Core will look for `sqlnet.ora` and `tnsnames.ora` files in the following precedence order:

1. `OracleConfiguration.OracleDataSources`
2. Directory set in `OracleConnection.TnsAdmin` property
3. Directory set for the `Tns_Admin` connection string attribute
4. Directory set in `OracleConfiguration.TnsAdmin` property
5. Current working directory
6. `TNS_ADMIN` directory setting of the OS environment variable or container environment variable

ODP.NET Core will look for `ldap.ora` files in the following precedence order:

1. Directory set in `OracleConnection.TnsAdmin`
2. Directory set for the `Tns_Admin` connection string attribute
3. Directory set in `OracleConfiguration.TnsAdmin` property
4. Directory set in `OracleConfiguration.LdapAdmin` property
5. Current working directory
6. `TNS_ADMIN` directory setting in the environment
7. `LDAP_ADMIN` directory setting in the environment

 **See Also:**

- [OracleConfiguration Class](#)
- [OracleDataSourceCollection Class](#)

## Configuration Differences among ODP.NET Drivers

[Table 2-9](#) lists other configuration differences among ODP.NET Core, ODP.NET, Managed Driver and ODP.NET, Unmanaged Driver..

**Table 2-9 Configuration Differences among ODP.NET Core, ODP.NET, Unmanaged Driver and ODP.NET, Managed Driver**

Feature Category	Difference compared to ODP.NET, Unmanaged Driver
Configuration	The older, traditional ODP.NET, Unmanaged Driver configuration file format is different. The new format allows both providers to share the same format. See <a href="#">"Oracle Data Provider for .NET, Managed Driver Configuration."</a>
Configuration	Windows Registry based configuration is not supported
Configuration Parameter	Edition is not supported.
Configuration Parameter	CheckConStatus is not supported.
Configuration Parameter	DllPath is not supported.
Configuration Parameter	StatementCacheWithUdts is not supported.
Configuration Parameter	ThreadPoolMaxSize is not supported.
Configuration Parameter	TraceFileName is not supported.
Configuration Parameter	UdtCacheSize is not supported.
Configuration Parameter	<i>UDT Mapping</i> is not supported.
Configuration Parameter	UseOraMTSManaged is not supported.
Connection String	Context Connection is not supported.
Connection String	LegacyTransactionBindingBehavior setting will be ignored. It will always be set to the default value of 1.
Connection String	Statement Cache Purge is not supported.
Connection String	Tns_Admin is supported in managed ODP.NET and ODP.NET Core, but not in unmanaged ODP.NET.
Connection String	Wallet_Location is supported in managed ODP.NET and ODP.NET Core, but not in unmanaged ODP.NET.
Connectivity	Connection to Oracle Times Ten Database is not supported.
Performance Monitor	NumberOfStatisConnections performance counter is not supported.
Performance Monitor	Performance monitor category name is "ODP.NET, Managed Driver"
Provider Types	Provider Types accept (via constructors) and generate (via ToString()) methods) only culture-invariant strings
Tracing	Dynamic tracing is enabled by changing the TraceLevel setting in the app/web/machine.config. NOTE: For ASP.NET applications, doing so will recycle the application domain.

## Configuring for Entity Framework Code First

Developers must configure applications to use the Oracle Entity Framework functionality. This consists of creating two entries in the `app.config` or `web.config` file and adding an assembly reference:

- Add entries in the .NET config file
  - Connection string

A standard ADO.NET connection string is used rather than the Entity Framework connection string used by Database First or Model First paths. The

connection string name should match the application context name. The connection string entry is an element of the `connectionStrings` section in the configuration file.

- Provider registration

Entity Framework uses the provider registration to determine the assembly to use for Oracle Entity Framework functionality. The provider registration is an element of the `providers` section within the `entityFramework` section in the application configuration file.

- Add Assembly reference

Add Oracle Entity Framework assembly to the project references.

 **Note:**

When using the official ODP.NET, NuGet installation, these preceding sections are created automatically, if they do not already exist. After the NuGet install, the ODP.NET connection string will need to be customized to the application's specific settings.

When using the Oracle Universal Installer or xcopy install, the preceding sections must all be configured manually.

Examples of connection strings are as follows:

- ODP.NET, Unmanaged Driver

```
<add name="TestContext" providerName="Oracle.DataAccess.Client"
connectionString="User Id=test;Password=testpassword;Data Source=efctest" />
```

- ODP.NET, Managed Driver

```
<add name="TestContext" providerName="Oracle.ManagedDataAccess.Client"
connectionString="User Id=test;Password=testpassword;Data Source=efctest" />
```

Examples of Oracle provider registration are as follows:

- ODP.NET, Unmanaged Driver

```
<provider invariantName="Oracle.DataAccess.Client"
type="Oracle.DataAccess.EntityFramework.EFOracleProviderServices,
Oracle.DataAccess.EntityFramework, Version=6.121.2.0, Culture=neutral,
PublicKeyToken=89b483f429c47342" />
```

- ODP.NET, Managed Driver

```
<provider invariantName="Oracle.ManagedDataAccess.Client"
type="Oracle.ManagedDataAccess.EntityFramework.EFOracleProviderServices,
Oracle.ManagedDataAccess.EntityFramework, Version=6.121.2.0, Culture=neutral,
PublicKeyToken=89b483f429c47342" />
```

## Entity Framework 6 Code-Based Registration

Entity Framework 6 allows an application to register with an Entity Framework provider without using any configuration file. With ODP.NET, Managed Driver, the code will look as follows:

```
// C#
using Oracle.ManagedDataAccess.EntityFramework;
```

```
...
public class ModelConfiguration : DbConfiguration
{
    public ModelConfiguration()
    {
        SetProviderServices("Oracle.ManagedDataAccess.Client",
EFOracleProviderServices.Instance);
    }
}
```

For ODP.NET, Unmanaged Driver, replace occurrences of `ManagedDataAccess` with `DataAccess` in the preceding code.

If you are using code-based registration, then the configuration file should not include the registration. The configuration file based registration overrides the code-based registration.

## Migrating from ODP.NET, Unmanaged Driver to ODP.NET, Managed Driver

To ease migration, the APIs of ODP.NET, Managed Driver are a complete subset of the APIs of ODP.NET, Unmanaged Driver. As long as the existing unmanaged ODP.NET applications use currently available managed ODP.NET APIs, migration is straightforward and simple.

In future versions, the managed driver will support more APIs of ODP.NET, Unmanaged Driver. Both drivers will continue to be enhanced to support the latest Oracle Database and .NET Framework features.

To migrate from unmanaged to managed ODP.NET, perform the following steps:

1. Add a Reference to `Oracle.ManagedDataAccess.dll` in the .NET project.
2. Change the existing ODP.NET, Unmanaged Driver namespace references to ODP.NET, Managed Driver references.

```
// C#
using Oracle.ManagedDataAccess.Client;
using Oracle.ManagedDataAccess.Types;

// VB
Imports Oracle.ManagedDataAccess.Client
Imports Oracle.ManagedDataAccess.Types
```

3. Some provider configuration settings may need to be migrated because ODP.NET, Managed Driver supports very few Windows Registry settings and a different .NET configuration setting format.



### See Also:

[Configuring Oracle Data Provider for .NET](#) for more information.

## Configuring a Port to Listen for Database Notifications

Oracle Data Provider for .NET opens a port to listen for database notifications when the following features are used:

- HA Events
- Load Balancing
- Continuous Query Notification
- AQ Notifications

All these features share the same port, which can be configured centrally by setting the `db notifications port` in an application or web configuration file.

If the configuration file does not exist or the `db notification port` is not specified, ODP.NET uses a valid, random port number. The configuration file may also request for a random port by specifying a `db notification port` value of `-1`. To specify a particular port in ODP.NET, Unmanaged Driver, for example, `1200`, an application or web configuration file can be used as follows:

```
<configuration>
  <oracle.dataaccess.client>
    <settings>
      <add name="DbNotificationPort" value="1200"/>
    </settings>
  </oracle.dataaccess.client>
</configuration>
```

To specify a particular port in ODP.NET, Managed Driver, an application or web configuration file can be used as follows:

```
<configuration>
  <oracle.manageddataaccess.client>
    <version number="*">
      <settings>
        <setting name="DbNotificationPort" value="1200"/>
      </settings>
    </version>
  </oracle.manageddataaccess.client>
</configuration>
```

The port number should be unique for each process running on a computer. Thus, the port number should be set uniquely for each application either programmatically or through an application config file. Note that if the specified port number is already in use or invalid, ODP.NET does not provide any errors.

When the process using ODP.NET starts, the application reads the `db notification port` number and listens on that port. Once the port is opened, the port number cannot be changed during the lifetime of the process.

 **See Also:**

- ["Fast Application Notification"](#)
- ["Runtime Connection Load Balancing"](#)
- ["Continuous Query Notification Support "](#)
- ["Oracle Database Advanced Queuing Support"](#)

## General .NET Programming Recommendations and Tips for ODP.NET

- `Thread.Abort()` should not be used, as unmanaged resources may remain unreleased, which can potentially cause memory leaks and hangs.
- To optimize resource usage, ODP.NET objects, such as `OracleConnection` and `OracleCommand`, should be explicitly closed or disposed, or both, when they are no longer needed. This should be done rather than relying on the .NET Framework garbage collector to reclaim resources. Many users have found that under stress conditions, explicit `Close` or `Dispose` calls result in much lower resource usage.
- It is recommended not to proceed with application execution if the application encounters exceptions that are associated with possible memory corruption, such as `System.AccessViolationException` and `System.Runtime.InteropServices.SEHException`.
- If the `HKEY_LOCAL_MACHINE\Software\Oracle\NLS_LANG` registry entry is set to `NA`, ODP.NET encounters `ORA-12705` errors. To eliminate this problem, remove the `HKEY_LOCAL_MACHINE\Software\Oracle\NLS_LANG` registry entry.
- .NET requires certain special characters, such as backslash `\` and double quotation mark `"`, to be escaped when used within a string. In a connection string or a class property, .NET requires using the escape character, backslash, before the special character. To represent a backslash in a string, use a double backslash `\\`. To represent a double quotation mark in a string, use a backslash followed by a double quotation mark `\"`. Alternatively, use the at sign `@` to mark the entire string as a verbatim string literal, in which case .NET ignores special characters.

# 3

## Features of Oracle Data Provider for .NET

This section describes Oracle Data Provider for .NET provider-specific features and how to use them to develop .NET applications.

This section contains the following topics:

- [Base Classes and Provider Factory Classes](#)
- [Code Access Security](#)
- [Connecting to Oracle Database](#)
- [Real Application Clusters and Global Data Services](#)
- [Using Transaction Guard to Prevent Logical Corruption](#)
- [Application Continuity](#)
- [Database Sharding](#)
- [OracleCommand Object](#)
- [ODP.NET Types Overview](#)
- [GUIDs](#)
- [Obtaining Data from an OracleDataReader Object](#)
- [PL/SQL REF CURSOR and OracleRefCursor](#)
- [Implicit REF CURSOR Binding](#)
- [LOB Support](#)
- [Native JSON Support](#)
- [ODP.NET XML Support](#)
- [Oracle User-Defined Types \(UDTs\) and .NET Custom Types](#)
- [Bulk Copy](#)
- [Oracle Database Advanced Queuing Support](#)
- [Continuous Query Notification Support](#)
- [OracleDataAdapter Safe Type Mapping](#)
- [OracleDataAdapter Requery Property](#)
- [Guaranteeing Uniqueness in Updating DataSet to Database](#)
- [Globalization Support](#)
- [Debug Tracing](#)
- [Database Application Migration: SQL Translation Framework](#)

## Base Classes and Provider Factory Classes

With ADO.NET, data classes derive from the base classes defined in the `System.Data.Common` namespace. Developers can create provider-specific instances of these base classes using provider factory classes.

Provider factory classes allow generic data access code to access multiple data sources with a minimum of data source-specific code. This reduces much of the conditional logic currently used by applications accessing multiple data sources.

Using Oracle Data Provider for .NET, the `OracleClientFactory` class can be returned and instantiated, enabling an application to create instances of the following ODP.NET classes that inherit from the base classes:

**Table 3-1 ODP.NET Classes that Inherit from ADO.NET 2.0 Base Classes**

ODP.NET Classes	Inherited from ADO.NET 2.0 Base Class
<code>OracleClientFactory</code>	<code>DbProviderFactory</code>
<code>OracleCommand</code>	<code>DbCommand</code>
<code>OracleCommandBuilder</code>	<code>DbCommandBuilder</code>
<code>OracleConnection</code>	<code>DbConnection</code>
<code>OracleConnectionStringBuilder</code>	<code>DbConnectionStringBuilder</code>
<code>OracleDataAdapter</code>	<code>DbDataAdapter</code>
<code>OracleDataReader</code>	<code>DbDataReader</code>
<code>OracleDataSourceEnumerator</code>	<code>DbDataSourceEnumerator</code>
<code>OracleException</code>	<code>DbException</code>
<code>OracleParameter</code>	<code>DbParameter</code>
<code>OracleParameterCollection</code>	<code>DbParameterCollection</code>
<code>OracleTransaction</code>	<code>DbTransaction</code>

In general, applications still require Oracle-specific connection strings, SQL or stored procedure calls, and declare that a factory from ODP.NET is used.



**Note:**

ODP.NET Core does not support factory classes.



**See Also:**

[OracleClientFactory Class](#)

## Code Access Security

ODP.NET implements code access security through the `OraclePermission` class. This ensures that application code trying to access the database has the requisite permission to do so.

When a .NET assembly tries to access Oracle Database through ODP.NET, ODP.NET demands `OraclePermission`. The .NET runtime security system checks to see whether the calling assembly, and all other assemblies in the call stack, have `OraclePermission` granted to them. If all assemblies in the call stack have `OraclePermission` granted to them, then the calling assembly can access the database. If any one of the assemblies in the call stack does not have `OraclePermission` granted to it, then a security exception is thrown.



### Note:

ODP.NET Core does not support Code Access Security.

## Configuring OraclePermission

The `DemandOraclePermission` configuration attribute is used to enable or disable `OraclePermission` demand for an ODP.NET API. The `DemandOraclePermission` value can be specified in the Windows registry for unmanaged ODP.NET only, or an individual application configuration file for both unmanaged and managed ODP.NET.

The following Windows registry key is used to configure the `DemandOraclePermission` configuration attribute:

```
HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\ODP.NET\Assembly_Version\DemandOraclePermission
```

Here `Assembly_Version` is the full assembly version number of `Oracle.DataAccess.dll`. The `DemandOraclePermission` key is of type `REG_SZ`. It can be set to either 1 (enabled) or 0 (disabled).

You can also enable `OraclePermission` demand for an individual application using its application configuration file. The following example enables the `DemandOraclePermission` property in an application configuration file for ODP.NET, Unmanaged Driver:

```
<configuration>
  <oracle.dataaccess.client>
    <settings>
      <add name="DemandOraclePermission" value="1"/>
    </settings>
  </oracle.dataaccess.client>
</configuration>
```

Similarly, you can use `DemandOraclePermission` to configure ODP.NET, Managed Driver under the settings section for managed provider configuration. See also "[settings section](#)" for more information.

An application or assembly can successfully access the database if `OraclePermission` has been added to the permission set associated with the assembly's code group. A system

administrator can modify the appropriate permission set manually or by using the Microsoft .NET configuration tool (`Mscorcfg.msc`).

Administrators may also use an appropriate .NET Framework Tool, such as the Code Access Security Policy Tool (`Caspol.exe`), to modify security policy at the machine, user, and enterprise levels for including `OraclePermission`.

`OracleConnection` makes security demands using the `OraclePermission` object when `OraclePermission` demand has been enabled using `DemandOraclePermission` configuration attribute. Application developers should make sure that their code has sufficient permission before using `OracleConnection`.

#### See Also:

- ["OraclePermission Class"](#)
- ["OraclePermissionAttribute Class"](#)

## Configuring OraclePermission for Web Applications with High or Medium Trust Levels

For Web applications operating under high or medium trust, `OraclePermission` needs to be configured in the appropriate `web_TrustLevel.config` file, so that the application does not encounter any security errors.

`OraclePermission` can be configured using the `OraProvCfg` tool. `OraProvCfg.exe` adds appropriate entries to the `web_hightrust.config` and `web_mediumtrust.config` files associated with the specified .NET framework version. The following example illustrates using the `OraProvCfg` tool for configuring `OraclePermission` in a .NET 2.0 Web application:

```
OraProvCfg.exe /action:config /product:odp /component:oraclepermission
               /frameworkversion:v2.0.50727
               /providerpath:full_path_of_Oracle.DataAccess.dll
```

On running the preceding command, the following entry is added to the `web_hightrust.config` and `web_mediumtrust.config` files under the ASP.NET permission set:

```
<IPermission class="Oracle.DataAccess.Client.OraclePermission, Oracle.DataAccess,
Version=2.112.2.0, Culture=neutral, PublicKeyToken=89b483f429c47342" version="1"
Unrestricted="true" />
```

`OraProvCfg` can also be used to remove these entries from the `.config` files when required. The following example illustrates this:

```
OraProvCfg.exe /action:unconfig /product:odp /component:oraclepermission
               /frameworkversion:v2.0.50727
               /providerpath:full_path_of_Oracle.DataAccess.dll
```

## Configuring OraclePermission for Windows Applications Running in a Partial Trust Environment

For Windows applications operating in a partial trust environment, the `OraclePermission` entry should be specified under the appropriate permission set in the `security.config` file. The `security.config` file is available in the `%windir%\Microsoft.NET\Framework\{version}\CONFIG` folder.

The following example specifies the `OraclePermission` entry for a .NET 2.0 Windows application:

```
<IPermission class="Oracle.DataAccess.Client.OraclePermission, Oracle.DataAccess, Version=2.112.2.0, Culture=neutral, PublicKeyToken=89b483f429c47342" version="1" Unrestricted="true" />
```

## Connecting to Oracle Database

Oracle Data Provider for .NET can connect to Oracle Database in a number of ways, such as using a user name and password, Windows Native Authentication, Kerberos, and Transport Layer Security/Secure Sockets Layer. This section describes `OracleConnection` provider-specific features, including:

- [Connecting to Oracle Autonomous Database](#)
- [Using Azure Active Directory](#)
- [Connection String Attributes](#)
- [Connection String Builder](#)
- [Specifying the Data Source Attribute](#)
- [Using WebSocket](#)
- [Using Transport Layer Security and Secure Sockets Layer](#)
- [Using Secure External Password Store](#)
- [Using Kerberos](#)
- [Using Windows Native Authentication \(NTS\)](#)
- [Network Data Encryption and Integrity](#)
- [Schema Discovery](#)
- [Connection Pooling](#)
- [Connection Pool Management](#)
- [Connection Performance Counters](#)
- [Database Resident Connection Pooling](#)
- [Oracle Multitenant and Pluggable Databases](#)
- [Edition-Based Redefinition](#)
- [Privileged Connections](#)
- [Connection Pooling with OracleCredential](#)
- [Password Expiration](#)

- [Proxy Authentication](#)
- [Dynamic Distributed Transaction Enlistment](#)
- [Client Identifier and End-to-End Tracing](#)
- [Transparent Application Failover \(TAF\) Callback Support](#)

## Connecting to Oracle Autonomous Database

Oracle Autonomous Database includes several deployment options:

- Oracle Autonomous Database on Shared Exadata Infrastructure (ADB-S)
- Oracle Autonomous Database on Dedicated Exadata Infrastructure (ADB-D)
- Oracle Autonomous Database on Exadata Cloud@Customer (ADBC@C)

TLS/SSL must be used to connect to ADB-S. For ADB-D and ADBC@C, use of TLS is optional. Currently, only ADB-S can be used with Oracle Identity and Access Management.

This documentation section focuses on how to connect to ADB-S.

Unmanaged ODP.NET 19.14 and 21.5 and higher supports TLS connections without a wallet.

ODP.NET core and managed drivers 19.13 and 21.4 and higher support TLS connections without a wallet.

ODP.NET Core 19.13.1 or 21.4.1 and higher support token based authentication with Oracle Identity and Access Management (IAM).

Managed ODP.NET 21.6.1 now supports token based authentication with IAM.

Oracle recommends using the latest 19c or 21c-based ODP.NET driver version available on NuGet Gallery or Oracle website when connecting to Oracle ADB-S.

### Connecting with a Wallet

The following quick start link has instructions how to download, install, and configure ODP.NET and Oracle Developer Tools for Visual Studio when using a wallet:

[Quick Start: Developing .NET Applications for Oracle Autonomous Database](#)

### Connecting without a Wallet

When you connect to Oracle ADB-S with ODP.NET, you do not need to deploy the Oracle wallet or the Oracle network configuration files `sqlnet.ora` or `tnsnames.ora` with your application. Instead, you supply the data source attribute, a TLS connection string, with the configuration information in the ODP.NET connection.

To use ODP.NET TLS connections, do the following:

1. Obtain managed ODP.NET or ODP.NET Core versions 19.13 or 21.4 or above. For unmanaged ODP.NET, versions 19.14 and 21.5 can be obtained. Lower level versions do not support TLS connections without wallets.
2. Enable TLS connections on your Autonomous Database instance. See [Update your Autonomous Database Instance to Allow both TLS and mTLS Authentication](#) for details.

3. After you enable TLS connections, supply a TLS connection string in the ODP.NET data source to connect to your Autonomous Database instance. See View TNS Names and Connection Strings for an Autonomous Database Instance for details on viewing or copying TLS connection strings.

 **Note:**

The TLS connection string uses quotation marks around the distinguished name. If you store the TLS connection string in a .NET string, add a backslash escape sequence before each quotation mark (for example, `\"`). This allows .NET to recognize the quotation mark as part of the TLS connection string.

### Connecting with Oracle Identity and Access Management

Oracle identity and access management (IAM) solutions provide secure access to enterprise applications for both cloud and on-premises deployments. Oracle IAM cloud service supports a unified identity across Oracle cloud services, including Oracle ADB-S. This capability allows identity to be propagated to all services Oracle IAM supports. A unified identity makes user management and account management easier for administrators and end users.

IAM users can connect to the Oracle Autonomous Database instance by using either an IAM database password verifier, an IAM token, or a database alternate password for token authentication.

Using the IAM database password verifier is similar to the Oracle Database password authentication process. However, instead of the password verifier (encrypted hash of the password) being stored in the Oracle Autonomous Database, the verifier is instead stored as part of the Oracle Cloud Infrastructure (OCI) IAM user attributes. This option is supported by all ODP.NET clients.

The second connection method, the use of an IAM token for the database, is more modern. The use of token-based access is a better fit for Cloud resources such as Oracle Autonomous Database. The token is based on the strength that the IAM endpoint can enforce. This can be multi-factor authentication, which is stronger than the use of passwords alone. Starting with versions 19.13.1 and 21.4.1, ODP.NET Core supports this new connection method. This functionality was added to managed ODP.NET in version 21.6.1. This will utilize native OCI Authentication primitive, specifically OCI supported tokens for authenticating OCI users when they logon to a database. By integrating with OCI IAM for authentication, Oracle databases in OCI will provide seamless identity integration with OCI services.

The third connection method is the database password for IAM token authentication. This method is different from using the IAM database password verifier since it is using a database alternate password for token authentication. This connection method is also called token-based authentication using password. ODP.NET Core and Managed ODP.NET support this feature starting with version 21.6.1.

See also Use Identity and Access Management (IAM) Authentication with Autonomous Database in Using Oracle Autonomous Database on Shared Exadata Infrastructure.

### Configuring a Client Connection Using an IAM Database Password Verifier

After you have configured the authorization needed for the IAM user, this user can log in without additional configuration.

The application provides the IAM user name and IAM database password, not the Oracle Cloud Infrastructure (OCI) console password, using any ODP.NET driver type. The only constraint is that the ODP.NET driver must have support for Oracle Database 12c passwords verifiers. Earlier password verifiers are not supported with IAM. No special client or tool configuration is needed for the IAM user to connect to the Oracle Autonomous Database instance.

### Configuring a Client Connection Using Token

ODP.NET supports the IAM token, which is a Signature token represented in standard JSON Web Token (JWT). Signature Token – also called Proof of Possession (PoP) token – is associated with a private key known to the client. The client sends a signature and token to the protected resource. The protected resource verifies the signature along with the token itself.

For passing IAM token to Oracle Autonomous Database, the following options are supported:

- Use of token file: For existing applications, use Oracle Cloud Infrastructure (OCI) command line interface (CLI) to request and store the database token in the file system, and configure ODP.NET to use the token file.
- Use of API: Modify application to request database token from IAM and pass the database token to the database client through ODP.NET API.

ODP.NET presents the database token when connecting to a database. The database requests the public key from IAM and the database validates the database token. If the token is valid, the database requests the IAM groups that the user is a member. The database reviews the local schema mappings to find which global schema the IAM user will have access to, exclusive or shared. If no schema mapping exists, the user will not be allowed to access the database.

### Configuring Client Connection to use Token File

The OCI CLI is available to request database tokens from IAM. When the OCI CLI tool is used to request tokens, it copies the token and private key to the default directory on the local machine or a custom directory can be specified. On Windows operating systems, the default directory is based on the USERPROFILE environment variable (i.e. `$USERPROFILE/.oci/db-token`). On Linux and macOS operating systems, the default directory is based on the HOME environment variable (i.e. `$HOME/.oci/db-token`).

To use token file for authentication:

1. Set ODP.NET User Id to “/” in the connection string and leave the password empty.
2. Set `TOKEN_AUTH` parameter to `OCI_TOKEN`. This parameter can be configured at various levels like TNS descriptor, EZConnect string, `sqlnet.ora` file or application configuration file. This can also be configured programmatically either at connection level through the `OracleConnection.TokenAuthentication` property or at process level through the `OracleConfiguration.TokenAuthentication` property.
3. If using a non-default token location, set the token file directory. More details on setting a specific token file location is discussed in the “Use of ODP.NET API to pass the Token” section.

When database token usage is enabled, all other external authentication methods, such as Kerberos, Windows authentication, and TLS cannot be used. However, TLS to

encrypt the client-server connection can be used – and must be used when using IAM tokens.

 **See Also:**

- [Authenticating and Authorizing IAM Users for Oracle Autonomous Databases](#) for all the steps needed to get the token file.
- [OCI Command Line Interface](#)

### Use of ODP.NET API to pass the Token

Applications can use OCI SDK to get database token for IAM user and pass the database token along with private key to ODP.NET through the API.

The database token has attributes within the token, some of which are worth noting, which will be covered in more detail later:

- `exp` attribute within the token represents the expiry time of the token.
- `sub` attribute within the token represents the IAM user of the token.

The `OracleConnection.AccessToken` property can be set to the `OracleAccessToken` object. The `OracleAccessToken` object can be constructed by providing both the signature token and private key, which are required to connect via IAM.

If `OracleConnection.AccessToken` property is not supplied by the application and the `TOKEN_AUTH` parameter is set to `OCI_TOKEN`, then ODP.NET will look for the signature token and private key files in the default directory. Applications can override this default directory by setting the `TOKEN_LOCATION` parameter. This parameter can also be configured at various levels like TNS descriptor, EZConnect string, `sqlnet.ora` file, or application configuration file. This parameter can also be configured programmatically either at the ODP.NET connection level through the `OracleConnection.TokenLocation` property or at process level through the `OracleConfiguration.TokenLocation` property.

The following table shows how ODP.NET will use IAM when a signature token is supplied and when `TOKEN_AUTH` / `TokenAuthentication` property is set.

**Table 3-2 ODP.NET Authentication using IAM and Signature Token**

Application Supplied Oracle Access Token	<code>TOKEN_AUTH</code> / <code>TokenAuthentication</code> Setting	<code>PASSWORD_AUTH</code> / <code>PasswordAuthentati</code> <code>on Setting</code>	ODP.NET Authentication
Yes	<code>OCI_TOKEN</code> / <code>OracleTokenAuth.Oci</code> <code>Token</code>	NOT SET / <code>OraclePasswordAuth.</code> <code>PasswordVerifier</code> (Default)	IAM via application SUPPLIED TOKEN
Yes	NOT SET / <code>OracleTokenAuth.Dis</code> <code>abled (default)</code>	NOT SET / <code>OraclePasswordAuth.</code> <code>PasswordVerifier</code> (default)	IAM via application SUPPLIED TOKEN

**Table 3-2 (Cont.) ODP.NET Authentication using IAM and Signature Token**

<b>Application Supplied Oracle Access Token</b>	<b>TOKEN_AUTH / TokenAuthentication Setting</b>	<b>PASSWORD_AUTH / PasswordAuthentication Setting</b>	<b>ODP.NET Authentication</b>
No (default)	OCI_TOKEN / OracleTokenAuth.OciToken	NOT SET / OraclePasswordAuth.PasswordVerifier (Default)	IAM via file SUPPLIED TOKEN
No (default)	NOT SET / OracleTokenAuth.Disabled (default)	NOT SET / OraclePasswordAuth.PasswordVerifier (Default)	External Authentication, such as Kerberos, Windows, and TLS/SSL
Yes	OCI_TOKEN / OracleTokenAuth.OciToken	OCI_TOKEN / OraclePasswordAuth.OciToken	IAM via application SUPPLIED TOKEN
Yes	NOT SET / OracleTokenAuth.Disabled (default)	OCI_TOKEN / OraclePasswordAuth.OciToken	IAM via application SUPPLIED TOKEN
No (default)	OCI_TOKEN / OracleTokenAuth.OciToken	OCI_TOKEN / OraclePasswordAuth.OciToken	If userid=/, IAM via file supplied token. Else if TokenAuthentication set programmatically, then error. In all other cases, token from REST service.
No (default)	NOT SET / OracleTokenAuth.Disabled (default)	OCI_TOKEN / OraclePasswordAuth.OciToken	Token From REST Service if userid/ password set or userid= / with SEPS enabled. In all other cases, External Authentication.

ODP.NET applications using the API to provide signature token and private key are recommended to register with the `RefreshAccessToken` event exposed on the `OracleAccessToken` object to receive a callback when token is about to expire. The .NET event provides a convenient way for applications to “refresh” the signature token and the private key before they expire.

ODP.NET triggers the token refresh callback 60 seconds before it expires. It is the application’s responsibility to ensure that ODP.NET always has a valid token for authentication when creating new connections to the database. Please note that the callback will be called only once for an authenticated token.

After the callback provides the refreshed token and private key, all new connections start using the refreshed token for authentication. However, the token expiry has no impact on existing connections checked out from or within the connection pool. If for some reason, applications fail to provide a valid refreshed token and private key through the callback, it can use `OracleConnection` object’s `OpenWithNewToken()` method to open a connection by passing a new signature token and private key.

It's important to note that already established idle connections will be dispensed even when the token has expired. The newly supplied signature token will be used only to create new connections. If the supplied signature token is invalid or expired, applications will receive an error during the `Open()` method invocation on the `OracleConnection` object.

### IAM Token Functionality Requirements

With ODP.NET Core NuGet packages, applications must target .NET 5.0 or higher to use IAM tokens.

Managed ODP.NET does not have any unique .NET assembly version dependencies to use IAM tokens.

### Sample Code

Here is ODP.NET sample code showing how to use `OracleAccessToken` to establish a connection and how to propagate the refreshed token through the `OracleRefreshAccessTokenEventArgs` class. This sample code works with managed ODP.NET and ODP.NET Core.

```
// C#
using System;
using System.IO;
using Oracle.ManagedDataAccess.Client;

class RefreshDbTokenSample
{
    // Update this path based from where token and private key would be read.
    private static string tokenPath = @"C:\token_dir";

    static void Main(string[] args)
    {
        // Create token and private key file path.
        string tokenFile = Path.Combine(tokenPath, "token");
        string privateKeyFile = Path.Combine(tokenPath, "oci_db_key.pem");

        // Read token and private key contents.
        char[] dbToken = File.OpenText(tokenFile).ReadToEnd().ToCharArray();
        char[] privateKey = File.OpenText(privateKeyFile).ReadToEnd().ToCharArray();

        // Create OracleAccessToken
        OracleAccessToken accessToken = new OracleAccessToken(dbToken, privateKey);

        // Set the token refresh call back
        accessToken.RefreshAccessToken += new
OracleRefreshAccessTokenEventHandler(OnRefreshAccessToken);

        // establish a connection
        string constr = "user id=/;data source=oracle";

        // Create connection object
        OracleConnection con = new OracleConnection(constr);

        // Set accessToken to the connection before opening connection.
        con.AccessToken = accessToken;

        // Open connection now.
        con.Open();
    }
}
```

```
        Console.WriteLine("Connected using DB Token Authentication");

        con.Dispose();
    }

    public static void OnRefreshAccessToken(
        OracleRefreshAccessTokenEventArgs eventArgs)
    {
        // Application code to get Refreshed DB token and private key
        RefreshToken(out char[] refreshedToken, out char[] refreshedPrivateKey);

        // Set the refreshed DB token and private key to eventArgs
        eventArgs.DbToken = refreshedToken;
        eventArgs.PrivateKey = refreshedPrivateKey;
    }

    public static void RefreshToken(out char[] refreshedToken, out char[]
refreshedPrivateKey)
    {
        refreshedToken = null;
        refreshedPrivateKey = null;

        // TODO: Add code to refresh the token.
    }
}
```

### Configuring a Client Connection Using Database Alternate Password for Token Authentication

The database alternate password connection method uses a username and password specific for IAM token-based authentication. This set of credentials is separate from the more common database username and password.

To use this feature, the `PASSWORD_AUTH` parameter must be set to `OCI_TOKEN`.

IAM exposes a REST endpoint for clients to request database bearer tokens. ODP.NET makes calls to request tokens from the endpoint via TLS 1.2 or higher. The driver specifies a username, password, tenant Oracle Cloud Identifier (OCID), a database compartment identifier (optional), and a database identifier (optional) in the request. If a database identifier is specified, then the database compartment identifier becomes mandatory. A bearer token is returned to ODP.NET in the response. The driver then sends the returned bearer token to authenticate with the database.

ODP.NET caches the token for reuse when additional connection requests occur. It holds onto the token until its expiration. The application will need to refresh the token before it expires to be able to make connections.

ODP.NET alternate password credentials can be stored securely in a Secure External Password Store (SEPS) wallet for application use.

### Comparing IAM Token Authentication Methods

The following table identifies the differences and similarities among the IAM token authentication options.

App provides Database Token and Private Key	Database Token and Private Key through File	Alternate User Credentials for Token Authentication
Username must be set to "/" in the connection string.	Username must be set to "/" in the connection string.	Username and Password in ODP.NET connection string represent alternate credentials.
-	-	SEPS can store credentials. When SEPS is enabled, the username and password is retrieved first. Then, the parameter, <code>PASSWORD_AUTH</code> , determines whether database access occurs via username/password or token-based authentication.
Setting <code>OracleCredential</code> results in an error when opening a connection.	Setting <code>OracleCredential</code> results in an error when opening a connection.	<code>OracleCredential</code> can be set with alternate username and password. The username/password is provided through the connection string or <code>OracleCredential</code> .
No configuration parameter	<code>TOKEN_AUTH=OCI_TOKEN</code>	<code>PASSWORD_AUTH=OCI_TOKEN</code>
No configuration parameter	<code>TOKEN_LOCATION</code> can also be set to override default directory location of token and private file. You can set both <code>TOKEN_AUTH</code> and <code>PASSWORD_AUTH</code> to <code>OCI_TOKEN</code> on the same connection. In this scenario, if the username is set to "/", then file-based token authentication is used. Otherwise, alternate password is used.	<code>OCI_IAM_URL</code> and <code>OCI_TENANCY</code> must be set. <code>OCI_COMPARTMENT</code> and <code>OCI_DATABASE</code> can be set to provide specific compartment identifier and database identifier, respectively. If <code>OCI_DATABASE</code> is set, then, <code>OCI_COMPARTMENT</code> is mandatory. You can set both <code>TOKEN_AUTH</code> and <code>PASSWORD_AUTH</code> to <code>OCI_TOKEN</code> on the same connection. In this scenario, if the username is set to "/", then file-based token authentication is used. Otherwise, alternate password is used.
<code>OracleAccessToken</code> must be set on connection with proper database token and private key before opening.	-	-
Database token provided by the application must be Signature token.	Database token read from the file must be Signature token.	Database token received from IAM is bearer token.

App provides Database Token and Private Key	Database Token and Private Key through File	Alternate User Credentials for Token Authentication
<p>ODP.NET sends the following information to the database upon opening a connection:</p> <ul style="list-style-type: none"> <li>• database token</li> <li>• header</li> <li>• Signature generated by signing the header using private key</li> </ul>	<p>ODP.NET reads the database token and private key from the files and sends the following information to the database for authentication upon opening a connection;</p> <ul style="list-style-type: none"> <li>• database token</li> <li>• header</li> <li>• Signature generated by signing the header using private key</li> </ul>	<p>Upon opening a connection, ODP.NET uses the username/password to request the database token from IAM and then sends that token to the database for authentication.</p>

 **See Also:**

- [Developing .NET Applications for Oracle Autonomous Database](#)
- [Developing .NET Applications for Oracle Database as a Service](#)
- [Autonomous Database Cloud Services Documentation](#)
- [Oracle Database Cloud Services Documentation](#)

## Using Azure Active Directory

Starting with ODP.NET 21.7 and 19.15.1, ODP.NET supports Azure Active Directory (AAD) authentication when connecting to Oracle Database. ODP.NET will then use an access token to authenticate instead of a username and password.

This feature benefits applications and services that use AAD for centralized user authentication with Oracle database. Those services can include Azure and Microsoft 365-based cloud services, such as Microsoft Power BI service, that rely on AAD for user management.

Using token-based authentication is more secure and simpler for the end user. It becomes unnecessary to specify credentials each time the user accesses a resource. Moreover, the resource never needs to handle and manage individual user credentials.

AAD follows the OAuth 2.0 user authorization standard. OAuth 2.0 provides a means of obtaining an access token, then using that access token for accessing resources, such as Oracle database.

AAD is supported in the core, managed, and unmanaged ODP.NET drivers. It requires Oracle Autonomous Database or Oracle Database 19.16 or higher.

Managed and unmanaged ODP.NET require NET Framework 4.5.2 or higher for Azure Active Directory support. ODP.NET Core does not have a runtime requirement more specific than the general component system requirements to support Azure Active Directory.

## Configuring a Client Connection Using AAD

For an ODP.NET application using the managed or core provider to authenticate with AAD using a file-based access token, the `TOKEN_AUTH` parameter or `OracleConfiguration.TokenAuthentication` property must be set to `OAUTH`. The token's location is then specified in the `TOKEN_LOCATION` parameter or `TokenLocation` property. The token location must be specified explicitly when using `OAUTH`. Otherwise, an error will occur. For `OAUTH`, this location can be the directory where the file "token" is, or the full path that includes a file name.

For an ODP.NET application to authenticate with AAD with an access token, none of these configuration steps is necessary. The access token is provided through ODP.NET APIs.

Developers construct an `OracleAccessToken` object to provide the access token via the `OracleConnection.AccessToken` property. If the application sets up a `RefreshAccessToken` event handler, ODP.NET will invoke it 60 seconds before the access token expires. The `OracleRefreshAccessTokenEventArgs` parameter provides a refreshed access token in the callback method.

The `OracleAccessToken` token can only be updated by calling `OpenWithNewToken` method or by setting the `OracleRefreshAccessTokenEventArgs.Token` property upon a .NET callback invocation.

For ODP.NET connection pooling, the `OracleAccessToken` object will be used to distinguish connection pools, not the actual token as they can expire and be refreshed. Only new connections need to use a refreshed access token. Existing pooled connections do not depend on the access token and will continue to work. Applications should always specify the same `OracleAccessToken` object on `OracleConnection` to ensure the same connection pool is used.

`TOKEN_AUTH` and `TOKEN_LOCATION` can also be set in the `tnsnames.ora` and `sqlnet.ora` files. To use `OAuth` with unmanaged ODP.NET, set your token values in these files as there are no equivalent unmanaged ODP.NET APIs.

### Sample Code: Using ODP.NET Azure Active Directory Authentication

```
// This is a simple ODP.NET, Core Driver application that connects to an Oracle
Autonomous Database
// using a token obtained from Azure Active Directory (Azure AD).

// Azure.Identity can be obtained through NuGet Gallery.
// It will include the Azure.Core and Azure.Identity namespaces.
using System;
using System.Threading;
using Azure.Core;
using Azure.Identity;
using Oracle.ManagedDataAccess.Client;

namespace ConnectToOracleUsingAccessToken
{
    class Program
    {
        static void Main()
        {
            try
            {
                // Retrieve an access token from Azure AD.
```

```
string token = GetAccessToken();

// Create an instance of an OracleAccessToken. The access token needs to
// be passed to the OracleAccessToken constructor as array of characters.
var oracleAccessToken = new OracleAccessToken(token.ToCharArray());

// Create an instance of an OracleConnection object.
// The developer must provide the appropriate data source setting.
var connection = new OracleConnection("User Id=;/Data Source=<oracle>");

// tnsnames.ora, sqlnet.ora, and cwallet.sso must reside in the same
// directory as the application executable. These files can be
downloaded
// from Oracle Cloud for the Oracle Autonomous DB instance.
connection.TnsAdmin = @".\";

// Assign the OracleAccessToken to the AccessToken property on the
// OracleConnection object.
connection.AccessToken = oracleAccessToken;

// Open the connection.
connection.Open();

// If Open() fails, it will throw an exception.
Console.WriteLine("Open success.");

// Dispose the OracleConnection object.
connection.Dispose();
}
catch (Exception ex)
{
    Console.WriteLine(ex);
}
}

// Retrieves an Azure AD access token through the
// Service Principal Auth flow using a client secret.
static string GetAccessToken()
{
    // The developer must configure the Azure AD parameters below.
    string clientId = "<client Id of app registration in Azure AD>";
    string tenantId = "<tenant Id of Azure AD>";
    string clientSecret = "<secret value of app registration in Azure AD>";
    string scope = "<scope of DB registration in Azure AD>";

    // Create a TokenRequestContext object.
    var tokenRequestContext = new TokenRequestContext(new[] { scope });

    // Create a ClientSecretCredential object.
    var credentials = new ClientSecretCredential(tenantId, clientId,
clientSecret);

    // Get the access token from Azure AD.
    AccessToken accessToken = credentials.GetToken(tokenRequestContext,
default(CancellationTokens));

    // Return the access token.
    return accessToken.Token;
}
}
}
```

**See Also:**

More Azure Active Directory ODP.NET sample code can be found on Oracle .NET GitHub site:

<https://github.com/oracle/dotnet-db-samples/tree/master/samples/azure-active-directory>

## Connection String Attributes

Table 3-3 lists the supported connection string attributes.

**Table 3-3 Supported Connection String Attributes**

Connection String Attribute	Description	Default Value
Application Continuity	Enables database requests to automatically replay transactional or non-transactional operations in a non-disruptive and rapid manner in the event of a severed database session, which results in a recoverable error. <i>Not Available in ODP.NET, Managed Driver and ODP.NET Core</i>	true
Connection Lifetime	Minimum life time (in seconds) of the connection.	0
Connection Timeout	The time to wait (in seconds) for a new connection or an idle connection from the connection pool before a connection time out error can occur.	15
Context Connection	Returns an implicit database connection if set to true. <i>Supported in a .NET stored procedure only</i>	false
Data Source	Oracle Net Services Name, Connect Descriptor, or an easy connect naming that identifies the database to which to connect.	empty string
DBA Privilege	Administrative privileges: SYSDBA, SYSASM, SYSOPER, SYSBACKUP, SYSDG, SYSKM, or SYSRAC.	empty string
Decr Pool Size	Number of connections that are closed when an excessive amount of established connections are unused.	1
Enlist	Controls the enlistment behavior and capabilities of a connection in context of COM+ transactions or System.Transactions.	true

**Table 3-3 (Cont.) Supported Connection String Attributes**

Connection String Attribute	Description	Default Value
HA Events	Enables ODP.NET connection pool to proactively remove connections from the pool when an Oracle database service, service member, instance, or node goes down. Works with Oracle Global Data Services, including Oracle RAC, Data Guard, GoldenGate, and some single instance deployments.	true
Load Balancing	Enables ODP.NET connection pool to balance work requests across Oracle database instances based on the load balancing advisory and service goal. Works with Oracle Global Data Services, including Oracle RAC, Active Data Guard, and GoldenGate.	true
Incr Pool Size	Number of new connections to be created when all connections in the pool are in use.	5
Max Pool Size	Maximum number of connections in a pool.	100
Metadata Pooling	Caches metadata information.	True
Min Pool Size	Minimum number of connections in a pool.	1
Password	Password for the user specified by User Id.	empty string
Persist Security Info	Retrieval of the password in the connection string.	false
Pooling	Connection pooling.	true
Proxy User Id	User name of the proxy user.	empty string
Proxy Password	Password of the proxy user.	empty string
Self Tuning	Enables or disables self-tuning for a connection.	true
Statement Cache Purge	Statement cache purged when the connection goes back to the pool.	false
Statement Cache Size	Statement cache enabled and cache size, that is, the maximum number of statements that can be cached.	0
Tns_Admin	Directory where ODP.NET can find its <code>sqlnet.ora</code> and <code>tnsnames.ora</code> configuration files. <i>Not available in ODP.NET, Unmanaged Driver.</i>	empty string
Token_Auth	This attribute specifies the access token authentication type. Possible values are OCITOKEN, OAUTH, or DISABLED. Only supported for managed ODP.NET and ODP.NET Core.	DISABLED

**Table 3-3 (Cont.) Supported Connection String Attributes**

Connection String Attribute	Description	Default Value
Token_Location	This attribute is the file-based token location. The value can be a directory where a file named "token" is or it can be the file's full path specification.  Only supported for managed ODP.NET and ODP.NET Core.	Varies depending on token authentication type
User Id	Oracle user name.	empty string
Validate Connection	Validation of connections coming from the pool.	false
Wallet_Location	ODP.NET wallet directory. <i>Not available in ODP.NET, Unmanaged Driver</i>	empty string

The following example uses connection string attributes to connect to Oracle Database:

```
// C#

using System;
using Oracle.DataAccess.Client;

class ConnectionSample
{
    static void Main()
    {
        OracleConnection con = new OracleConnection();

        //using connection string attributes to connect to Oracle Database
        con.ConnectionString = "User Id=scott;Password=tiger;Data Source=oracle";
        con.Open();
        Console.WriteLine("Connected to Oracle" + con.ServerVersion);

        // Close and Dispose OracleConnection object
        con.Close();
        con.Dispose();
        Console.WriteLine("Disconnected");
    }
}
```

#### See Also:

- ["OracleConnection Properties"](#) for detailed information on connection attributes
- ["OracleCommand Object"](#) for detailed information on statement caching

## Connection String Builder

The `OracleConnectionStringBuilder` class makes creating connection strings less error-prone and easier to manage.

Using this class, developers can employ a configuration file to provide the connection string and/or dynamically set the values through the key/value pairs. One example of a configuration file entry follows:

```
<configuration>
  <connectionStrings>
    <add name="Publications" providerName="Oracle.DataAccess.Client"
        connectionString="User Id=scott;Password=tiger;Data Source=inst1" />
  </connectionStrings>
</configuration>
```

Connection string information can be retrieved by specifying the connection string name, in this example, `Publications`. Then, based on the `providerName`, the appropriate factory for that provider can be obtained. This makes managing and modifying the connection string easier. In addition, this provides better security against string injection into a connection string.



#### See Also:

[OracleConnectionStringBuilder Class](#)

## Specifying the Data Source Attribute

This section describes different ways of specifying the data source attribute.

The following example shows a connect descriptor mapped to a TNS alias called `sales` in the `tnsnames.ora` file:

```
sales=
  (DESCRIPTION=
    (ADDRESS= (PROTOCOL=tcp) (HOST=sales-server) (PORT=1521))
    (CONNECT_DATA=
      (SERVICE_NAME=sales.us.acme.com)))
```

The connection pool will maintain the full descriptor of an alias so that subsequent connection requests with the same connection string will not need to resolve the alias again. This applies to `tnsnames.ora`, `.NET` config data sources, and LDAP aliases. To flush out the cached full descriptor maintained by the connection pool, invoke `OracleDataSourceEnumerator.GetDataSources()` followed by `OracleConnection.ClearPool()` or `OracleConnection.ClearAllPools()`.

If connection pooling is not used, the alias will need to be resolved to the full descriptor for each request. In the case of LDAP, the LDAP server is contacted for each connection request.

## Using the TNS Alias

To connect as `scott/tiger` using the TNS Alias, a valid connection appears as follows:

```
"user id=scott;password=tiger;data source=sales";
```

## Using the Connect Descriptor

ODP.NET also allows applications to connect without the use of the `tnsnames.ora` file. To do so, the entire connect descriptor can be used as the "data source".

The connection string appears as follows:

```
"user id=scott;password=tiger;data source=" +  
  "(DESCRIPTION=(ADDRESS=(PROTOCOL=tcp) " +  
  "(HOST=sales-server) (PORT=1521)) (CONNECT_DATA="+  
  "(SERVICE_NAME=sales.us.acme.com)) )"
```

## Easy Connect and Easy Connect Plus Naming Methods

The Easy Connect and Easy Connect Plus naming methods enable clients to connect to a database without any configuration.

With this enabled, ODP.NET allows applications to specify the `Data Source` attribute in the form of:

```
//host:[port]/[service_name]
```

Using the same example, some valid connection strings follow:

```
"user id=scott;password=tiger;data source=//sales-server:1521/sales.us.acme.com"  
"user id=scott;password=tiger;data source=//sales-server/sales.us.acme.com"  
"user id=scott;password=tiger;data source=sales-server/sales.us.acme.com"
```

If the port number is not specified, 1521 is used by default.

Easy Connect has been enhanced in ODP.NET 19c to support a wider application breadth, including clustered or cloud databases, and for ease of use. These improvements are called Easy Connect Plus and its features include:

- TCP/IP with SSL/TLS
- Any SQL\*Net description level parameter can be used
- Multiple hosts and ports
- A straightforward name-value pair format

The syntax uses the question mark symbol `?` to indicate the name-value pairs start and the ampersand symbol `&` to delimit each name-value pair. The entire connect string must be specified as a single string. Leading and trailing white spaces are ignored within parameter values. If whitespace is required as part of the value, it should be placed within double-quotes.

Easy Connect Plus syntax:

```
[[protocol:]]/[host1{,host12}[:port1]{,host2:port2}[/service_name][:server][/  
instance_name][?parameter_name=value{&parameter_name=value}]
```

Easy Connect Plus samples:

- `tcps://salesserver1:1521/sales.us.example.com`
- `salesserver1:1521,salesserver2,salesserver3:1522/sales.us.example.com`
- `tcps://salesserver1:1521/sales.us.example.com?wallet_location=D:/oracle`

- `tcps://salesserver1:1521/sales.us.example.com?ssl_server_cert_dn=cn=sales,cn=OracleContext,dc=us,dc=example,dc=com`
- `tcps://salesserver1:1521/sales.us.example.com?https_proxy=www-proxy.mycompany.com&https_proxy_port=80`
- `salesserver1:1521/sales.us.example.com?connect_timeout=60&transport_connect_timeout=30&retry_count=3`

 **See Also:**

*Oracle Database Net Services Administrator's Guide* for details and requirements in the section *Using Easy Connect Naming Method*

## Using LDAP

ODP.NET can connect with connect identifiers mapped to connect descriptors in an LDAP-compliant directory server, such as Oracle Internet Directory and Microsoft Active Directory.

To configure LDAP for ODP.NET, Unmanaged Driver, follow these Oracle documentation instructions in *Configuring the Directory Naming Method* in *Oracle Database Net Services Administrator's Guide*.

To configure LDAP for ODP.NET, Managed Driver, follow the instructions in "[settings section](#)" and "[LDAPsettings section](#)."

To configure LDAP for ODP.NET Core, use the `OracleConfiguration` class directory properties settings. ODP.NET Core LDAP support is available on Windows operating systems. It requires the `System.DirectoryServices` and `System.DirectoryServices.Protocols` version 4.5 or higher as dependencies.

Starting with version 19.10, ODP.NET Core supports LDAP on non-Windows operating systems. This feature requires `System.DirectoryServices` and `System.DirectoryServices.Protocols` 5.0 or higher versions as project dependencies.

Beginning with Oracle Database release 18c, version 18.1, organizations can use centrally managed users (CMUs) with Active Directory. This feature is designed for organizations who prefer to use Active Directory as their centralized identity management solution. Organizations can use Kerberos, PKI, or password authentication with CMU and Active Directory.

LDAP channel binding and LDAP signing are ways to enhance the communication security between LDAP clients and Active Directory domain controllers. Beginning with version 19, managed ODP.NET and ODP.NET Core LDAP Naming adapters fully comply with the Microsoft LDAP hardening guidance.

 **See Also:**

- *Oracle Database Net Services Administrator's Guide* and *Oracle Database Security Guide* for details and requirements in the section Using LDAP
- Microsoft Guidance for [Enabling LDAP Channel Binding and LDAP Signing](#)

## Data Source Enumerator

The data source enumerator enables the application to generically obtain a collection of the Oracle data sources that the application can connect to.

 **See Also:**

["OracleDataSourceEnumerator Class"](#)

## Using WebSocket

WebSocket is a protocol that offers full-duplex communication channels over a single TCP connection. WebSocket with SSL/TLS offers a secure WebSocket connection. WebSocket is an extension to HTTP and is able to work with HTTP proxies and intermediaries.

ODP.NET Core, managed, and unmanaged providers all support WebSocket and secure WebSocket protocols in Oracle Database 19c and higher.

### ODP.NET WebSocket Configuration

WebSocket and secure WebSocket can be set through the connect descriptor by setting PROTOCOL to WS for WebSocket or WSS for secure WebSocket in `tnsnames.ora`, `.NET` configuration file, or `OracleDataSourceCollection` Class.

The WebSocket uniform resource identifier (URI) can be set in `tnsnames.ora`, `sqlnet.ora`, `.NET` configuration file, and `OracleConfiguration` class.

### ODP.NET Configuration File WebSocket URI Setting Sample:

```
<oracle.manageddataaccess.client>
  <version number="*">
    <settings>
      <setting name="SQLNET.URI" value="<WebSocket URI>"/>
    </settings>
  </version>
</oracle.manageddataaccess.client>
```

### OracleConfiguration WebSocket URI Setting C# Sample:

```
OracleConfiguration.SqlNetURI = <WebSocket URI>;
```

When setting the URI in unmanaged ODP.NET, it cannot begin with a forward slash character. For managed ODP.NET, the forward slash at the beginning of the URI is optional.

## Using Transport Layer Security and Secure Sockets Layer

Transport Layer Security (TLS) and its predecessor, Secure Sockets Layer (SSL), are industry standard protocols for securing network connections.

ODP.NET core, managed, and unmanaged versions support one-way and two-way TLS/SSL with wallets for database and transport authentication. ODP.NET core, managed, and unmanaged also support one-way TLS without wallets. Not having to provide a wallet can simplify database connectivity, such as with Oracle Autonomous Database.

## Secure Sockets Layer and Transport Layer Security Differences

Although SSL was primarily developed by Netscape Communications Corporation, the Internet Engineering Task Force (IETF) took over development of it, and renamed it Transport Layer Security (TLS).

Essentially, TLS is an incremental improvement to SSL version 3.0.

Managed ODP.NET and ODP.NET Core support TLS 1.0, 1.1, and 1.2. ODP.NET, Unmanaged Driver supports the same SSL and TLS versions as the Oracle Database Client version it is certified with.

The SSL/TLS client can ensure that the distinguished name (DN) is correct for the database server it is trying to connect to. Parameters for DN Matching are `SSL_SERVER_DN_MATCH` (`sqlnet.ora`) and `SSL_SERVER_CERT_DN` (`tnsnames.ora`), which can be defined in the `.NET` config file as well.

To turn DN Match on, set `SSL_SERVER_DN_MATCH` to `True` (or `On` or `Yes`). `SSL_SERVER_CERT_DN` is optional. It allows the administrator to specify exactly the DN they want to match. If the `SSL_SERVER_CERT_DN` is not set, then `HOSTNAME` based DN matching will be done.

### See Also:

- The TLS Protocol Version 1.0 [RFC 2246] at the IETF Web site, which can be found at:  
<http://www.ietf.org>
- `SSL_VERSION` in the "settings section."

### Note:

To simplify the discussion, this section uses the term SSL where either SSL or TLS may be appropriate because SSL is the most widely recognized term. However, where distinctions occur between how you use or configure these protocols, this section specifies what is appropriate for either SSL or TLS.

## ODP.NET Secure Sockets Layer Configuration Using Wallets

When you configure Secure Sockets Layer on the client, you must confirm that the wallet is created and use TCP/IP with SSL on the client. Optionally, you can perform additional steps to enhance the configuration.



### Note:

ODP.NET supports auto login wallets, but not the local auto login wallet option.

### SSL Configuration Topics:

- [Step 1: Confirm Client Wallet Creation](#)
- [Step 2: Use TCP/IP with SSL on the Client](#)
- [Step 3: Specify Required Client SSL Configuration \(Wallet Location\)](#)
- [Step 4: Set the SSL Version on the Client \(Optional\)](#)
- [Step 5: Set SSL as an Authentication Service on the Client \(Optional\)](#)

### Step 1: Confirm Client Wallet Creation

Before proceeding to the next step, you must confirm that a wallet has been created on the client and that the client has a valid certificate.

ODP.NET, managed and core drivers support file and Microsoft Certificate Store (MCS) based wallets.

- For file-based wallets, use Oracle Wallet Manager to check that the wallet has been created. See [Step 1A: Confirm Wallet Creation on the Server in Oracle Database Security Guide](#) for information about checking a wallet.
- For MCS, ODP.NET will retrieve the credentials from the MY or Personal certificate store. Use Microsoft tools or the `orapki` utility to create certificates, then load the certificates into MCS for use.

### Step 2: Use TCP/IP with SSL on the Client

The ODP.NET Data Source must be modified to use SSL. Specifically, the transport protocol must be changed to use TCP/IP with SSL or what Oracle calls "tcps". An example ODP.NET Data Source for use with SSL is:

```
finance = (DESCRIPTION=
  (ADDRESS = (PROTOCOL=tcps) (HOST=finance_server) (PORT=1575) )
  (CONNECT_DATA = (SERVICE_NAME=Finance.us.example.com) ) )
```

### Step 3: Specify Required Client SSL Configuration (Wallet Location)

Edit the `sqlnet.ora` or `.NET` application configuration to specify the wallet location.

- An example of setting the SSL wallet location for file based wallets, where `<wallet_location>` is the specified location where the client wallet is stored:

```
wallet_location = (SOURCE=(METHOD= File)
                  (METHOD_DATA=(DIRECTORY=<wallet_location>)))
```

- An example of setting the SSL wallet location for MCS based wallets is:

```
wallet_location = (SOURCE=(METHOD= MCS))
```

#### Step 4: Set the SSL Version on the Client (Optional)

The `SSL_VERSION` parameter can be set through the `sqlnet.ora` or the `.NET application.config`, `web.config`, or `machine.config` file. Normally, it is not necessary to set this parameter. The default setting for this parameter is `any`, which allows the database server to apply any necessary restrictions to the SSL version accepted. An example setting in the `sqlnet.ora` is:

```
SSL_VERSION=1.2
```

#### Step 5: Set SSL as an Authentication Service on the Client (Optional)

If TCPS is to be used as both a transport and as an external database authentication, set the `SQLNET.AUTHENTICATION_SERVICES` parameter in the `sqlnet.ora` or `application.config`, `web.config`, or `machine.config` file.

Note that SSL can be used as just a transport encryption vehicle. Hence, the "optional" designation for this setting.

If SSL/TLS is to be used as an external database authentication method, then an externally authenticated database user matching the client certificate must be created.

An example setting allowing SSL external authentication in the `sqlnet.ora` is:

```
SQLNET.AUTHENTICATION_SERVICES = (TCPS)
```

#### Note:

Prior to ODAC 12c Release 4, ODP.NET, Managed Driver SSL connections would be redirected to dynamic (ephemeral) port on the database server machine. With ODAC 12c Release 4 and later, managed ODP.NET SSL connections will now continue to the original socket connection to the Oracle Listener. Hence, firewalls will now only need to allow access to the Oracle Listener's port (e.g., 1521).

#### See Also:

- Enabling Secure Sockets Layer in *Oracle Database Security Guide* for more information about TLS/SSL and configuration with Oracle database.
- Creating a User Who Is Authenticated Externally in *Oracle Database Security Guide* for more information about creating externally identified database users.

## ODP.NET Secure Sockets Layer Configuration without Wallets

Starting with versions 19.13 and 21.4, ODP.NET managed and core drivers support SSL without wallets. Unmanaged ODP.NET introduced SSL support without wallets from versions 19.14 and 21.5. With one-way TLS, the client certificate is not required. A client wallet for the trusted Certificate Authority (CA) can be provided for ODP.NET authentication of the server. Without a wallet, the trusted CA will come from the local host's default trustpoints. Connection configuration is simpler without wallet files.

One-way TLS can be used in one of two ways:

- If the database server uses a certificate/wallet signed by a Windows-trusted certificate authority, then no client changes are required besides un-setting the Oracle wallet location if it is already set.
- If the database server uses a self-signed certificate/wallet, then the self-signed root certificate (public key) for the server certificate/wallet must be inserted into the root certificate store (root/localmachine) of the client machine.

ODP.NET will attempt to connect with one-way TLS when TCPS protocol is specified and either:

- no wallet location setting is present, or,
- wallet location is set to `system`.

ODP.NET essentially ignores existing static wallet configuration when `system` is specified as the wallet location. This wallet location property can be set in any one of the following:

- TNS connect descriptor
  - `WALLET_LOCATION` or `MY_WALLET_DIRECTORY`
- Easy Connect Plus
  - `WALLET_LOCATION`
- ODP.NET connection string
  - `Wallet_Location`
- ODP.NET `OracleConnection` property
  - `WalletLocation`

These options allow administrators to specify at different granularities connections using a client certificate or SEPS and connections not using a wallet.

By default, Oracle Autonomous Database credentials use the `WALLET_LOCATION` in `sqlnet.ora`. To disable the wallet requirement, remove the `sqlnet.ora` `WALLET_LOCATION` setting completely or set one of the wallet location settings to `system`.

## Inserting Public Keys into System Trusted Certificate Authority List

The Certificate Authority (CA) public key is stored in the CA certificate. This certificate is stored in the local trust store on the client system. Here are typical commands to install root certificate in different platform.

### Windows:

Base64/PEM format:

```
openssl pkcs12 -in ewallet.p12 -clcerts -nokeys -out rootca.pem  
certutil -addstore -enterprise -f -v root rootca.pem
```

### Linux (Oracle and Red Hat):

Create PEM certificate from PKCS #12 file:

```
openssl pkcs12 -in ewallet.p12 -clcerts -nokeys -out rootca.pem -password  
pass:<password>  
sudo cp rootca.pem /etc/pki/ca-trust/source/anchors  
sudo update-ca-trust
```

On Linux, the administrator can manually edit the root PEM file by adding the PEM file contents resulting from the `OPENSSL` command shown above. The root PEM file on Linux is located in `/etc/pki/tls/cert.pem`, which is a link to `/etc/pki/ca-trust/extracted/pem/tls-ca-bundle.pem`.

### Linux (Ubuntu):

Change the PEM (.pem) or CER (.cer) file extension to a CRT extension (.crt). Then, execute the following two commands:

```
sudo cp rootca.crt /usr/local/share/ca-certificates/rootca.crt  
sudo update-ca-certificates
```

### macOS:

Base64 format:

```
sudo security add-trusted-cert -d -r trustRoot -k "/Library/Keychains/  
System.keychain" "<directory>/rootca.cer "
```

PEM format:

```
sudo security add-trusted-cert -d -r trustRoot -k "/Library/Keychains/  
System.keychain" "<directory>/rootca.pem"
```

## Troubleshooting TLS/SSL Setup

This section discusses commonly encountered issues and their typical resolution steps.

### Common TLS/SSL Wallet Errors

Microsoft Windows now restricts wallets from using the MD5 algorithm. Oracle wallets may have been generated with this algorithm as that was the default option in Oracle Public Key Infrastructure (`orapki`) utility 12.1 and earlier.

`orapki` can be found in the `ORACLE_HOME\bin` directory of the database server installation or Oracle client administrator install. It is not included with Oracle Instant Client. The utility is only needed to setup up the wallet; it is not necessary to deploy it with the wallet.

When you setup TLS/SSL and encounter an "ORA-0052: Failure during SSL handshake" error combined with a 0x80004005 error code and first inner exception "A SSPI-call failed" and second inner exception "A token sent to the function is invalid",

then it is very likely that Microsoft Security Support Provider Interface (SSPI) rejected your Oracle Wallet, such as when MD5 is used. This is a failure on the handshake. You can resolve this error by using the SHA-2 algorithm instead.

If the second inner exception instead indicates "The credentials supplied to the package were not recognized", it is possible the user certificate was generated without a certificate authority (CA). You can resolve this error by using `orapki` to generate a CA/root certificate and then regenerating your user wallet/certificate to point to this new CA/root certificate.

The steps below will regenerate your Oracle Wallet using `orapki` and SHA-2. Any `orapki` version can be used to generate the wallet with these instructions.

1. Create root wallet, for example, a CA wallet.

```
orapki wallet create -wallet ./root -pwd <password>
```

2. Add a self-signed certificate (CA certificate) to the root wallet.

```
orapki wallet add -wallet ./root -dn 'CN=<my root>' -keysize 1024 -  
self_signed -validity 3650 -pwd <password> -sign_alg sha512
```

3. Export the self-signed certificate from the wallet.

```
orapki wallet export -wallet ./root -dn 'CN=<my root>' -cert ./root/  
b64certificate.txt -pwd <password>
```

4. Create a user wallet, for example, a customer wallet.

```
orapki wallet create -wallet ./user -pwd <password> -auto_login
```

5. Add a certificate request.

```
orapki wallet add -wallet ./user -dn 'CN=<client's hostname>' -keysize  
1024 -pwd <password> -sign_alg sha512
```

6. Export the certificate request.

```
orapki wallet export -wallet ./user -dn 'CN=<client's hostname>' -  
request ./user/creq.txt -pwd <password>
```

7. Create a certificate issued by a CA.

```
orapki cert create -wallet ./root -request ./user/creq.txt -cert ./user/  
cert.txt -validity 3650 -pwd <password> -sign_alg sha512
```

8. Add a trusted certificate (CA certificate) to the wallet. This example assumes the same CA for both the client and server wallets.

```
orapki wallet add -wallet ./user -trusted_cert -cert ./root/  
b64certificate.txt -pwd <password>
```

**9. Add a user certificate.**

```
orapki wallet add -wallet ./user -user_cert -cert ./user/cert.txt -  
pwd <password> -sign_alg sha512
```

**10. Display contents of user wallet.**

```
orapki wallet display -wallet ./user -pwd <password>
```

**11. Create a server wallet.**

```
orapki wallet create -wallet ./server -pwd <password> -auto_login
```

**12. Add a server certificate request.**

```
orapki wallet add -wallet ./server -dn 'CN=<server's hostname>' -  
keysize 1024 -pwd <password> -sign_alg sha512
```

**13. Export the certificate request.**

```
orapki wallet export -wallet ./server -dn 'CN=<server's hostname>' -  
request ./server/creq.txt -pwd <password>
```

**14. Create a server certificate issued by a CA.**

```
orapki cert create -wallet ./root -request ./server/creq.txt -  
cert ./server/cert.txt -validity 3650 -pwd <password> -sign_alg  
sha512
```

**15. Add a trusted certificate (CA certificate) to the server wallet. This example assumes the same CA for both the client and server wallets.**

```
orapki wallet add -wallet ./server -trusted_cert -cert ./root/  
b64certificate.txt -pwd <password>
```

**16. Add an user\_cert certificate for the server wallet.**

```
orapki wallet add -wallet ./server -user_cert -cert ./server/  
cert.txt -pwd <password> -sign_alg sha512
```

**17. Display contents of server wallet.**

```
orapki wallet display -wallet ./server -pwd <password>
```

## Using Secure External Password Store

The Secure External Password Store (SEPS) is the use of a client-side wallet for securely storing the password credentials. All ODP.NET driver types can be configured to use the external password store.

An Oracle wallet is a container that securely stores authentication and signing credentials. Wallets can simplify large-scale deployments that rely on password

credentials for database connections. Applications no longer need embedded user names and passwords, which reduces security risk.

Using SEPS with ODP.NET Core requires the NuGet package, `System.Security.Cryptography.Pkcs` version 4.7 or higher, as a dependency for your application project.

## Configuring Secure External Password Store (SEPS)

Steps for configuring SEPS:

- [Step 1. Create the wallet file](#)
- [Step 2. Point the configuration to the client wallet](#)
- [Step 3. Turn on SEPS](#)

### Step 1. Create the wallet file

Use the `mkstore` utility to create the wallet file and insert the credentials.

**Step 1a.** Create a wallet on the client by using the following syntax at the command line:

```
mkstore -wrl wallet_location -create
```

For example:

```
mkstore -wrl c:\oracle\product\12.1.0\db_1\wallets -create
Enter password: password
```

**Step 1b.** Create database connection credentials in the wallet by using the following syntax at the command line:

```
mkstore -wrl wallet_location -createCredential db_connect_string username
Enter password: password
```

For example:

```
mkstore -wrl c:\oracle\product\12.1.0\db_1\wallets -createCredential orcl system
Enter password: password
```

### Step 2. Point the configuration to the client wallet

In the client `sqlnet.ora` file, enter the `WALLET_LOCATION` parameter and set it to the directory location of the wallet you created in Step 1.

For example, if you created the wallet in `$ORACLE_HOME/network/admin` and your Oracle home is set to `C:\app\client\<user>\product\<version>\client_1\`, then you need to enter the following into your client `sqlnet.ora` file:

```
WALLET_LOCATION =
  (SOURCE = (METHOD = FILE)
    (METHOD_DATA =
      (DIRECTORY =
        C:\app\client\<user>\product\<version>\client_1\Network\Admin) ) )
```

### Step 3. Turn on SEPS

Enable SEPS in your application by setting the wallet override setting to `true` in the `OracleConfiguration.SqlNetWalletOverride` property or `SQLNET.WALLET_OVERRIDE` setting in `sqlnet.ora` or `.NET` configuration file.

```
SQLNET.WALLET_OVERRIDE = TRUE
```

This setting causes all `CONNECT /@db_connect_string` statements to use the information in the wallet at the specified location to authenticate to databases.

When external authentication is in use, an authenticated user with such a wallet can use the `CONNECT /@db_connect_string` syntax to access the previously specified databases without providing a user name and password. Note however, that the wallet file needs to be kept up to date with the database credentials. If the database credentials change, but the wallet file is not changed appropriately, then the connections will fail.

#### See Also:

- [Oracle Data Provider for .NET, Managed Driver Configuration](#) for more details about the wallet settings.
- [Managing the Secure External Password Store for Password Credentials in Oracle Database Security Guide](#) for more information about secure external password store and configuration with Oracle database.

## Using Kerberos

Kerberos is a network authentication service for security in distributed environments. ODP.NET applications can use Kerberos for single sign-on and centralized user authentication. ODP.NET, Unmanaged Driver and Managed Driver both support Kerberos for external authentication to the database server.

#### Note:

- ODP.NET Core does not support Kerberos.
- Managed ODP.NET does not support Kerberos constrained delegation.
- Managed ODP.NET also does not support Kerberos5Pre authentication adapter.

## File Based Credential Cache and MSLSA

ODP.NET supports both a file-based Kerberos client credential cache (CC) and the ability to use Windows logon credentials as Kerberos client credentials. The latter is called MSLSA-based Kerberos authentication.

In order to utilize a file based Kerberos client credential cache (CC), the following executables associated with the full Oracle Call Interface (OCI) install are needed:

- `okinit.exe`
- `oklist.exe`
- `okdstry.exe`

The executables are required in order to acquire the Kerberos5 credentials and store them in the file based credential cache (CC). However, after credential cache creation, as long as the credentials remain valid, the above executables are then unneeded by the ODP.NET application at run-time.

## ODP.NET, Managed Driver Dependency on MIT Kerberos

To use Kerberos5 database authentication in conjunction with ODP.NET, Managed Driver, download and install MIT Kerberos for Windows 4.0.1 on the same machine as ODP.NET, Managed Driver from the following location:

<http://web.mit.edu/kerberos/dist/>



### See Also:

Configuring Kerberos Authentication in *Oracle Database Security Guide* for more information about Kerberos and configuration with Oracle database.

## Configuring Kerberos Authentication with ODP.NET

Please reference the following "key" when viewing the below Kerberos configuration examples:

- `oracleclient` = Kerberos/Windows Domain user ID used by the Oracle database client program to represent the Oracle Client user on the domain
- `oraclserver` = Kerberos/Windows Domain user ID used by the Oracle database server
- `DOMAIN.COMPANY.COM` = Kerberos/Windows domain
- `dbhost.company.com` = Oracle database server machine hostname
- `kerberos_service_name` = Kerberos service name
- `dc.company.com` = hostname for Kerberos Key Distribution Center (KDC) and Windows Domain Controller

### Configuring Kerberos Authentication Topics:

- [Step 1. Update Windows services file to include a "kerberos5" entry](#)
- [Step 2. Create client and server Kerberos users \(Windows domain users for MSLSA\)](#)
- [Step 3. Associate the DB server's Kerberos principal name with the DB server's Kerberos Service \(SPN mapping\) and generate the server keytab file](#)
- [Step 4. Confirm the mapping of server user to service principal](#)
- [Step 5. Setup server sqlnet.ora to point to the keytab file generated in step 2](#)
- [Step 6. Create a kerberos configuration file that points to the Kerberos KDC \(Windows Domain Controller for MSLSA\)](#)
- [Step 7. Configure the Oracle database client and server sqlnet.ora or .NET config to point to the above Kerberos configuration file](#)
- [Step 8. Point the client sqlnet.ora or .NET config to a credential cache file or to MSLSA](#)

- Step 9. Set the client and server authentication services in the sqlnet.ora or .NET config to Kerberos5
- Step 10. Setup an externally authenticated database user that matches the Kerberos client user setup in step 1 (note the case)
- Step 11. Login to the client machine via the Windows Domain client user (for MSLSA) or perform an okinit to authenticate the client Kerberos user (for file based CC):
- Step 12. Run the ODP.NET application

### Step 1. Update Windows services file to include a "kerberos5" entry

Change the Kerberos entry in the Windows service file  
(C:\windows\system32\drivers\etc\services) from:

```
kerberos 88/tcp          krb5 kerberos-sec      #Kerberos
```

to:

```
kerberos 88/tcp kerberos5 krb5 kerberos-sec      #Kerberos
```

### Step 2. Create client and server Kerberos users (Windows domain users for MSLSA)

As noted in the above "key", we will use `oracleclient` and `oraclserver` as our client and server Kerberos user IDs, respectively.

ODP.NET supports MSLSA using Windows domain users which have the following attributes:

- "Kerberos DES" unchecked
- "Kerberos AES 128 bit" checked
- "Kerberos AES 256 bit" checked
- "Kerberos preauthentication not required" checked

### Step 3. Associate the DB server's Kerberos principal name with the DB server's Kerberos Service (SPN mapping) and generate the server keytab file

Run the following commands on the Kerberos KDC (Windows Domain Controller for MSLSA) as an administrator:

```
> ktpass -princ kerberos_service_name/dbhost.company.com@DOMAIN.COMPANY.COM /
crypto all /mapuser oraclserver@DOMAIN.COMPANY.COM /pass <oraclserver
password> /out v5srvtab
```

```
> setspn -A kerberos_service_name/dbhost.company.com@DOMAIN.COMPANY.COM
oraclserver
```

### Step 4. Confirm the mapping of server user to service principal

Also on the Kerberos KDC, run the following command, noting the output:

```
> setspn -L oraclserver

Registered ServicePrincipalNames for
CN=oraclserver,CN=Users,DC=domain,DC=company,DC=com:
    kerberos_service_name/dbhost.company.com
kerberos_service_name/dbhost.company.com@DOMAIN.COMPANY.COM
```

**Step 5. Setup server sqlnet.ora to point to the keytab file generated in step 2**

Add the following line to the server `sqlnet.ora`:

```
sqlnet.kerberos5_keytab = c:\krb\v5srvtab
```

**Step 6. Create a kerberos configuration file that points to the Kerberos KDC (Windows Domain Controller for MSLSA)**

An example kerberos configuration file (`krb.conf`):

```
[libdefaults]
default_realm = DOMAIN.COMPANY.COM

[realms]
DOMAIN.COMPANY.COM = {
    kdc = dc.company.com
}

[domain_realm]
.domain.company.com = DOMAIN.COMPANY.COM
domain.company.com = DOMAIN.COMPANY.COM
.DOMAIN.COMPANY.COM = DOMAIN.COMPANY.COM
DOMAIN.COMPANY.COM = DOMAIN.COMPANY.COM
```

**Step 7. Configure the Oracle database client and server sqlnet.ora or .NET config to point to the above Kerberos configuration file**

Edit the client or server `sqlnet.ora` to include:

```
sqlnet.kerberos5_conf = C:\krb\krb.conf
```

Or edit the client application config to include (in the [settings section](#)):

```
<setting name="sqlnet.kerberos5_conf" value="C:\krb\krb.conf" />
```

**Step 8. Point the client sqlnet.ora or .NET config to a credential cache file or to MSLSA**

Example pointing to Credential Cache file:

```
sqlnet.kerberos5_cc_name = c:\krb\krb.cc
```

Example pointing to MSLSA:

```
sqlnet.kerberos5_cc_name = MSLSA:
```

**Step 9. Set the client and server authentication services in the sqlnet.ora or .NET config to Kerberos5**

```
sqlnet.authentication_services=(Kerberos5)
```

**Step 10. Setup an externally authenticated database user that matches the Kerberos client user setup in step 1 (note the case)**

```
create user "ORACLECLIENT@DOMAIN.COMPANY.COM" identified externally;
grant connect, create session to "ORACLECLIENT@DOMAIN.COMPANY.COM";
```

**Step 11. Login to the client machine via the Windows Domain client user (for MSLSA) or perform an okinit to authenticate the client Kerberos user (for file based CC):**

```
okinit oracleclient
```

## Step 12. Run the ODP.NET application

Set the ODP.NET connection string to `User Id=/ and leave the Password blank.`

### Note:

- After configuring the client and server, the last 2 steps are the only steps required on an ongoing basis to run the ODP.NET application.
- A Microsoft Visual C Run-Time Library (MSVCRT.DLL) bug can cause ODP.NET, Managed Driver's setting of the Kerberos5 configuration to be ignored by the Microsoft run-time. In such a case, you will encounter the error message:

```
OracleInternal.Network.NetworkException (0x80004005): NA Kerberos5:
Authentication handshake failure at stage: krb5_sname_to_principal:
default realm not found. Please set SQLNET.Kerberos5_conf.
```

To workaroud this error, manually set `KRB5_CONFIG` in the ODP.NET application's run-time environment to point to the Kerberos5 configuration file pointed to by `SQLNET.Kerberos5_conf`. For example,

```
set KRB5_CONFIG=c:\oracle\network\admin\krb5.ini
```

### See Also:

Configuring Kerberos Authentication in *Oracle Database Security Guide* for more information about Kerberos and configuration with Oracle database.

## Using Windows Native Authentication (NTS)

With the Windows native authentication adapter, Oracle users can authenticate to the database using just their Windows user login credentials. It provides a way to enable single sign-on and to simplify user and role credential management. Windows native authentication is also known as Windows Native authentication (NTS).

### Note:

- ODP.NET Core supports Windows Native Authentication on Windows only
- Due to a limitation in the Microsoft .NET APIs, ODP.NET, Managed Driver only supports Windows Native authentication (NTS) via Microsoft NT LAN Manager (NTLM) instead of Kerberos-based credentials. Normally, this limitation would be invisible to the ODP.NET, Managed Driver application, since the Windows domain and the Oracle database server will transparently support both NTLM and Kerberos domain credentials by default.

## Configuring Windows Native Authentication (NTS) for the ODP.NET Client

Steps in configuring the NTS for the ODP.NET Client:

- [Step 1. Ensure OSAUTH\\_PREFIX\\_DOMAIN is set correctly](#)
- [Step 2. Setup the externally identified database user](#)
- [Step 3. Setup the client configuration to utilize NTS as the authentication methodology](#)

### Step 1. Ensure OSAUTH\_PREFIX\_DOMAIN is set correctly

Make sure `OSAUTH_PREFIX_DOMAIN` is set appropriately. If you desire the externally identified user ID to include the domain, set it to true, otherwise false. The parameter is a registry setting that can be found at `HKLM/software/oracle/HOME<ORACLE_SID>`. For example, if your `ORACLE_SID` is `r1`, it is located at `HKLM/software/oracle/HOMEr1`.

### Step 2. Setup the externally identified database user

If you set the parameter to true in Step 1, use the following commands to setup the externally identified database user associated with the desired Windows domain user:

```
create user "MYDOMAIN\MYUSER" identified externally;  
grant connect, create session to "MYDOMAIN\MYUSER";
```

### Step 3. Setup the client configuration to utilize NTS as the authentication methodology

Edit the client `sqlnet.ora` or app config to add NTS to the `sqlnet.authentication_services`. For example.

```
sqlnet.authentication_services = (NTS)
```

#### Note:

After configuring the client and server, the last 2 steps are the only steps required on an ongoing basis to run the ODP.NET application.

#### See Also:

Authenticating Database Users with Windows in *Oracle Database Platform Guide for Microsoft Windows for Windows* for more information about Windows native authentication.

## Operating System Authentication Credentials

Oracle Database can use Windows user login credentials to authenticate database users. To open a connection using Windows user login credentials, the `User Id` connection string attribute must be set to a slash (/). If the `Password` attribute is provided, it is ignored.

 **Note:**

Operating system authentication is not supported in a .NET stored procedure.

ODP.NET Core supports operating system authentication for Windows only.

All ODP.NET, Unmanaged Driver connections, including those using operating system authentication, can be pooled. ODP.NET, Managed Driver supports operating system authentication, except when the Windows domain is constrained to only support Kerberos-based domain authentication. Connections are pooled by default, and no configuration is required, as long as pooling is enabled.

The following example shows the use of operating system authentication:

```
/* Create an OS-authenticated user in the database
   Assume init.ora has OS_AUTHENT_PREFIX set to "" and <OS_USER>
   is any valid OS or DOMAIN user.

   create user <OS_USER> identified externally;
   grant connect, resource to <OS_USER>;

   Login through OS Authentication and execute the sample. See Oracle
   documentation for details on how to configure an OS-Authenticated user
*/

// C#

using System;
using Oracle.DataAccess.Client;

class OSAuthenticationSample
{
    static void Main()
    {
        OracleConnection con = new OracleConnection();

        //Establish connection using OS Authentication
        con.ConnectionString = "User Id=;/;Data Source=oracle;";
        con.Open();
        Console.WriteLine("Connected to Oracle" + con.ServerVersion);

        // Close and Dispose OracleConnection object
        con.Close();
        con.Dispose();
        Console.WriteLine("Disconnected");
    }
}
```

 **See Also:**

*Oracle Database Administrator's Reference for Microsoft Windows* for information on how to set up Oracle Database to authenticate database users using Windows user login credentials

## Network Data Encryption and Integrity

ODP.NET enables data encryption and integrity over a network for both intranet and cloud deployments. This ensures that data is disguised to all, except authorized users, and guarantees the original message contents are not altered. In earlier releases, these features were known as Oracle Advanced Security Option (ASO) encryption. Starting with Oracle Database 12c, Oracle ASO is not required to use network data encryption and data integrity.

### Using Data Encryption

Managed and unmanaged ODP.NET support the following encryption standards and algorithms:

- Advanced Encryption Standard (AES)
  - AES 128-bit
  - AES 192-bit
  - AES 256-bit
- Triple-DES (3DES)
  - 112-bit
  - 168-bit

ODP.NET, Managed Driver uses the following settings to configure network encryption:

- `SQLNET.ENCRYPTION_CLIENT`
- `SQLNET.ENCRYPTION_TYPES_CLIENT`



#### See Also:

[settings section](#) for definition and information on usage.

### Using Data Integrity

Managed and unmanaged ODP.NET support the following data integrity algorithms:

- SHA-1
- SHA-2
  - SHA-256
  - SHA-384
  - SHA-512

 **See Also:**

- For more information on network encryption and integrity or configuring them for ODP.NET, Unmanaged Driver, refer to the *Oracle Database Security Guide*.
- To configure network encryption or data integrity in ODP.NET, Managed Driver, refer to the `SQLNET.CRYPTO_CHECKSUM_CLIENT` and `SQLNET.CRYPTO_CHECKSUM_TYPES_CLIENT` settings in "Oracle Data Provider for .NET, Managed Driver Configuration." On the database server machine, you will likely have to configure the `SQLNET.CRYPTO_CHECKSUM_SERVER` and `SQLNET.CRYPTO_CHECKSUM_TYPES_SERVER` parameters in the `sqlnet.ora` file.

## Schema Discovery

ADO.NET exposes five different types of metadata collections through the `OracleConnection.GetSchema` API. This permits application developers to customize metadata retrieval on an individual-application basis, for any Oracle data source. Thus, developers can build a generic set of code to manage metadata from multiple data sources.

The following types of metadata are exposed:

- `MetaDataCollections`  
A list of metadata collections that is available from the data source, such as tables, columns, indexes, and stored procedures.
- `Restrictions`  
The restrictions that apply to each metadata collection, restricting the scope of the requested schema information.
- `DataSourceInformation`  
Information about the instance of the database that is currently being used, such as product name and version.
- `DataTypes`  
A set of information about each data type that the database supports.
- `ReservedWords`  
Reserved words for the Oracle query language.

 **See Also:**

[Oracle Schema Collections](#)

## User Customization of Metadata

ODP.NET provides a comprehensive set of database schema information. Developers can extend or customize the metadata that is returned by the `GetSchema` method on an individual application basis.

To do this, developers must create a customized metadata file and provide the file name to the application as follows:

1. Create a customized metadata file and put it in the `CONFIG` subdirectory where the .NET framework is installed. This is the directory that contains `machine.config` and the security configuration settings.

This file must contain the entire set of schema configuration information, not just the changes. Developers provide changes that modify the behavior of the schema retrieval to user-specific requirements. For instance, a developer can filter out internal database tables and just retrieve user-specific tables

2. Add an entry in the `app.config` file of the application, similar to the following, to provide the name of the metadata file, in name-value pair format.

```
<oracle.dataaccess.client>
  <settings>
    <add name="MetaDataXml" value="CustomMetaData.xml" />
  </settings>
</oracle.dataaccess.client>
```

When the `GetSchema` method is called, ODP.NET checks the `app.config` file for the name of the customized metadata XML file. First, the `GetSchema` method searches for an entry in the file with a element named after the provider, in this example, `oracle.dataaccess.client`. In this XML element, the value that corresponds to the name `MetaDataXml` is the name of the customized XML file, in this example, `CustomMetaData.xml`.

If the metadata file is not in the correct directory, then the application loads the default metadata XML file, which is part of ODP.NET.



### See Also:

["GetSchema"](#)

## Connection Pooling

ODP.NET connection pooling is enabled and disabled using the `Pooling` connection string attribute. By default, connection pooling is enabled. The following are `ConnectionString` attributes that control the behavior of the connection pooling service:

- `Connection Lifetime`
- `Connection Timeout`
- `Decr Pool Size`
- `HA Events`
- `Incr Pool Size`

- Load Balancing
- Max Pool Size
- Min Pool Size
- Pooling
- Validate Connection

### Connection Pooling Example

The following example opens a connection using `ConnectionString` attributes related to connection pooling.

```
// C#

using System;
using Oracle.DataAccess.Client;

class ConnectionPoolingSample
{
    static void Main()
    {
        OracleConnection con = new OracleConnection();

        //Open a connection using ConnectionString attributes
        //related to connection pooling.
        con.ConnectionString =
            "User Id=scott;Password=tiger;Data Source=oracle;" +
            "Min Pool Size=10;Connection Lifetime=100000;Connection Timeout=60;" +
            "Incr Pool Size=5; Decr Pool Size=2";
        con.Open();
        Console.WriteLine("Connection pool successfully created");

        // Close and Dispose OracleConnection object
        con.Close();
        con.Dispose();
        Console.WriteLine("Connection is placed back into the pool.");
    }
}
```

## Using Connection Pooling

When connection pooling is enabled (the default), the `Open` and `Close` methods of the `OracleConnection` object implicitly use the connection pooling service, which is responsible for pooling and returning connections to the application.

The connection pooling service creates connection pools by using the `ConnectionString` property as a signature, to uniquely identify a pool.

In managed and Core versions of ODP.NET, connection strings themselves must be an exact match in their entirety. If keywords are supplied in a different order or a space is added to the connection string, a new pool is created. If a pool already exists with the requested signature, a connection is returned to the application from that pool.

In unmanaged ODP.NET, a new pool is created only when connection string attribute values change. Extra spaces or changing keyword order do not create a new pool.

When a connection pool is created, the connection pooling service initially creates the number of connections defined by the `Min Pool Size` attribute of the `ConnectionString` property. This number of connections is always maintained by the connection pooling service for the connection pool, except when Fast Connection Failover removes invalid connections is exceeded. In this case, the connection number could drop below the `Min Pool Size`. ODP.NET would then attempt to restore the minimum pool size level upon the next connection request.

At any given time, these connections are in use by the application or are available in the pool.

The `Incr Pool Size` attribute of the `ConnectionString` property defines the number of new connections to be created by the connection pooling service when more connections are needed in the connection pool.

When the application closes a connection, the connection pooling service determines whether or not the connection lifetime has exceeded the value of the `Connection Lifetime` attribute. If so, the connection pooling service destroys the connection; otherwise, the connection goes back to the connection pool. The connection pooling service enforces the `Connection Lifetime` only when `Close()` or `Dispose()` is invoked.

The `Max Pool Size` attribute of the `ConnectionString` property sets the maximum number of connections for a connection pool. If a new connection is requested, but no connections are available and the limit for `Max Pool Size` has been reached, then the connection pooling service waits for the time defined by the `Connection Timeout` attribute. If the `Connection Timeout` time has been reached, and there are still no connections available in the pool, the connection pooling service raises an exception indicating that the connection pool request has timed-out. Upon a connection timeout, ODP.NET distinguishes whether the timeout occurred due to the database server failing to deliver a connection in the allotted time or no connection being available in the pool due to the maximum pool size having been reached. The exception text returned will either be "Connection request timed out" in the case of the former or "Pooled connection request timed out" in the case of the latter.

The `Validate Connection` attribute validates connections coming out of the pool. This attribute should be used only when absolutely necessary, because it causes a round-trip to the database to validate each connection immediately before it is provided to the application. If invalid connections are uncommon, developers can create their own exception/error handler to retrieve and validate a new connection, rather than using the `Validate Connection` attribute. This generally provides better performance.

The connection pooling service closes connections when they are not used; connections are closed every 3 minutes. The `Decr Pool Size` attribute of the `ConnectionString` property provides connection pooling service for the maximum number of connections that can be closed every 3 minutes.

Enabling connection pooling by setting "`pooling=true`" in the connection string (which is the case by default) will also pool operating system authenticated connections.

## Connection Pool Management

ODP.NET connection pool management provides explicit connection pool control to ODP.NET applications. Applications can explicitly clear connections in a connection pool.

Using connection pool management, applications can do the following:



**Note:**

These APIs are not supported in a .NET stored procedure.

- Clear connections from connection pools using the `ClearPool` method.
- Clear connections in all the connection pools in an application domain, using the `ClearAllPools` method.



**See Also:**

- ["ClearPool"](#)
- ["ClearAllPools"](#)

## Connection Performance Counters

Installing Oracle Data Provider for .NET creates a set of performance counters on the target system. All ODP.NET provider types (Core, managed, and unmanaged) publish these performance counters for each of their client applications. These performance counters can be viewed using Windows Performance Monitor (Perfmon) or the `PerformanceCounter` class in the `System.Diagnostics` namespace version 4.5.0 or higher.



**Note:**

ODP.NET performance counters are available on Windows platforms only.

As ODP.NET performance counters are not enabled nor registered after installation, administrators must register the counters, then enable the specific counters of interest before being able to monitor them.

## Registering Performance Counters

After installation, ODP.NET performance counters must be registered so that tools, such as `Perfmon`, can consume them. Registration requires running a PowerShell script for the respective provider.

ODP.NET installs six scripts for counters that must be run from PowerShell to take effect

- `register_odpc_perfmon_counters.ps1` – Registers ODP.NET Core counters
- `register_odpm_perfmon_counters.ps1` – Registers managed ODP.NET counters
- `register_odpu_perfmon_counters.ps1` – Registers unmanaged ODP.NET counters
- `unregister_odpc_perfmon_counters.ps1` – Unregisters ODP.NET Core counters

- `unregister_odpm_perfmon_counters.ps1` – Unregisters managed ODP.NET counters
- `unregister_odpu_perfmon_counters.ps1` – Unregisters unmanaged ODP.NET counters

These scripts are located in the `ORACLE_HOME\odp.net\PerfCounters` directory for Oracle Universal Installer and NuGet deployments, in the

`<INSTALLATION_DIRECTORY>\odp.net\PerfCounters` directory for xcopy deployments, and `<VISUAL_STUDIO_SOLUTION_DIRECTORY>\packages\Oracle.ManagedDataAccess.<VERSION>\PerfCounters` directory for MSI deployments.

Windows Administrator privileges are required when running these PowerShell scripts.

To unregister, run the unregister PowerShell script that matches the ODP.NET provider type you wish to unregister.

Previously, the `OraProvCfg.exe` utility was included with ODP.NET for registering and unregistering counters. These PowerShell scripts replace the utility. If you registered ODP.NET counters with this utility, then unregister with the same `OraProvCfg.exe` version.

## Enabling Performance Counters

ODP.NET enables monitoring many different connection counters, including pooled and non-pooled connections. These counters can be monitored individually or together. Developers can set which counters to monitor prior to application startup using the `PerformanceCounters` setting in the `<settings>` section of the .NET config file, which is available in managed and unmanaged ODP.NET, or Windows Registry, which is available in unmanaged ODP.NET only. For ODP.NET Core, developers can set the `OracleConfiguration.PerformanceCounters` property.

[Table 3-4](#) lists the connection performance counters with their setting values.

**Table 3-4 Performance Counters for Connection Pooling**

Performance Counter	Valid Values	Description
None	0	Not enabled (Default)
HardConnectsPerSecond	1	Number of sessions being established with the Oracle Database every second.
HardDisconnectsPerSecond	2	Number of sessions being severed from the Oracle Database every second.
SoftConnectsPerSecond	4	Number of active connections originating from connection pools every second.
SoftDisconnectsPerSecond	8	Number of active connections going back to the connection pool every second.
NumberOfActiveConnectionPools	16	Total number of active connection pools.
NumberOfInactiveConnectionPools	32	Number of inactive connection pools.
NumberOfActiveConnections	64	Total number of connections in use.

**Table 3-4 (Cont.) Performance Counters for Connection Pooling**

Performance Counter	Valid Values	Description
NumberOfFreeConnections	128	Total number of connections available for use in all the connection pools.
NumberOfPooledConnections	256	Total number of pooled active and free connections.
NumberOfNonPooledConnections	512	Number of non-pooled active connections.
NumberOfReclaimedConnections	1024	Number of connections which were garbage-collected implicitly.
NumberOfStasisConnections	2048	No operation. This counter is no longer supported.

These settings are bitwise ORed in order to monitor more than one counter. For example, to collect counters for `SoftConnectsPerSecond` (4), `SoftDisconnectsPerSecond` (8), and `NumberOfActiveConnectionPools` (16), set `PerformanceCounters` to 28 (i.e. 4 + 8 + 12).

## Setting Performance Counters in .NET Configuration Files

Performance counters can be set using an .NET configuration file, such as `web.config` or `app.config`, in managed and unmanaged ODP.NET only. Since .NET configuration entries take precedence over Windows Registry settings, they can be used for a specific application.

As earlier described, populating the `PerformanceCounters` setting in the `<settings>` section enables individual performance counters to be monitored. Windows Perfmon uses very long and not easily human readable application instance names. To make identifying each application easier administrators can assign an identifier name in the `<connectionPools>` section of the .NET configuration file. This section supports the following settings:

- `connectionString`: This setting identifies the connections or pool to monitor using the connection string as the unique identifier. The connection string entered here must match the target connection string to be monitored, but without the password attribute.
- `poolName` (optional): Connection strings can be very long and hard to read with many that look similar. `poolName` allows using an arbitrary string to easily identify which pool is being monitored.

The following examples show how to use these settings.

### ODP.NET, Managed Driver

```
<oracle.manageddataaccess.client>
  <version number="*">
    <connectionPools>
      :
      :
      <connectionPool connectionString="[connection string without password]"
poolName="[Pool Name]"> </connectionPool>
```

```

        .
    </connectionPools>
</version>
</oracle.manageddataaccess.client>

```

ODP.NET, Unmanaged Driver can use the same pool name setting and format as listed above by replacing the `<oracle.manageddataaccess.client>` tags with `<oracle.unmanageddataaccess.client>` tags. Alternatively, the legacy `<oracle.dataaccess.client>` format is available for unmanaged ODP.NET.

### ODP.NET, Unmanaged Driver

```

<configuration>
  <oracle.dataaccess.client>
    <settings>
      .
      .
      <add name="[connection string without password]" value="connectionPool
name=' [Pool Name] '"/>
      .
      .
    </settings>
  </oracle.dataaccess.client>
</configuration>

```

## Setting Performance Counters in Windows Registry

Publication of individual unmanaged ODP.NET performance counters is enabled or disabled using the Windows Registry value `PerformanceCounters` of type `REG_SZ`. This registry value is under:

```
HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\ODP.NET\Assembly_Version
```

where `Assembly_Version` is the full assembly version number of `Oracle.DataAccess.dll`.

Similarly to the .NET config file, multiple performance counters can be obtained by adding the valid values. For example, if `PerformanceCounters` is set to 3, then both `HardConnectsPerSecond` and `HardDisconnectsPerSecond` are enabled.

## Publishing Performance Counters

Commonly, ODP.NET performance counters are monitored using Perfmon. The counters are published under the following Category Names:

- ODP.NET, Core Driver
- ODP.NET, Managed Driver
- ODP.NET, Unmanaged Driver

Administrators can choose the individual ODP.NET counters to monitor after selecting one or more of these categories. PerfMon shows all ODP.NET counters, but only the explicitly enabled counters generate statistics.

After choosing the counters to monitor, administrators then select the running instance(s) to monitor. ODP.NET instances must be actively running for them to appear in PerfMon. Otherwise, no instances will appear available to monitor. After instance selection occurs, they are added to PerfMon as counters to monitor.

Performance counters can monitor at the application domain, pool, or database instance level. Database instance level monitoring only applies if load balancing or Fast Connection Failover features are enabled.

The instance name format is as follows:

<Application Domain Name> [<Process Id>, <Application Domain Id>]  
[<Connection String/Pool Name>][<Instance Name>]. The entry is limited to 127 characters. There is a restriction length on every field in the instance name. The following table shows the maximum number of characters allocated for each field:

**Table 3-5 Field Names of Performance Counters and Maximum Number of Characters**

Field Name	Maximum Number of Characters
Application Domain	40
Pool Name/Connection String	70
Database Instance Name	16

When the length of a field value exceeds the length limit, the string is truncated and appended with ". . ." to fit within the length limit and indicate the continuation. For example, for a given application called `Program.exe` with a connection string `user id=hr;Password=<password>;data source=inst1;max pool size=125;min pool size=50`, one may see the following similar to the following for a process that has two application domains:

- `Program.exe [123, 1]`
- `Program.exe [123, 1][ user id=hr;data source=inst1;max pool siz...]`
- `Program.exe [123, 1][ user id=hr;data source=inst1;max pool siz...]  
[instA]`
- `Domain 2[123, 2]`
- `Domain 2[123, 2][ user id=hr;data source=inst1;max pool siz...]`
- `Domain 2[123, 2][ user id=hr;data source=inst1;max pool siz...]  
[instB]`
- `Domain 2[123, 2][ user id=hr;data source=inst1;max pool siz...]  
[instC]`

Since connection pool attributes can be similar in their first 70 characters, applications can set a Pool Name to uniquely identify each one in the monitoring tool. For example, when using Pool Name, the process will show up as follows:

`Domain 2[123, 2][Pool Name][instC]`

## Database Resident Connection Pooling

Client side connection pooling can be very efficient for middle tier machines. However, it can consume a great deal of database server resources if there are numerous middle tier servers with idle connections. While the intent is to keep the number of idle connections to a minimum, it becomes difficult as the number of middle tier servers

increase, each possibly having idle connections that cannot be shared across applications.

Database Resident Connection Pooling (DRCP) is intended to optimize resource usage by pooling connections at the database server level, which can then be shared across many applications. The benefit is better scalability and lower resource usage at the database server level.

Managed and unmanaged ODP.NET have been enhanced to support DRCP, which allows it to dispense and release DRCP connections to better utilize database server resources.

### About DRCP

DRCP pools server processes, each of which is the equivalent to a dedicated server process and database session combined. These are called pooled servers. Pooled servers can be shared by multiple applications running on the same or multiple hosts.

When DRCP is configured for Oracle Database Real Application Clusters (Oracle RAC), the pool configuration is applied to each database instance. Starting or stopping the pool on one instance starts or stops the pool on all instances.

### DRCP and ODP.NET

DRCP is a server side pool that complements ODP.NET client side pooling. These two pools can be used together.

In a typical dedicated server mode, client side connection pooling saves both on server round trips and socket/session creation. In a connection open/close sequence, a server round trip is involved only upon the first `Open()`. For subsequent open/close sequences on the same connection, no client to server interaction is required because the connection is pooled locally in the client address space.

With DRCP enabled, when the client creates a connection, the connection is assigned a pooled server when needed. When the connection is closed, the database server releases the DRCP server session back to the server side pool, effectively making the DRCP server session available for reuse. This server session can be reused by the same pool or a different pool on the same or different middle tier hosts.

### Configuring DRCP and ODP.NET

The following section describe how DRCP can be configured on the client side and the server side.

- **Configuring DRCP on the Client Side**

ODP.NET developers can enable DRCP on the client side by using `(SERVER=POOLED)` in the connect descriptor.

Sample Descriptor:

```
(DESCRIPTION=(ADDRESS=(PROTOCOL=tcp)(HOST=myhost)(PORT=1521))
(CONNECT_DATA=(SERVICE_NAME=sales.example.com)(SERVER=POOLED)))
```

- **Configuring DRCP on the Server Side**

Oracle database includes a default connection pool called `SYS_DEFAULT_CONNECTION_POOL`. By default, this pool is created, but not started. To enable database resident connection pooling, you must explicitly start the connection pool.

You must be a database administrator (DBA) and must log on as SYSDBA to start and end a pool.

```
SQL> EXECUTE DBMS_CONNECTION_POOL.START_POOL();
```

For DRCP connections to be shared across multiple client-side ODP.NET connection pools, then set the `OracleConnection.DRCPConnectionClass` property to a string value before opening the ODP.NET connection. ODP.NET will first try to obtain an idle connection with the same DRCP connection class property value. If it does not find one, then it will create a new connection instead.

### Example 3-1 Using Database Resident Connection Pooling: Sample Code

```
// This application uses the following connect descriptor:
// oracle = (DESCRIPTION=(ADDRESS=(PROTOCOL=tcp)(HOST=<hostname>)
// (PORT=1521))(CONNECT_DATA=(SERVICE_NAME=<service name>)
// (SERVER=POOLED)))

using System;
using Oracle.ManagedDataAccess.Client;

class DRCP
{
    static void Main()
    {
        string constr = "user id=hr;password=hr;data
source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.DRCPConnectionClass = "GroupA";
        con.Open();

        con.Dispose();
    }
}
```



#### Note:

To use DRCP with ODP.NET, Unmanaged Driver,:

- the .NET configuration setting, `CPVersion`, must be set to 2.0, or,
- have `CPVersion` not set at all, but have `(SERVER=POOLED)` in the TNS full descriptor that is used by the application.

Refer to [settings section](#) for more information.

 **See Also:**

*Oracle Database Administrator's Guide* for more information on configuring the default connection pool or end pool.

### DRCP for Oracle Multitenant

DRCP cannot be created on the PDB. DRCP can only be created on the CDB and is shared among all the PDBs.

ODP.NET has one DRCP for the entire CDB and it can be configured and managed (start, stop, or reconfigure) only by connecting to root container.

To configure, set a session to point to the CDB and start the DRCP pool. For example:

```
alter session set container = cdb$root;  
execute dbms_connection_pool.configure_pool('SYS_DEFAULT_CONNECTION_POOL');  
execute dbms_connection_pool.start_pool();
```

### DRCP for Oracle Real Application Clusters (RAC)

In an Oracle Real Application Clusters (RAC) environment, when a user creates a DRCP on an instance, that DRCP is replicated on all the instances of an Oracle RAC database and you can use any instance to manage the connection pool. Any changes you make to the pool configuration are applicable on all Oracle RAC instances.

### DRCP Restrictions for ODP.NET

ODP.NET does not support the following features with DRCP:

- Open the proxy connection with end user authentication
- Open the `sysoper` connection
- Open using `OpenWithNewPassword`
- Set the `SQLNET.AUTHENTICATION_SERVICES` parameter value to `nts`, which enables Microsoft Windows native operating system authentication
- .NET Framework versions earlier than .NET Framework 4

## Oracle Multitenant and Pluggable Databases

Oracle Database 12c introduced Oracle Multitenant, which enables an Oracle database to contain a portable collection of schemas, schema objects, and nonschema objects that appears to ODP.NET as a separate database. This self-contained collection is called a pluggable database (PDB).

Oracle Multitenant is a database architecture that enables customers to easily consolidate multiple pluggable databases without changing their application. This architecture delivers all the benefits of managing many databases as one, yet retains the isolation and resource prioritization of separate databases. In addition, Oracle Multitenant enables rapid provisioning and upgrades, and fully complements other Oracle database options.

Managed and unmanaged ODP.NET fully support Oracle Multitenant. In addition to being able to connect to individual pluggable databases, ODP.NET has been enhanced so that

applications can request and obtain connections to specific PDBs from the same connection pool. The application can connect to any of the PDBs that are part of the same container database (CDB) and they must have the same common user. Moreover, if connections span multiple instances, such as with Oracle Real Application Clusters, then every instance must uniformly have the same exact PDBs and services for the common user to connect to. If these conditions are met, then ODP.NET will be able to connect to or implicitly switch connections from one PDB to another within the same pool in a highly performant manner.

To obtain a connection to a specific PDB (as a common user) set the `OracleConnections` properties, `PDBName` and `ServiceName`, and then call `OracleConnection.Open()` to obtain the a connection to the specified PDB and Service name. `PDBName` and `ServiceName` identify the PDB and service that the connection needs to be established to or switched to if using an existing idle connection from the connection pool. They are the pluggable database name and database service name, respectively. If only the `PDBName` property is set and the service name is not set by the user, then the provider will return a connection that uses the default (administrative) service.

 **Note:**

For ODP.NET, Unmanaged Driver to be able to switch PDB connections within the same pool:

- the .NET configuration setting, `CPVersion`, must be set to 2.0, or,
- have `CPVersion` not set at all, but set `PDBName` and/or `ServiceName` to a non-null/non-empty value for the first connection request for a given connection string.

Refer to [settings section](#) for more information.

### Example 3-2 Using Pluggable Database: Sample Code

```
// C#
using System;
using Oracle.ManagedDataAccess.Client;

class PDB
{
    static void Main()
    {
        string constr = "user id=hr;password=hr;data
source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.PDBName = "pdb1";
        con.ServiceName = "db1.company.com";
        con.Open();
        con.Close();
    }
}
```

ODP.NET keeps track of the `PDBName` and `ServiceName` to which the pooled connections are established to. Upon the application requesting for a connection with a specified `PDBName` and `ServiceName`, ODP.NET will return a connections that matches that request. However, if a matching connection is not found, ODP.NET will create a new connection and/or alter the session to switch to the requested `PDBName` and `ServiceName`. If the `PDBName` and/or `ServiceName` has been altered, then the `SwitchedConnection` property will return true if called with the `Open()` method invocation.

ODP.NET does not support usage of the `ALTER SESSION` statement to modify the container database during the lifetime of a process. If using PDBs with Oracle Continuous Query Notification, you must connect to Oracle Database 12c Release 2 or higher. Hosting connections to multiple PDBs from the same pool requires ODP.NET for .NET Framework 4 or higher.

 **Note:**

When the connection is implicitly being switched from one PDB/Service to another, Service Relocation Connection Timeout(SRCT) will not take effect.

 **See Also:**

Managing Pluggable Databases in *Oracle Database Administrator's Guide*

## Edition-Based Redefinition

Edition-based redefinition enables you to upgrade the database component of an application even while the application is being used. This minimizes or eliminates downtime for the application.

ODP.NET does not support usage of the `ALTER SESSION` statement to modify the Edition during the lifetime of a process.

Managed and unmanaged ODP.NET can connect to a database edition, and also have the ability to host connections to multiple Editions from within the same pool. An ODP.NET application can obtain a connection that is associated with a specified database edition by setting the `OracleConnection.DatabaseEditionName` property to the name of the database edition that the connection should be associated with. To use a single pool, the same user must be able to connect to both Editions. Applications will perform better and more efficiently when using Editions because ODP.NET can use the same connection pool and even share the same `OracleConnection` object by only changing Edition-specific properties.

### Example 3-3 Using Edition-Based Redefinition: Sample Code

```
using System;
using Oracle.ManagedDataAccess.Client;

class Editions
{
    static void Main()
    {
        // Create a connection
```

```
        string constr = "user id=hr;password=hr;data  
source=oracle";  
        OracleConnection con = new OracleConnection(constr);  
  
        // Obtain a connection associated with EditionX  
        con.DatabaseEditionName = "EditionX";  
        con.Open();  
  
        // Obtain a connection associated with EditionY  
        con.Close();  
        con.DatabaseEditionName = "EditionY";  
        con.Open();  
        con.Dispose();  
    }  
}
```

Changing the edition name through `DatabaseEditionName` while the connection is open is not allowed. It must be changed while the connection is in a closed state.

ODP.NET supports Editions when connecting to Oracle Database 11g Release 2 or later. Hosting multiple Editions in the same pool is available only in ODP.NET for .NET Framework 4 and above.

 **Note:**

To use this Edition-Based Redefinition feature with unmanaged ODP.NET connection pools:

- the .NET configuration setting, `CPVersion`, must be set to 2.0, or,
- have `CPVersion` not set at all, but set the `DatabaseEditionName` property to a non-null/non-empty value for the first connection request for a given connection string.

Refer to [settings section](#) for more information.

Applications can specify an Edition at deployment time using the registry or configuration file. An application can create the following registry entry of type `REG_SZ`:

```
HKLM\Software\Oracle\ODP.NET\version\Edition
```

Here `version` is the version of ODP.NET, and `Edition` is a valid Edition string value.

An application can alternatively use the `web.config` or `application.config` configuration file to specify the Edition at deployment time. The `machine.config` configuration file can be used to specify the Edition for all applications that use a particular version of the .NET framework.

The following example sets the Edition to `E1` in a .NET configuration file for ODP.NET, Unmanaged Driver:

```
<?xml version="1.0" encoding="utf-8" ?>  
<configuration>  
  <oracle.dataaccess.client>  
    <settings>
```

```
<add name="Edition" value="E1"/>
</settings>
</oracle.dataaccess.client>
</configuration>
```

To summarize, the Edition name can be set by the `DatabaseEditionName` property, in the .NET configuration file, or in the Windows Registry. If `DatabaseEditionName` is set, then it takes precedence over the other two settings. If the .NET configuration file has an Edition set, then it takes precedence over the registry.

 **See Also:**

For more information on Editions refer to the *Oracle Database Administrator's Guide* and *Oracle Database Development Guide*

## Privileged Connections

Oracle allows database administrators to connect to Oracle Database with various privileges, such as `SYSDBA`, `SYSASM`, and `SYSOPER`. This is done through the `DBA Privilege` attribute of the `ConnectionString` property.

The following example connects `scott/tiger` as `SYSDBA`:

```
// C#

using System;
using Oracle.DataAccess.Client;

class PrivilegedConnectionSample
{
    static void Main()
    {
        OracleConnection con = new OracleConnection();

        //Connect scott/tiger as SYSDBA
        con.ConnectionString = "User Id=scott;Password=tiger;" +
            "DBA Privilege=SYSDBA;Data Source=oracle;";
        con.Open();
        Console.WriteLine("Connected to Oracle" + con.ServerVersion);

        // Close and Dispose OracleConnection object
        con.Close();
        con.Dispose();
        Console.WriteLine("Disconnected");
    }
}
```

 **See Also:**

DBA Privilege "[Table 7-50](#)" for further information on privileged connections in the database

## Connection Pooling with OracleCredential

To better secure passwords, all ODP.NET applications can use `OracleCredential` to store user names and passwords outside of the connection string. `OracleCredential` mitigates the possibility of exposing user credentials in a page file swap or in a crash dump.

`OracleCredential` can be used with or without connection pooling.

When using the `OracleCredential` object, one should be aware of the connection pool algorithm that has been modified to take this new feature into consideration, when opening connection to the Oracle database. With earlier implementations of ODP.NET connection pool algorithm, the uniqueness of connection string attribute values were used to decide if a new connection pool needs to be created or an existing connection pool can be used to dispense connections. But with the introduction of `OracleCredential`, the reference of this object is also used to decide which connection pool that `OracleConnection` object is associated with.

The decision to create a new connection pool now depends on two factors, first is the uniqueness of connection string (as in earlier releases) and the second is the reference comparison of the `OracleCredential` provided to the `OracleConnection` object while opening a new connection. If either of these is different, a separate pool is used. In order to keep re-using the same connection pool and not create additional connection pools while using the `OracleCredential` object, simply create one `OracleCredential` object per database user and re-use the same object when opening connections.

Here is an example to clarify the new algorithm:

```
using System;
using System.Security;
using Oracle.ManagedDataAccess.Client;
//using Oracle.DataAccess.Client;

class Test
{
    static void Main()
    {
        string connStr1 = "user id=hr; password=hr; data source=oracle";
        string connStr2 = "data source=oracle";

        SecureString secPwd = new SecureString();
        secPwd.AppendChar('h');
        secPwd.AppendChar('r');
        secPwd.MakeReadOnly();

        OracleCredential oc1 = new OracleCredential("hr", secPwd);
        OracleCredential oc2 = new OracleCredential("hr", secPwd);
        OracleCredential oc3 = new OracleCredential("hr", secPwd);

        // con1 and con2 are associated with the same connection pool since both are
        using the same
        // connection string and OracleCredential remains null in both cases.
        OracleConnection con1 = new OracleConnection(connStr1);
        OracleConnection con2 = new OracleConnection(connStr1, null);
    }
}
```

```
// con3 and con4 use the same connection string but different OracleCredential
objects
// (although same contents) so they are associated with different connection pools.
OracleConnection con3 = new OracleConnection(connStr2, oc1);
OracleConnection con4 = new OracleConnection(connStr2, oc2);

// con5 and con6 use the same connection string and same OracleCredential object
// so they are associated with the same connection pool.
OracleConnection con5 = new OracleConnection(connStr2, oc3);
OracleConnection con6 = new OracleConnection(connStr2, oc3);

// Open the connections
con1.Open();
con2.Open();
con3.Open();
con4.Open();
con5.Open();
con6.Open();

// Please note that con1 and con2 use the same connection pool.
// In addition, con3 and con4 use different connection pools
// And lastly con5 and con6 use the same connection pool.
// Thus, in the end, there will be 4 different connection pools created in total.
}
}
```

 **Note:**

`OracleCredential` does not support double quotes around a `SecureString` password. Double quotes can be used within a password, however.

 **See Also:**

[OracleCredential Class](#)

## Password Expiration

Oracle allows users passwords to expire. ODP.NET lets applications handle the password expiration by providing a new method, `OpenWithNewPassword`, that opens the connection with a new password.

The following example uses the `OracleConnection` `OpenWithNewPassword` method to connect with a new password of `panther`:

```
/* Database Setup
connect / as sysdba;
drop user testexpire cascade;
-- create user "testexpire" with password "testexpire"
grant connect , resource to testexpire identified by testexpire;
alter user testexpire password expire;
*/
```

```
// C#

using System;
using Oracle.DataAccess.Client;

class PasswordExpirationSample
{
    static void Main()
    {
        OracleConnection con = new OracleConnection();

        try
        {
            con.ConnectionString =
                "User Id=testexpire;Password=testexpire;Data Source=oracle";
            con.Open();
            Console.WriteLine("Connected to Oracle" + con.ServerVersion);
        }
        catch (OracleException ex)
        {
            Console.WriteLine(ex.Message);

            //check the error number
            //ORA-28001 : the password has expired
            if (ex.Number == 28001)
            {
                Console.WriteLine("\nChanging password to panther");
                con.OpenWithNewPassword("panther");
                Console.WriteLine("Connected with new password.");
            }
        }
        finally
        {
            // Close and Dispose OracleConnection object
            con.Close();
            con.Dispose();
            Console.WriteLine("Disconnected");
        }
    }
}
```

 **Note:**

- The `OpenWithNewPassword` method should be used only when the user password has expired, not for changing the password.
- If connection pooling is enabled, then invoking the `OpenWithNewPassword` method also clears the connection pool. This closes all idle connections created with the old password.

 **See Also:**

["OpenWithNewPassword\(String\)"](#)

## Proxy Authentication

With proper setup in the database, proxy authentication enables middle-tier applications to control the security by preserving database user identities and privileges, and auditing actions taken on behalf of these users. This is accomplished by creating and using a proxy database user that connects and authenticates against the database on behalf of a database user (that is, the *real* user) or database users.

Proxy authentication can then be used to provide better scalability with connection pooling. When connection pooling is used in conjunction with proxy authentication, the proxy authenticated connections can be shared among different real users. This is because only the connection and session established for the proxy is cached. An additional session is created for the real user when a proxy authenticated connection is requested, but it will be destroyed appropriately when the proxy authenticated connection is placed back into the pool. This design enables the application to scale well without sacrificing security.

ODP.NET applications can use proxy authentication by setting the "Proxy User Id" and "Proxy Password" attributes in the connection string. The real user is specified by the "User Id" attribute. Optionally, to enforce greater security, the real user's password can be provided through the "Password" connection string attribute. When using distributed transactions in conjunction with proxy authentication, the real user's password is no longer optional, and it must be supplied.

The following example illustrates the use of ODP.NET proxy authentication:

```
/* Log on as DBA (SYS or SYSTEM) that has CREATE USER privilege.
   Create a proxy user and modified scott to allow proxy connection.

   create user appserver identified by eagle;
   grant connect, resource to appserver;
   alter user scott grant connect through appserver;
*/

// C#

using System;
using Oracle.DataAccess.Client;

class ProxyAuthenticationSample
{
    static void Main()
    {
        OracleConnection con = new OracleConnection();

        // Connecting using proxy authentication
        con.ConnectionString = "User Id=scott;Password=tiger;" +
            "Data Source=oracle;Proxy User Id=appserver;Proxy Password=eagle; ";
        con.Open();
        Console.WriteLine("Connected to Oracle" + con.ServerVersion);

        // Close and Dispose OracleConnection object
        con.Close();
        con.Dispose();
        Console.WriteLine("Disconnected");
    }
}
```

 **See Also:**

- *Oracle Database SQL Language Reference* for the description and syntax of the proxy clause for the `ALTER USER` statement
- *Oracle Database Security Guide* for information about how auditing works for SQL statements and privileges in a multitier environment

## Dynamic Distributed Transaction Enlistment

For those applications that dynamically enlist in distributed transactions through the `EnlistDistributedTransaction` of the `OracleConnection` object, the "Enlist" connection string attribute must be set to a value of "true". If "Enlist=true", the connection enlists in a transaction when the `Open` method is called on the `OracleConnection` object, if it is within the context of a COM+ transaction or a `System.Transactions`. If not, the `OracleConnection` object does not enlist in a distributed transaction, but it can later enlist explicitly using the `EnlistDistributedTransaction` or the `EnlistTransaction` method. If "Enlist" is equal to "false" or "dynamic", the connection cannot enlist in the transaction. ODP.NET, Unmanaged Driver in ODAC 12c Release 3 first introduced this new behavior for "Enlist=dynamic".

 **See Also:**

- "[Connection String Attributes](#)"
- "[EnlistDistributedTransaction](#)"

## Client Identifier and End-to-End Tracing

The client identifier is a predefined attribute from the Oracle application context namespace `USERENV`. It is similar to proxy authentication because it can enable tracking of user identities. However, client identifier does not require the creation of two sessions (one for the proxy user and another for the end user) as proxy authentication does. In addition, the client identifier does not have to be a database user. It can be set to any string. But most importantly, by using client identifier, ODP.NET developers can use application context and Oracle Label Security, and configure Oracle Virtual Private Database (VPD) more easily. To set the client identifier, ODP.NET applications can set the `ClientId` property on the `OracleConnection` object after opening a connection. If connection pooling is enabled in unmanaged ODP.NET, then the `ClientId` is reset to null whenever a connection is placed back into the pool. In managed ODP.NET, the `ClientId` is reset to null (assuming no new value is provided) upon the first database round trip after a connection is placed back into the pool.

The client identifier can also be used for end-to-end application tracing. End-to-end tracing simplifies the process of diagnosing performance problems in multitier environments. In multitier environments, a request from an end client is routed to

different database sessions by the middle tier making it difficult to track a client across different database sessions. End-to-end tracing uses the client identifier to uniquely trace a specific end-client through all tiers to the database server.

ODP.NET exposes the `ActionName`, `ClientId`, `ClientInfo`, and `ModuleName` write-only properties on the `OracleConnection` object. These properties correspond to the following end-to-end tracing attributes:

- `ActionName` - Specifies an action, such as an `INSERT` or `UPDATE` operation, in a module
- `ClientId` - Specifies an end user based on the logon ID, such as `HR.HR`
- `ClientInfo` - Specifies user session information
- `ModuleName` - Specifies a functional block, such as Accounts Receivable or General Ledger, of an application

#### See Also:

- ["OracleConnection Properties"](#)
- *Oracle Database SQL Tuning Guide* for an overview of End-to-End Application Tracing
- *Oracle Database Security Guide*

## Transparent Application Failover (TAF) Callback Support

[Transparent Application Failover \(TAF\)](#) is a feature in Oracle Database that provides high availability.

#### Note:

ODP.NET, Managed Driver and ODP.NET Core do not support TAF nor TAF callbacks.

TAF enables an application connection to automatically reconnect to another database instance if the connection gets severed. Active transactions roll back, but the new database connection, made by way of a different node, is identical to the original. This is true regardless of how the connection fails.

With TAF, a client notices no loss of connection as long as there is one instance left serving the application. The database administrator controls which applications run on which instances, and also creates a failover order for each application.

When a session fails over to another database, the NLS settings that were initially set on the original session are not carried over to the new session. Therefore, it is the responsibility of the application to set these NLS settings on the new session.

## TAF Notification

Given the delays that failovers can cause, applications may wish to be notified by a TAF callback. ODP.NET supports the TAF callback function through the `Failover` event of the `OracleConnection` object, which allows applications to be notified whenever a failover occurs. To receive TAF callbacks, an event handler function must be registered with the `Failover` event.

## When Failover Occurs

When a failover occurs, the `Failover` event is raised and the registered event handler is invoked several times during the course of reestablishing the connection to another Oracle instance.

The first call to the event handler occurs when Oracle Database first detects an instance connection loss. This allows the application to act accordingly for the upcoming delay for the failover.

If the failover is successful, the `Failover` event is raised again when the connection is reestablished and usable. At this time, the application can resynchronize the `OracleGlobalization` session setting and inform the application user that a failover has occurred. No significant database operation should occur immediately after a `FailoverEvent.Begin` event. SQL and major database operations should wait until the `FailoverEvent.End` event. `FailoverEvent.Begin` is primarily used to reject failover or to trace it. `FailoverEvent.Begin` can also be used for non-database application operations, such as informing the end user a failover is in progress and to wait until it completes before proceeding. Transactions can be used in the `FailoverEvent.End` callback phase, such as to file fault tickets or audit. These transactions must be committed before the callback completes.

If failover is unsuccessful, the `Failover` event is raised to inform the application that a failover did not take place.

The application can determine whether or not the failover is successful by checking the `OracleFailoverEventArgs` object that is passed to the event handler.

## Registering an Event Handler for Failover

The following example registers an event handler method called `OnFailover`:

```
// C#  
  
using System;  
using Oracle.DataAccess.Client;  
  
class TAFCallBackSample  
{  
    public static FailoverReturnCode OnFailover(object sender,  
                                                OracleFailoverEventArgs eventArgs)  
    {  
        switch (eventArgs.FailoverEvent)  
        {  
            case FailoverEvent.Begin :  
                Console.WriteLine(  
                    "\nFailover Begin - Failing Over ... Please standby \n");  
                Console.WriteLine(  

```

```
        " Failover type was found to be " + eventArgs.FailoverType);
        break;

    case FailoverEvent.Abort :
        Console.WriteLine(" Failover aborted. Failover will not take place.\n");
        break;

    case FailoverEvent.End :
        Console.WriteLine(" Failover ended ...resuming services\n");
        break;

    case FailoverEvent.Reauth :
        Console.WriteLine(" Failed over user. Resuming services\n");
        break;

    case FailoverEvent.Error :
        Console.WriteLine(" Failover error gotten. Sleeping...\n");
        return FailoverReturnCode.Retry;

    default :
        Console.WriteLine("Bad Failover Event: %d.\n", eventArgs.FailoverEvent);
        break;
    }
    return FailoverReturnCode.Success;
} /* OnFailover */

static void Main()
{
    OracleConnection con = new OracleConnection();

    con.ConnectionString = "User Id=scott;Password=tiger;Data Source=oracle;";
    con.Open();
    con.Failover += new OracleFailoverEventHandler(OnFailover);
    Console.WriteLine("Event Handler is successfully registered");

    // Close and Dispose OracleConnection object
    con.Close();
    con.Dispose();
}
}
```

The `Failover` event invokes only one event handler. If multiple `Failover` event handlers are registered with the `Failover` event, only the event handler registered last is invoked.

**Note:**

Distributed transactions are not supported in an environment where failover is enabled.

 **See Also:**

- *Oracle Database Net Services Administrator's Guide*
- ["OracleFailoverEventHandler Delegate"](#)
- ["OracleFailoverEventArgs Class"](#)

## Real Application Clusters and Global Data Services

This section discusses optimizations for the following products:

- Oracle Real Application Clusters (Oracle RAC) is a cluster database with a shared cache architecture that overcomes the limitations of traditional shared-nothing and shared-disk approaches to provide highly scalable and available database solutions for business applications.
- Oracle Data Guard provides one or more standby databases to protect Oracle data from failures, disasters, human error, and data corruptions for high availability in mission critical applications.
- Oracle GoldenGate replicates data among heterogeneous data environments. It enables high availability solutions, real-time data integration, transactional change data capture, data replication, transformations, and verification between operational and analytical enterprise systems.
- Global Data Services (GDS), new in Oracle Database 12c, provides database workload management features across replicated databases, such as Data Guard and GoldenGate.

ODP.NET supports Oracle Real Application Clusters (Oracle RAC), Data Guard, and GoldenGate transparently, meaning you do not need to change ODP.NET code to use these Oracle components. To further take advantage of these technologies, ODP.NET offers connection pooling optimization features for achieving better application high availability and performance. You can do this through configuring ODP.NET to receive, respond, and send database status messages to .NET applications.

These optimization configurations include the use of features such as Fast Application Notification (FAN), Runtime Connection Load Balancing, and Fast Connection Failover (FCF).

These connection pooling optimizations can improve high availability and performance for Oracle Real Application Clusters and Global Data Services products:

- [Fast Application Notification](#)
- [In-Band Fast Application Notification](#)
- [Runtime Connection Load Balancing](#)
- [Fast Connection Failover \(FCF\)](#)

 **See Also:**

- *Oracle Real Application Clusters Administration and Deployment Guide.*
- *Oracle Data Guard Concepts and Administration.*

## Fast Application Notification

Fast Application Notification (FAN) is a high availability and load balancing notification mechanism that Oracle RAC, Data Guard, and GoldenGate use to notify ODP.NET applications about cluster configuration and service-level information, including status changes such as UP or DOWN events and server load. FAN UP and DOWN events can apply to instances, services, and nodes. Based on information received, ODP.NET can adjust its connection pool accordingly to improve application availability and performance.

With out-of-band FAN, Oracle RAC, Data Guard, and GoldenGate use one of two Oracle messaging infrastructures to send notifications to ODP.NET applications:

- Oracle Notification Service (ONS)
- Oracle Database Advanced Queueing (AQ).

[Table 3-6](#) describes when each messaging system is used and the ODP.NET-related client configuration.

**Table 3-6 Configurations for ODP.NET Driver Types**

ODP.NET Driver Type	Database Server Version	FAN Infrastructure	Configuration	Manual ONS Configuration Locations
Core and managed	12.1 and later	ONS	Automatic or Manual	Either of these two files: <ul style="list-style-type: none"> <li>• .NET configuration file</li> <li>• ONS configuration file</li> </ul>
Core and managed	11.2 and earlier	ONS	Manual	Either of these two files: <ul style="list-style-type: none"> <li>• .NET configuration file</li> <li>• ONS configuration file</li> </ul>
unmanaged	12.1 and later	ONS	Automatic or Manual	<code>oraaccess.xml</code> file
unmanaged	11.2 and earlier	AQ	Automatic	N/A

For automatic ONS configuration, developers can add more nodes and ports for ODP.NET to listen to, in addition to the nodes and ports that ODP.NET obtains from the database automatically.

ODP.NET applications do not require code changes to migrate from the AQ to ONS FAN infrastructure. However, some ODP.NET client configuration changes may be necessary when migrating to ONS, a newer database server version, or from ODP.NET, Unmanaged Driver to the managed driver, as documented above.

On the database server side, FAN must be set up and configured for out-of-band messages.

Using out-of-band FAN from the database, ODP.NET can do the following:

- With Runtime Connection Load Balancing, ODP.NET load balances connections among Oracle RAC nodes, services, and service members and GDS resources. This feature improves ODP.NET response time and ensures better resource allocation of server resources.
- With the Fast Connection Failover (FCF) feature, Oracle RAC, Data Guard, and GoldenGate can inform the ODP.NET connection pool if database nodes, services, service members, or the databases have gone down. These DOWN messages indicate which connections in the pool are invalid and must be removed.

 **See Also:**

- [onsConfig section](#) to configure the .NET configuration file.
- [Client Side ONS Daemon Configuration](#) to configure the ONS configuration file.
- [Configuring a Port to Listen for Database Notifications](#) for more information on AQ configuration for FAN.
- [Runtime Connection Load Balancing](#)
- *Oracle Real Application Clusters Administration and Deployment Guide* for more information about FAN.
- *Oracle Call Interface Programmer's Guide* to configure `oraaccess.xml`.
- *Oracle Database Development Guide*

## In-Band Fast Application Notification

Oracle recommends using out of band notifications when possible as they support more high availability event types than in band and can be more reliable. In some scenarios, such as cloud deployments and when firewalls block notification messages between the database and client, out of band messages and using ONS may not be possible. ODP.NET can use in-band FAN notifications instead in these scenarios. In-band FAN notifications support the following usage scenarios:

- Pluggable database relocation
- Database service relocation
- Database rolling upgrade
- Connection Manager planned maintenance

In-band notifications rely on existing ODP.NET connections to communicate messages and for connection pooling to be enabled. ODP.NET will check for notifications every time a connection makes a database round trip, is checked in, or checked out. When a DOWN notification is received, ODP.NET will scan the pool for affected connections and close them. Applications should not see any errors as long as connections are returned to the pool prior to the drain timeout.

To use in-band notifications, no database server nor ODP.NET configuration changes are required. They are enabled automatically in ODP.NET Core and managed 19.9 and unmanaged ODP.NET 19.10 or higher versions. On the server side, in-band notifications are automatically enabled in Oracle Database 18c or higher versions.

As an HA best practice, out of band notifications should be enabled along with the default in-band notifications when possible.

## Runtime Connection Load Balancing

With Runtime Connection Load Balancing, Oracle Data Provider for .NET balances work requests across Oracle RAC instances based on the load balancing advisory and service goal. Because workloads can constantly change, load balancing occurs when the application requests a new connection. Thus, ODP.NET optimizes service levels by connecting users to the least loaded nodes in real-time.

In Oracle Database 12c, Runtime Connection Load Balancing has been extended to Oracle Data Guard and Oracle GoldenGate so that ODP.NET 12c connections can be load balanced with these two database services as part of Global Data Services. No ODP.NET applications require code changes to use Global Data Services if they are already using Runtime Connection Load Balancing.

When Runtime Connection Load Balancing is enabled:

- The ODP.NET connection pool dispenses connections based on the load balancing advisory and service goal.
- The ODP.NET connection pool also balances the number of connections to each service member providing the service, based on the load balancing advisory and service goal.

By default, ODP.NET is enabled to receive Runtime Connection Load Balancing FAN messages from the server. The feature has been enabled via the "Load Balancing=true" and "pooling=true" settings in the connection string, which are the default values. This feature can only be used if "pooling=true". In order to use Runtime Connection Load Balancing, specific Oracle server configurations must be set.

The following connection string example enables Runtime Connection Load Balancing:

```
"user id=scott;password=tiger;data source=erp;load balancing=true;"
```

### See Also:

- [Table 3-3](#)
- ["Configuring a Port to Listen for Database Notifications"](#)
- *Oracle Database Net Services Administrator's Guide* to set up the Oracle Net configuration that Runtime Connection Load Balancing requires
- *Oracle Real Application Clusters Administration and Deployment Guide* for the required Oracle RAC configuration
- *Oracle Database Global Data Services Concepts and Administration Guide*

## Fast Connection Failover (FCF)

When an Oracle RAC service, service member, node, or a Data Guard database fails, the severed ODP.NET connection objects may continue to exist in the application. If users attempt to use these invalid connections, they will encounter errors. FCF enables ODP.NET

to free these severed connections proactively and quickly. Users then will be able to use the application after a server side failure without manual intervention from an administrator.

In Oracle Database 12c, FCF has been extended to Oracle Data Guard and Oracle GoldenGate for ODP.NET 12c connections through Global Data Services. No ODP.NET applications require code changes to use Global Data Services if they already use FCF.

ODP.NET applications can enable FCF through the High Availability Events, "`HA Events`", connection string attribute. When HA Events are enabled:

- ODP.NET connection pool proactively removes connections from the pool when a Global Data Service or Oracle RAC service, service member, node, or database goes down.
- ODP.NET proactively forces threads waiting for responses from the downed database to exit out from the existing call to avoid any hangs. When such a connection is then returned to the pool, any resource associated with that connection is freed.
- ODP.NET establishes connections to existing Oracle instances if the removal of severed connections brings the total number of connections below the "`min pool size`", upon the next connection request.

By default, ODP.NET is enabled to receive FCF FAN messages from the server. This feature have been enabled via the `HA Events=true` and `pooling=true` settings in the connection string, which are the default values.

The following connection string example enables HA Events:

```
"user id=scott;password=tiger;data source=erp;HA events=true;"
```

#### See Also:

- [Table 3-3](#)
- [Configuring a Port to Listen for Database Notifications](#)
- *Oracle Database Net Services Administrator's Guide* to set up the Oracle Net configuration that FCF requires
- *Oracle Real Application Clusters Administration and Deployment Guide* for the required Oracle RAC configuration
- *Oracle Database Global Data Services Concepts and Administration Guide*

## Using FCF Planned Outage to Minimize Service Disruption

FCF not only provides high availability services for unplanned outages, such as node failures, but also for planned outages, such as server repairs, upgrades, and changes, to minimize service disruption to ODP.NET application users.

When a database service is set to be stopped or relocated, a FAN message is published with a planned reason code. A FCF-aware ODP.NET connection pool (`HA`

Events=true) receives the notification and commences to close idle connections, no longer allowing new connections to that specific database service. Active connections to that specific database service remain until users complete their tasks and the connection is returned to the pool. Thus, no users must stop work mid-stream due to a planned outage.

Eventually, all users complete their tasks and no connections remain to that database service. The database administrator can then stop the service for the planned outage task. This feature allows the database service to be stopped as quickly as possible without end user disruption.

Oracle planned outage support works with Oracle Real Application Clusters (Oracle RAC), Oracle Data Guard, and some single instance scenarios.

### Oracle RAC Planned Outage

A typical planned outage scenario for Oracle RAC follows below. Note that the database server commands apply to Oracle RAC 12c Release 2 or higher. Commands for earlier releases may be different.

1. There is a need to upgrade, patch, or repair a software or hardware issue on a database server. Stop the instance gracefully such that existing users experience no to few errors. You can wait until all users complete their work before doing so. Business requirements will dictate whether you wait for all users to log out or begin the planned outage after a set time. An administrator could issue the following command line operation using Oracle Server Control Utility (srvctl):

```
srvctl relocate service -database <unique database name> -service <service name> -  
drain_timeout 120 -stopoption IMMEDIATE -oldinst <existing instance>
```

This command relocates the database service from the existing instance to any instance it is configured to run on. Oracle Cluster Ready Services (CRS) will choose this instance, as the command line specifies no target. CRS will wait 120 seconds (-drain\_timeout 120) for any active sessions to drain, after which any sessions remaining on the existing instance will be forcibly disconnected (-stopoption IMMEDIATE). If Application Continuity is used in conjunction with planned outage, an attempt is made to recover these killed sessions, masking the outage from end users.

The relocate operation starts the service in the new location prior to stopping the service in its existing location. Immediate relocation allows draining with no brownout. If the service cannot be started, it is not stopped at the original location to maintain availability.

2. Meanwhile in the connection pool, the FAN planned DOWN event clears idle sessions for the instance being shutdown from the ODP.NET connection pool immediately and marks that instance's active sessions to be released at the next check-in. These FAN actions drain the sessions from this instance without disrupting the users.

Existing connections on other instances remain usable, and new connections can be opened to these other instances.

3. Not all sessions will check their connections into the pool immediately. The timeout period specified by -drain\_timeout after which the instance is forcibly shut down, evicting any remaining client connections. Administrators can check whether any active sessions to the instance remain by querying the v\$session table.
4. Once the upgrade, patch, or repair is complete, restart the instance and the service on the original node. The FAN UP event will inform the ODP.NET pool that it can now use the original machine again.

## Oracle Data Guard Planned Outage

Oracle Data Guard performs switchovers from primary databases to standby databases in planned failover scenarios. During the switchover, administrators will want to limit end user disruptions. In Oracle Database 12c Release 2 and higher, these administrators can use the Data Guard command-line interface (`DGMGRL`) command to switch roles between primary and standby databases:

```
SWITCHOVER TO <database name> [WAIT <timeout in seconds> ];
```

The `WAIT` option specifies to wait for sessions to drain before proceeding with the switchover.

Similar to the Oracle RAC scenario, FAN informs the ODP.NET to remove idle connections from the pool. Connections subsequently checked in are destroyed until no active connections remain to that primary database, which will allow the switchover to begin.

When switchover to the standby completes, a FAN UP event informs ODP.NET that it can start creating connections to the standby instance.

During the Data Guard service relocation process, new incoming connection requests will not be accepted until the service has fully relocated. Incoming connection requests arriving during the interim, such as in the middle of an Oracle Data Guard switchover, will receive connectivity errors.

To prevent these errors, ODP.NET can pause connection attempts until the new database service is available. ODP.NET blocks any connection attempts until the service is up or until the configured time limit expires from the time when the service DOWN event was received. This feature is useful for planned outages and service relocations. It works with Oracle RAC and Oracle Data Guard.

This time limit is the `ServiceRelocationConnectionTimeout` setting, which can be set in the `.NET` configuration file.



### See Also:

[ServiceRelocationConnectionTimeout](#)

## Pool Behavior in an Oracle RAC Database

When connection pools are created for a single-instance database, pool size attributes are applied to the single service. Similarly, when connection pools are created for an Oracle RAC database, the pool size attributes are applied to a service and not to service members. For example, if "Min Pool Size" is set to  $N$ , then ODP.NET does not create  $N$  connections for each service member. Instead, it creates, at minimum,  $N$  connections for the entire service, where  $N$  connections are distributed among the service members.

The following pool size connection string attributes are applied to a service.

- Min Pool Size
- Max Pool Size

- `Incr Pool Size`
- `Decr Pool Size`

ODP.NET connects to the same Oracle RAC node when required by a distributed transaction that has already begun on a particular node, by an Oracle runtime connection load balancing advisory, or by Oracle RAC load balancing gravitation in which connections will gravitate to an under utilized node. If the connection pool has no idle connections to this particular node, then ODP.NET will create a new connection to this node. Node affinity is honored even when the connection pool runs out of idle connections to dispense.

## Using Transaction Guard to Prevent Logical Corruption

Transaction Guard allows managed and unmanaged ODP.NET applications to use at-most-once execution in case of planned and unplanned outages and repeated submissions. Without Transaction Guard, applications that attempt to retry operations following outages can cause logical corruption by committing duplicate transactions.

After an outage, one of the traditional problems for recovering applications had been the non-durable commit message sent back to the client. If there is a break between the client and the server, the client sees an error message indicating that the communication failed, also known as a recoverable error. This error does not inform the application if the submission executed any commit operations, or if a procedural call ran to completion while executing all expected commits. The error also does not indicate session state changes or intermittent failures. The client is left wondering if the transaction committed and if it fully completed.

These recoverable errors may require end users or applications to attempt replay by issuing duplicate transaction submissions or other forms of logical corruption. The transaction cannot be validly resubmitted if the non-transactional state is incorrect or if it is committed. Continuing to process a committed but not completed call can result in the application using a database session that is in the wrong state.

## ODP.NET and Transaction Guard

Transaction Guard allows ODP.NET, Managed Driver and ODP.NET, Unmanaged Driver to eliminate duplicate transactions automatically and transparently, and in a manner that scales.

When a failure occurs, such as a node, network, or database failure, ODP.NET applications can deterministically conclude whether the transaction committed by querying its status, if the database service is up. Oracle retains the transaction status automatically, even after one of these failures.

In ODAC 12c Release 4, using Transaction Guard application development has been streamlined, reducing the application logic needed to determine the transaction outcome. Moreover, these benefits are available to both managed and unmanaged ODP.NET.

When a recoverable error is raised by a Transaction Guard enabled database service upon a database commit or upon a SQL or PL/SQL execution, which could have called a commit, then an ODP.NET `OracleException` is created with an `OracleLogicalTransaction` instance. `OracleLogicalTransaction` is always non-null. The database maintains the outcome of the logical transaction for the retention period specified by the administrator. ODP.NET automatically queries the database on behalf of the application when a recoverable error occurs so that the `OracleLogicalTransaction` object instance on the `OracleException` object can indicate whether the transaction has committed or not and whether the user call has completed or not.

If the status is committed, then the transaction has completed successfully. No other action is likely needed by the administrator.

If not committed, then ODP.NET applications can learn the current transaction state, whether it is recoverable, and whether it can be retried using `OracleLogicalTransaction`. If the error is recoverable, then the transaction is safe to re-submit. If the error is not recoverable, the application will need to determine the transaction outcome using an alternative mechanism.

 **Note:**

Transaction Guard supports only local transactions. It does not support distributed transactions.

The Transaction Guard feature is enabled or disabled through the Oracle service-level configuration through the `COMMIT_OUTCOME` setting. By default, it is not enabled. This setting can be changed without bringing down the database. Only new connections created against the service will use the new setting.

Here's an example of setting the `COMMIT_OUTCOME` using `SRVCTL`:

```
srvctl modify service -d orcl -s GOLD -commit_outcome TRUE
```

 **Note:**

Grant the `EXECUTE` privilege on the `DBMS_APP_CONT` package to the database users that retrieve the transaction status:

```
GRANT EXECUTE ON DBMS_APP_CONT TO <user name> ;
```

The following is an example ODP.NET Transaction Guard application scenario:

An ODP.NET application receives a Fast Application Notification (FAN) down event or error. FAN automatically aborts the dead session and the application receives an `OracleException`. A Transaction Guard application built to handle errors transparently would do the following:

1. `OracleException.OracleLogicalTransaction.LogicalTransactionId` property

The value returned by this property will be non-null if

- Transaction Guard is enabled,
- Transparent Application Failover (TAF) is not enabled on the connection, and
- ODP.NET was not able to determine the outcome of the transaction.

For a given `OracleException` object, if `OracleLogicalTransaction.Committed` and `OracleLogicalTransaction.UserCallCompleted` return all nulls, then the error is either a non-recoverable error, Transaction Guard is not enabled, or TAF is enabled on the connection. In any of these cases, the application should rollback then re-submit the transaction.

The `LogicalTransactionId` property will return null even if Transaction Guard is enabled and a recoverable error happens, if `OracleLogicalTransaction.Committed` is true or false.

2. `OracleException.OracleLogicalTransaction.Committed` property

This property returns true or false, depending on whether the transaction has been committed or not. If it returns null, then

- ODP.NET could not determine the outcome of the transaction,
- Error is not recoverable,
- Transaction Guard was not enabled, or
- TAF is enabled on the connection.

3. `OracleException.OracleLogicalTransaction.UserCallCompleted` property

This property returns true if the user call has completed, else it returns false. This property returns null if

- Transaction Guard was not enabled,
- Error is not recoverable,
- TAF is enabled on the connection, or
- ODP.NET is not able to determine if the user call has completed or not.

See the following table for the implications of what `Committed` and `UserCallCompleted` values mean.

**Table 3-7 Implication of Committed and UserCallCompleted Values**

Committed Value	UserCallCompleted Value	Outcome
True	True	The transaction was successful. The result can be returned to the application.
False	False	The transaction was not successful. The application can resubmit the transaction again.
True	False	The transaction committed, but there may be additional state, such as row counts or nested PL/SQL logic, that prevents the application from continuing as expected.

**Example 3-4 Using Transaction Guard: Sample Code**

```
using System;
using Oracle.DataAccess.Client;
//alternatively can use using Oracle.ManagedDataAccess.Client;

class TransactionGuardSample
{
    static void Main()
    {
        bool bReadyToCommit = false;
```

```
string constr = "user id=hr;password=hr;data source=oracle";
OracleConnection con = new OracleConnection(constr);
OracleTransaction txn = null;
OracleCommand cmd = null;

try
{
    string sql = " update employees set salary=10000 where
employee_id=103";
    con.Open();
    txn = con.BeginTransaction();
    cmd = new OracleCommand(con, sql);
    cmd.ExecuteNonQuery();
    bReadyToCommit = true;
}
catch (Exception ex)
{
    // rollback here as the SQL execution is unsuccessful
    txn.Rollback();
    Console.WriteLine(ex.ToString());
}

try
{
    if (bReadyToCommit)
        txn.Commit();
}
catch (Exception ex)
{
    if (ex is OracleException)
    {
        // It's safe to re-submit the work if the error is
recoverable and the transaction has not been committed
        if (ex.IsRecoverable &&
ex.OracleLogicalTransaction.Committed == false)
        {
            // safe to re-submit work
        }
        else
        {
            // do not re-submit work
        }
    }
}
finally
{
    // dispose all objects
    txn.Dispose();
    cmd.Dispose();
    con.Dispose(); // place the connection back to the
connection pool
}
}
```

Transaction Guard is not supported when Transparent Application Failover (TAF) is enabled for the service. As such, when TAF is enabled, the `LogicalTransactionId` will always be null and the transaction outcome will not be determined.



#### See Also:

- ["OracleLogicalTransaction Class"](#)
- *Oracle Database Development Guide* for more information on Transaction Guard

## Application Continuity

Oracle Application Continuity enables database requests to automatically replay transactional or non-transactional operations in a non-disruptive and rapid manner in the event of a severed database session, which results in a recoverable error. Application Continuity improves end-user experience by masking planned and unplanned related errors. Applications can be developed without complex logic to handle exceptions, while automatically replaying database operations upon a recoverable error.

Without Application Continuity, it is almost impossible to mask outages in a safe and reliable manner. Common issues encountered include:

- The client state remains at present time, with entered data, returned data, and variables cached, while the database state changes are lost.
- If a transaction commit has occurred, the commit message is not durable. Moreover, checking a lost request does not guarantee that it will not commit after being checked.
- Non-transactional database session state is lost.
- If the request can continue, the database and the client session must be synchronized.

Application Continuity is a feature available with the Oracle Real Application Clusters (RAC), Oracle RAC One Node, Oracle Active Data Guard, and Oracle Autonomous Database in both Shared and Dedicated Infrastructure.

In Oracle Database 18c, Application Continuity improves transparent session and transactional state tracking and recording of the database session to enable recovery following recoverable outages. This enhancement is called Transparent Application Continuity (TAC). TAC has no reliance on application knowledge or application code changes, allowing it to be enabled for your applications. ODP.NET application transparency and failover are achieved by consuming the state-tracking information that captures and categorizes the session state usage as the application issues user calls.

## ODP.NET and Application Continuity

ODP.NET, Unmanaged Driver first supported Application Continuity with version 12.2. While Application Continuity was first introduced in Oracle Database 12c Release 1 (12.1), ODP.NET requires a minimum of Oracle Database 12c Release 2 (12.2) server.

 **Note:**

ODP.NET, Managed Driver and ODP.NET Core do not support Application Continuity and TAC.

With Application Continuity or TAC enabled, ODP.NET ensures all the application's executed statements are logged appropriately so that they can be replayed upon a recoverable error. This applies for all application SQL and PL/SQL, as well as any internal ODP.NET operations.

On the client side, Application Continuity or TAC is enabled by setting the ODP.NET connection string attribute, `Application Continuity=true`.

If `Application Continuity` is set to `true`, but the database server does not enable Application Continuity or TAC, then ODP.NET will still create new connections. However, these connections will not be `Application Continuity` enabled.

 **See Also:**

- *Oracle Call Interface Programmer's Guide*
- *Oracle Real Application Clusters Administration and Deployment Guide*

## Database Sharding

Sharding is a data tier architecture, where data is horizontally partitioned across independent databases. Each database in such a configuration is called a shard. All shards together make up a single logical database, which is referred to as a sharded database. Sharding is a shared-nothing database architecture. The independent physical databases do not share CPU, memory, or storage devices. However, from the perspective of an application, the collection of physical databases looks like a single logical database.

Sharding uses Global Data Services (GDS), where GDS routes a client request to an appropriate database based on parameters such as availability, load, network latency, and replication lag. A GDS pool is a set of replicated databases that offers the same global service. The databases in a GDS pool can be located in multiple data centers across different regions. A sharded GDS pool contains all shards of a sharded database and their replicas, and appears as a single sharded database to database clients.

Applications can connect to multiple databases (shards) where data is partitioned based on one or more sharding strategies. The strategy can be hash based, range based, or list based. Each time a database operation is required, the application needs to determine which shard it must connect to.

A sharding key provides the partitioning key that determines in which shard a row of data is stored. A table can be partitioned using a sharding key.

A super sharding key is a collection of shard chunks, where only those chunks, which have a specific value of the super shard key identifier, are stored. A super sharding

key is used for distributing data across database groups. Specifying super sharding keys are a way through which user-controlled data partitioning is possible.

## ODP.NET Sharding

Starting from version 12.2, unmanaged ODP.NET and Oracle Database both support sharding. Managed ODP.NET and ODP.NET Core started supporting sharding with version 21. All three providers support the same sharding features with the exception that unmanaged ODP.NET does not support the chunk migration connection timeout property.

ODP.NET applications must provide the sharding key and super sharding key information before opening the database connection for single shard queries. These sharding values cannot be set or changed after opening the connection. If any of the shard key values need to be modified, a new connection must be created with the new values and then opened.

If shard keys are set after the connection has been opened, the ODP.NET connection will not use these new shard key values until after the next `OracleConnection.Open()` call.

The `OracleShardingKey` object stores one or more key values. Multiple keys can be set to create a composite key. ODP.NET recognizes the sharding key(s) specified and connects to the correct shard and chunk.

Sharding is supported with or without connection pooling. The ODP.NET connection pool maintains connections to different shards and chunks of the sharded GDS database within the same shared pool.

The shard key (`SHARD_KEY`) and super sharding key (`GROUP_KEY`) can be specified in the TNS connect descriptor, rather than in the application code. The .NET developer then chooses the connect descriptor applicable to the shard that the application will use.

The data distribution across the shards and chunks in the database is transparent to the end user. ODP.NET minimizes the end user impact of chunk resharding within GDS.

To perform cross-shard queries, no ODP.NET shard APIs are used. Instead, applications connect to the GDS catalog service, allowing access to all the sharded databases. The SQL query is specifically constructed to iterate over all the necessary shards. For example, the non-shard database query `select count(*) from employees` is equivalent to the cross-shard query `select sum(c) from (Iterator(select count(*) c from employees(i))`.

### ODP.NET Single Shard Query Example

```
using System;
using Oracle.DataAccess.Client;

class Sharding
{
    static void Main()
    {
        OracleConnection con = new OracleConnection("user id=hr;password=hr;Data
Source=orcl;");
        //Setting a shard key
        OracleShardingKey shardingKey = new OracleShardingKey(OracleDbType.Int32, 123);
        //Setting a second shard key value for a composite key
        shardingKey.SetShardingKey(OracleDbType.Varchar2, "gold");
        //Creating and setting the super shard key
        OracleShardingKey superShardingKey = new OracleShardingKey();
        superShardingKey.SetShardingKey(OracleDbType.Int32, 1000);

        //Setting super sharding key and sharding key on the connection
```

```
con.SetShardingKey(shardingKey, superShardingKey);
con.Open();

    //perform SQL query
}
}
```

By default, ODP.NET only dispenses connections to shards with chunks with read and write privileges available. If some chunks in a shard are read-only, ODP.NET will not dispense a connection to that shard unless `READONLY_CHUNK_OK` is set to `TRUE` in the `CONNECT_DATA` section of the connect descriptor. Connect descriptors are generally stored in `tnsnames.ora` files. Enabling `READONLY_CHUNK_OK` just means that both read/write and read-only connections can be dispensed. It does not specify only read-only connections are dispensed.

Shards are made read-only when chunks are migrating from one shard to another, usually to re-balance data or workload across shards.

Here's an example using `READONLY_CHUNK_OK` in a connect descriptor:

```
SHARDDB =
  (DESCRIPTION =
    (ADDRESS = (PROTOCOL = tcp)(HOST = myhost)(PORT = 1521))
    (CONNECT_DATA =
      (SERVICE_NAME = myservicename)
      (READONLY_CHUNK_OK=true)
    )
  )
)
```

#### See Also:

- [OracleShardingKey Class](#)
- [SetShardingKey\(OracleShardingKey, OracleShardingKey\)](#)

## OracleCommand Object

The `OracleCommand` object represents SQL statements or stored procedures executed on Oracle Database.

#### Note:

Optimizer hint syntax in the form `--+ ...` is not supported. ODP.NET supports this syntax: `/*+ ... */`.

This section includes the following topics:

- [Transactions](#)
- [System.Transactions and Promotable Transactions](#)
- [Distributed Transactions](#)

- [Parameter Binding](#)
- [Batch Processing](#)
- [Statement Caching](#)
- [Self-Tuning](#)

## Transactions

Oracle Database starts a transaction only in the context of a connection. Once a transaction starts, all the successive command execution on that connection run in the context of that transaction. Transactions can be started only on an `OracleConnection` object, and the read-only `Transaction` property on the `OracleCommand` object is implicitly set by the `OracleConnection` object. Therefore, the application cannot set the `Transaction` property, nor does it need to.



### Note:

Transactions are not supported in a .NET stored procedure.

Explicit transactions are required with SQL statements containing "FOR UPDATE" and "RETURNING" clauses. This is not necessary if global transactions are used.

## System.Transactions and Promotable Transactions

ODP.NET supports `System.Transactions`. A local transaction is created for the first connection opened in the `System.Transactions` scope to Oracle Database. When a second connection is opened, this transaction is automatically promoted to a distributed transaction. This functionality provides enhanced performance and scalability.

Connections created within a transaction context, such as `TransactionScope` or `ServiceComponent`, can be established to different versions of Oracle Database. However, in order to enable the local transaction to be promotable, the following must be true:

- The first connection in the transaction context must be established to an Oracle Database.
- Promoting local transactions requires Oracle Services for Microsoft Transaction Server. If this requirement is not met, then a second connection request in the same transaction context throws an exception.

Transaction promotion will throw an ORA-24797 error when the database transaction is already distributed due to the use of database links.

If applications use `System.Transactions`, it is required that the `enlist` connection string attribute is set to either `true` (default) or `dynamic`. However, `enlist=dynamic` cannot be used with `TransactionScope` because auto-enlistment requires `enlist=true`.

ODP.NET supports the following `System.Transactions` programming models for applications using distributed transactions.

- [Implicit Transaction Enlistment Using TransactionScope](#)
- [Explicit Transaction Enlistment Using CommittableTransaction](#) .

**Note:**

ODP.NET Core does not support distributed transactions

## Implicit Transaction Enlistment Using TransactionScope

The `TransactionScope` class provides a mechanism to write transactional applications where the applications do not need to explicitly enlist in transactions. To accomplish this, the application uses the `TransactionScope` object to define the transactional code. Connections created within this transactional scope will enlist in a local transaction that can be promoted to a distributed transaction.

Note that the application must call the `Complete` method on the `TransactionScope` object to commit the changes. Otherwise, the transaction is aborted by default.

```
// C#

using System;
using Oracle.DataAccess.Client;
using System.Data;
using System.Data.Common;
using System.Transactions;

class psfTxnScope
{
    static void Main()
    {
        int retVal = 0;
        string providerName = "Oracle.DataAccess.Client";
        string constr =
            @"User Id=scott;Password=tiger;Data Source=oracle;enlist=true";

        // Get the provider factory.
        DbProviderFactory factory = DbProviderFactories.GetFactory(providerName);

        try
        {
            // Create a TransactionScope object, (It will start an ambient
            // transaction automatically).
            using (TransactionScope scope = new TransactionScope())
            {
                // Create first connection object.
                using (DbConnection conn1 = factory.CreateConnection())
                {
                    // Set connection string and open the connection. this connection
                    // will be automatically enlisted in a promotable local transaction.
                    conn1.ConnectionString = constr;
                    conn1.Open();

                    // Create a command to execute the sql statement.
                    DbCommand cmd1 = factory.CreateCommand();
                    cmd1.Connection = conn1;
                    cmd1.CommandText = @"insert into emp (empno, ename, job) values
                                        (1234, 'emp1', 'dev1')";

                    // Execute the SQL statement to insert one row in DB.
                    retVal = cmd1.ExecuteNonQuery();
                }
            }
        }
    }
}
```

```
        Console.WriteLine("Rows to be affected by cmd1: {0}", retVal);

        // Close the connection and dispose the command object.
        conn1.Close();
        conn1.Dispose();
        cmd1.Dispose();
    }

    // The Complete method commits the transaction. If an exception has
    // been thrown or Complete is not called then the transaction is
    // rolled back.
    scope.Complete();
}
}
catch (Exception ex)
{
    Console.WriteLine(ex.Message);
    Console.WriteLine(ex.StackTrace);
}
}
}
```

## Explicit Transaction Enlistment Using CommittableTransaction

The instantiation of the `CommittableTransaction` object and the `EnlistTransaction` method provides an explicit way to create and enlist in a transaction. Note that the application must call `Commit` or `Rollback` on the `CommittableTransaction` object.

```
// C#

using System;
using Oracle.DataAccess.Client;
using System.Data;
using System.Data.Common;
using System.Transactions;

class psfEnlistTransaction
{
    static void Main()
    {
        int retVal = 0;
        string providerName = "Oracle.DataAccess.Client";
        string constr =
            @"User Id=scott;Password=tiger;Data Source=oracle;enlist=dynamic";

        // Get the provider factory.
        DbProviderFactory factory = DbProviderFactories.GetFactory(providerName);

        try
        {
            // Create a committable transaction object.
            CommittableTransaction cmtTx = new CommittableTransaction();

            // Open a connection to the DB.
            DbConnection conn1 = factory.CreateConnection();
            conn1.ConnectionString = constr;
            conn1.Open();

            // enlist the connection with the committable transaction.
            conn1.EnlistTransaction(cmtTx);
        }
    }
}
```

```
// Create a command to execute the sql statement.
DbCommand cmd1 = factory.CreateCommand();
cmd1.Connection = conn1;
cmd1.CommandText = @"insert into emp (empno, ename, job) values
                    (1234, 'emp1', 'dev1)";

// Execute the SQL statement to insert one row in DB.
retVal = cmd1.ExecuteNonQuery();
Console.WriteLine("Rows to be affected by cmd1: {0}", retVal);

// commit/rollback the transaction.
cmtTx.Commit(); // commits the txn.
//cmtTx.Rollback(); // rolls back the txn.

// close and dispose the connection
conn1.Close();
conn1.Dispose();
cmd1.Dispose();
}
catch (Exception ex)
{
    Console.WriteLine(ex.Message);
    Console.WriteLine(ex.StackTrace);
}
}
```

**See Also:**

["EnlistTransaction"](#)

## Distributed Transactions

A distributed transaction includes one or more statements that, individually or as a group, update data on two or more distinct nodes of a distributed database.

ODP.NET, Managed and Unmanaged Drivers integrate with Microsoft Distributed Transaction Coordinator (MSDTC) and Oracle databases. MSDTC coordinates with all the resource managers that are enlisted to the same `System.Transactions` object, to perform a 2-phase commit or rollback atomically. With that, Oracle distributed transactions can then be committed or rolled back across networks properly.

ODP.NET only supports the read committed isolation level for distributed transactions.

**Note:**

ODP.NET Core does not support Distributed Transactions.

## Microsoft Distributed Transaction Coordinator Integration

Managed ODP.NET includes a native fully managed implementation that supports integration with MSDTC for distributed transactions enlistments, commits, and rollbacks.

For unmanaged ODP.NET, Oracle Services for Microsoft Transaction (OraMTS) provides MSDTC integration that allows client components to participate in Oracle database distributed transactions. OraMTS act as a proxy for the Oracle database to MSDTC to ensure that Oracle distributed database transactions commit or rollback together with the rest of the distributed transaction.

Unmanaged ODP.NET can use either a managed or unmanaged OraMTS implementation. Oracle recommends using the managed OraMTS for applications requiring high availability from Oracle RAC or Data Guard.

If a failure occurs in a distributed transaction, such as a network failure or server hardware failure, then it can leave an in-process transaction in-doubt. Both managed and unmanaged ODP.NET use the OraMTS recovery service to resolve these in-doubt transactions. This recovery service runs as a Windows service. Administrators must install and configure the OraMTS Windows recovery service to manage recovery scenarios whether they use managed or unmanaged ODP.NET. Only one recovery service is needed per machine.

It is required to install the OraMTS Recovery Service on all the client machines where ODP.NET is running and participating in MSDTC. As a machine may have multiple IP addresses, administrators for managed ODP.NET applications can specify the host machine name or IP address that has the running recovery service in the application's .NET configuration file. ODP.NET, Unmanaged Driver resolves the IP/machine name for the recovery service automatically.

**Table 3-8 Supported ODP.NET Type and .NET Framework Version for Distributed Transaction**

ODP.NET Type	.NET Framework Version	Distributed Transaction Support
Managed	4.x	.NET Framework's native managed implementation for distributed transactions.
Unmanaged	4.x	OraMTS (default) or managed OraMTS implementation. Oracle recommends using managed OraMTS for unmanaged ODP.NET applications requiring high availability from Oracle RAC or Data Guard.

### See Also:

Manually Creating an Oracle MTS Recovery Service in *Oracle Services for Microsoft Transaction Server Developer's Guide for Microsoft Windows*.

## ODP.NET, Managed Driver Setup

This section explains the setup and configuration steps required for using distributed transactions with ODP.NET, Managed Driver. Follow these steps to configure distributed transactions in these .NET Framework versions:

1. Create and setup the OraMTS recovery service or make sure an existing recovery service is running.
2. Set the value of `OMTSRECO_PORT` in the .NET configuration to specify the port number that the OraMTS recovery service is running.

## ODP.NET, Unmanaged Driver Setup

This section explains the setup and configuration steps required for using distributed transactions with ODP.NET, Unmanaged Driver.

For .NET Framework 4.x, ODP.NET, Unmanaged Driver includes managed OraMTS in its assembly. OraMTS is the default option for ODP.NET, Unmanaged Driver, to ensure implementation continuity during upgrades. However, Oracle recommends the managed OraMTS option when using any high availability FAN operations (HA Events = true) with Oracle Real Application Clusters or Oracle Data Guard. The managed OraMTS option support high availability functionality, while the traditional OraMTS does not.

Applications can set OraMTS (default) or managed OraMTS usage through the `UseOraMTSManaged` parameter in the .NET configuration file.

Install and configure OraMTS, including its recovery service to use traditional OraMTS implementation for ODP.NET, Unmanaged Driver.

To set managed OraMTS up, perform the following steps:

1. Set `UseOraMTSManaged` to `true` in the .NET configuration file.
2. Create and setup the OraMTS recovery service or make sure an existing recovery service is running.



### See Also:

`distributedTransaction` section for more information about .NET configuration setup

## Parameter Binding

When the `DbType` property of an `OracleParameter` object is set, the `OracleDbType` property of the `OracleParameter` object changes accordingly, or vice versa. The parameter set last prevails. An application can bind the data and have ODP.NET infer both the `DbType` and `OracleDbType` properties from the .NET type of the parameter value. ODP.NET allows applications to obtain an output parameter as either a .NET Framework type or an ODP.NET type. The application can specify which type to return for an output parameter by setting the `DbType` property of the output parameter (.NET type) or the `OracleDbType` property (ODP.NET type) of the `OracleParameter` object.

For example, if the output parameter is set as a `DbType.String` type by setting the `DbType` property, the output data is returned as a .NET String type. On the other hand, if the parameter is set as an `OracleDbType.Char` type by setting the `OracleDbType` property, the output data is returned as an `OracleString` type. If both `DbType` and `OracleDbType` properties are set before the command execution, the last setting takes affect.

ODP.NET populates `InputOutput`, `Output`, and `ReturnValue` parameters with the Oracle data, through the execution of the following `OracleCommand` methods:

- `ExecuteReader`
- `ExecuteNonQuery`
- `ExecuteScalar`

An application should not bind a value for output parameters; it is the responsibility of ODP.NET to create the value object and populate the `OracleParameter.Value` property with the object.

When binding by position (default) to a function, ODP.NET expects the return value to be bound first, before any other parameters.

This section describes the following:

- [OracleDbType Enumeration Type](#)
- [Inference of DbType, OracleDbType, and .NET Types](#)
- [PL/SQL Associative Array Binding](#)
- [Array Binding](#)



#### See Also:

["OracleDbType Enumeration"](#)

## Command Timeouts

The `OracleCommand.CommandTimeout` property limits how long a command is allowed to execute before terminating with an exception. This setting prevents long running commands from consuming excessive resources or from blocking other necessary operations from occurring.

The database server can be interrupted via either TCP/IP urgent data or normal TCP/IP data, called out of band (OOB) or in band data, respectively. Windows-based database servers only support in band breaks, whereas all other (predominantly UNIX-based) database servers can support OOB or in band breaks.

ODP.NET, Managed Driver uses OOB breaks by default with database servers that support it. For certain network topologies, the routers or firewalls involved in the route to the database may have been configured to drop urgent data or in band the data. If the routers or firewalls can not be changed to handle urgent data appropriately, then the ODP.NET, Managed Driver can be configured to utilize in band breaks by setting the .NET configuration parameter `Disable_Oob` to `on`.

**See Also:**

[settings section](#) in the [Oracle Data Provider for .NET, Managed Driver Configuration](#) section for more information.

## OracleDbType Enumeration Type

OracleDbType enumerated values are used to explicitly specify the OracleDbType value of an OracleParameter object.

[Table 3-9](#) lists all the OracleDbType enumeration values with a description of each enumerated value.

**Table 3-9 OracleDbType Enumeration Values**

Member Name	Description
Array	Oracle Collection (VArray or Nested Table) <i>Not Available in ODP.NET, Managed Driver and ODP.NET Core</i>
BFile	Oracle BFILE type
BinaryFloat	Oracle BINARY_FLOAT type
BinaryDouble	Oracle BINARY_DOUBLE type
Blob	Oracle BLOB type
Boolean	Oracle BOOLEAN type
Byte	byte type
Char	Oracle CHAR type
Clob	Oracle CLOB type
Date	Oracle DATE type
Decimal	Oracle NUMBER type
Double	8-byte FLOAT type
Int16	2-byte INTEGER type
Int32	4-byte INTEGER type
Int64	8-byte INTEGER type
IntervalDS	Oracle INTERVAL DAY TO SECOND type
IntervalYM	Oracle INTERVAL YEAR TO MONTH type
Json	Oracle JSON type
Long	Oracle LONG type
LongRaw	Oracle LONG RAW type
NChar	Oracle NCHAR type
Object	Oracle Object type <i>Not Available in ODP.NET, Managed Driver and ODP.NET Core</i>
NClob	Oracle NCLOB type
NVarchar2	Oracle NVARCHAR2 type

**Table 3-9 (Cont.) OracleDbType Enumeration Values**

Member Name	Description
Raw	Oracle RAW type
Ref	Oracle REF type <i>Not Available in ODP.NET, Managed Driver and ODP.NET Core</i>
RefCursor	Oracle REF CURSOR type
Single	4-byte FLOAT type
TimeStamp	Oracle TIMESTAMP type
TimeStampLTZ	Oracle TIMESTAMP WITH LOCAL TIME ZONE type
TimeStampTZ	Oracle TIMESTAMP WITH TIME ZONE type
Varchar2	Oracle VARCHAR2 type
XmlType	Oracle XMLType type

**Note:**

PL/SQL LONG, LONG RAW, RAW, and VARCHAR data types can be bound with a size up to 32512 bytes.

## Inference of DbType, OracleDbType, and .NET Types

This section explains the inference from the `System.Data.DbType`, `OracleDbType`, and `Value` properties in the `OracleParameter` class.

In the `OracleParameter` class, `DbType`, `OracleDbType`, and `Value` properties are linked. Specifying the value of any of these properties infers the value of one or more of the other properties.

### Inference of DbType from OracleDbType

In the `OracleParameter` class, specifying the value of `OracleDbType` infers the value of `DbType` as shown in [Table 3-10](#).

**Table 3-10 Inference of System.Data.DbType from OracleDbType**

OracleDbType	System.Data.DbType
Array	Object
BFile	Object
Blob	Object
BinaryFloat	Single
BinaryDouble	Double
Boolean	Boolean
Byte	Byte

**Table 3-10 (Cont.) Inference of System.Data.DbType from OracleDbType**

OracleDbType	System.Data.DbType
Char	StringFixedLength
Clob	Object
Date	Date
Decimal	Decimal
Double	Double
Int16	Int16
Int32	Int32
Int64	Int64
IntervalDS	Object
IntervalYM	Int64
Json	String
Long	String
LongRaw	Binary
NChar	StringFixedLength
NClob	Object
NVarchar2	String
Object	Object
Raw	Binary
Ref	Object
RefCursor	Object
Single	Single
TimeStamp	DateTime
TimeStampLTZ	DateTime
TimeStampTZ	DateTimeOffset
Varchar2	String
XmlType	String

## Inference of OracleDbType from DbType

In the `OracleParameter` class, specifying the value of `DbType` infers the value of `OracleDbType` as shown in [Table 3-11](#).

**Table 3-11 Inference of OracleDbType from DbType**

System.Data.DbType	OracleDbType
Binary	Raw
Boolean	Boolean
Byte	Byte

**Table 3-11 (Cont.) Inference of OracleDbType from DbType**

<b>System.Data.DbType</b>	<b>OracleDbType</b>
Currency	<i>Not Supported</i>
Date	Date
DateTime	TimeStamp
DateTimeOffset	TimeStampTZ
Decimal	Decimal
Double	Double
Guid	Blob
Int16	Int16
Int32	Int32
Int64	Int64
Object	Object
Sbyte	<i>Not Supported</i>
Single	Single
String	Varchar2
StringFixedLength	Char
Time	TimeStamp
UInt16	<i>Not Supported</i>
UInt32	<i>Not Supported</i>
UInt64	<i>Not Supported</i>
VarNumeric	<i>Not Supported</i>

## Inference of DbType and OracleDbType from Value

In the `OracleParameter` class, `Value` is an object type that can be of any .NET Framework data type or ODP.NET type. If the `OracleDbType` and `DbType` properties of the `OracleParameter` class are not specified, the `OracleDbType` property is inferred from the type of the `Value` property.

[Table 3-12](#) shows the inference of `DbType` and `OracleDbType` properties from the `Value` property when the type of `Value` is one of the .NET Framework data types.

**Table 3-12 Inference of DbType and OracleDbType from Value (.NET Datatypes)**

<b>Value (.NET Datatypes)</b>	<b>System.Data.DbType</b>	<b>OracleDbType</b>
Boolean	Boolean	Boolean
Byte	Byte	Byte
Byte[]	Binary	Raw
Char / Char []	String	Varchar2
DateTime	DateTime	TimeStamp

**Table 3-12 (Cont.) Inference of DbType and OracleDbType from Value (.NET Datatypes)**

Value (.NET Datatypes)	System.Data.DbType	OracleDbType
DateTimeOffset	DateTimeOffset	TimeStampTZ
Decimal	Decimal	Decimal
Double	Double	Double
Float	Single	Single
Guid	Guid	Blob
Int16	Int16	Int16
Int32	Int32	Int32
Int64	Int64	Int64
IOracleCustomType	Object	Object
Single	Single	Single
String	String	Varchar2
TimeSpan	Object	IntervalDS

 **Note:**

Using other .NET Framework data types as values for the `OracleParameter` class without specifying either the `DbType` or the `OracleDbType` properties raises an exception because inferring `DbType` and `OracleDbType` properties from other .NET Framework data types is not supported.

[Table 3-13](#) shows the inference of `DbType` and `OracleDbType` properties from the `Value` property when type of `Value` is one of `Oracle.DataAccess.Types`.

**Table 3-13 Inference of DbType and OracleDbType from Value (ODP.NET Types)**

Value (Oracle.DataAccess.Types)	System.Data.DbType	OracleDbType
OracleBFile	Object	BFile
OracleBinary	Binary	Raw
OracleBlob	Object	Blob
OracleBoolean	Boolean	Boolean
OracleClob	Object	Clob
OracleDate	Date	Date
OracleDecimal	Decimal	Decimal
OracleIntervalDS	Object	IntervalDS
OracleIntervalYM	Int64	IntervalYM
OracleRef	Object	Ref

**Table 3-13 (Cont.) Inference of DbType and OracleDbType from Value (ODP.NET Types)**

Value (Oracle.DataAccess.Types)	System.Data.DbType	OracleDbType
OracleRefCursor	Object	RefCursor
OracleString	String	Varchar2
OracleTimeStamp	DateTime	TimeStamp
OracleTimeStampLTZ	DateTime	TimeStampLTZ
OracleTimeStampTZ	DateTimeOffset	TimeStampTZ
OracleXmlType	String	XmlType

## PL/SQL Associative Array Binding

ODP.NET supports PL/SQL Associative Arrays (formerly known as PL/SQL Index-By Tables) binding.

An application can bind an `OracleParameter` object, as a PL/SQL Associative Array, to a PL/SQL stored procedure. The following `OracleParameter` properties are used for this feature:

- `CollectionType`

This property must be set to `OracleCollectionType.PLSQLAssociativeArray` to bind a PL/SQL Associative Array.

- `ArrayBindSize`

This property is ignored for the fixed-length element types (such as `Int32`).

For variable-length element types (such as `Varchar2`), each element in the `ArrayBindSize` property specifies the size of the corresponding element in the `Value` property.

For Output parameters, InputOutput parameters, and return values, this property must be set for variable-length variables.

If the database server supports up to 32 KB `VARCHAR2`, then each ODP.NET array element can store up to 32 KB characters or binary data. If the database server supports up to 4 KB `VARCHAR2`, then each ODP.NET array element can store up to 4 KB characters or 2 KB binary data.

- `ArrayBindStatus`

This property specifies the execution status of each element in the `OracleParameter.Value` property.

- `Size`

This property specifies the maximum number of elements to be bound in the PL/SQL Associative Array.

- `Value`

This property must be set to an array of values, null, or the `DBNull.Value` property.

ODP.NET supports binding parameters of PL/SQL Associative Arrays which contain the following data types.

- BINARY\_FLOAT
- CHAR
- DATE
- NCHAR
- NUMBER
- NVARCHAR2
- RAW
- ROWID
- UROWID
- VARCHAR2

Using unsupported data types with associative arrays can cause an ORA-600 error.

### Example of PL/SQL Associative Arrays

This example binds three `OracleParameter` objects as PL/SQL Associative Arrays: `Param1` as an `In` parameter, `Param2` as an `InputOutput` parameter, and `Param3` as an `Output` parameter.

#### PL/SQL Package: MYPACK

```
/* Setup the tables and required PL/SQL:

connect scott/tiger@oracle
CREATE TABLE T1(COL1 number, COL2 varchar2(20));

CREATE or replace PACKAGE MYPACK AS
  TYPE AssocArrayVarchar2_t is table of VARCHAR(20) index by BINARY_INTEGER;
  PROCEDURE TestVarchar2(
    Param1 IN AssocArrayVarchar2_t,
    Param2 IN OUT AssocArrayVarchar2_t,
    Param3 OUT AssocArrayVarchar2_t);
END MYPACK;
/

CREATE or REPLACE package body MYPACK as
  PROCEDURE TestVarchar2(
    Param1 IN AssocArrayVarchar2_t,
    Param2 IN OUT AssocArrayVarchar2_t,
    Param3 OUT AssocArrayVarchar2_t)
  IS
    i integer;
  BEGIN
    -- copy a few elements from Param2 to Param1\n
    Param3(1) := Param2(1);
    Param3(2) := NULL;
    Param3(3) := Param2(3);
    -- copy all elements from Param1 to Param2\n
    Param2(1) := Param1(1);
    Param2(2) := Param1(2);
    Param2(3) := Param1(3);
    -- insert some values to db\n
```

```
        FOR i IN 1..3 LOOP
            insert into T1 values(i,Param2(i));
        END LOOP;
    END TestVarchar2;
END MYPACK;
/
*/

// C#

using System;
using System.Data;
using Oracle.DataAccess.Client;

class AssociativeArraySample
{
    static void Main()
    {
        OracleConnection con = new OracleConnection();

        con.ConnectionString = "User Id=scott;Password=tiger;Data Source=oracle";
        con.Open();
        Console.WriteLine("Connected to Oracle" + con.ServerVersion);

        OracleCommand cmd = new OracleCommand(
            "begin MyPack.TestVarchar2(:1, :2, :3); end;", con);

        OracleParameter Param1 = cmd.Parameters.Add("1", OracleDbType.Varchar2);
        OracleParameter Param2 = cmd.Parameters.Add("2", OracleDbType.Varchar2);
        OracleParameter Param3 = cmd.Parameters.Add("3", OracleDbType.Varchar2);

        Param1.Direction = ParameterDirection.Input;
        Param2.Direction = ParameterDirection.InputOutput;
        Param3.Direction = ParameterDirection.Output;

        // Specify that we are binding PL/SQL Associative Array
        Param1.CollectionType = OracleCollectionType.PLSQLAssociativeArray;
        Param2.CollectionType = OracleCollectionType.PLSQLAssociativeArray;
        Param3.CollectionType = OracleCollectionType.PLSQLAssociativeArray;

        // Setup the values for PL/SQL Associative Array
        Param1.Value = new string[3] {
            "First Element", "Second Element ", "Third Element "
        };
        Param2.Value = new string[3] {
            "First Element", "Second Element ", "Third Element "
        };
        Param3.Value = null;

        // Specify the maximum number of elements in the PL/SQL Associative Array
        Param1.Size = 3;
        Param2.Size = 3;
        Param3.Size = 3;

        // Setup the ArrayBindSize for Param1
        Param1.ArrayBindSize = new int[3] { 13, 14, 13 };

        // Setup the ArrayBindStatus for Param1
        Param1.ArrayBindStatus = new OracleParameterStatus[3] {
            OracleParameterStatus.Success, OracleParameterStatus.Success,
            OracleParameterStatus.Success};
    }
}
```

```
// Setup the ArrayBindSize for Param2
Param2.ArrayBindSize = new int[3] { 20, 20, 20 };

// Setup the ArrayBindSize for Param3
Param3.ArrayBindSize = new int[3] { 20, 20, 20 };

// execute the cmd
cmd.ExecuteNonQuery();

//print out the parameter's values
Console.WriteLine("parameter values after executing the PL/SQL block");
for (int i = 0; i < 3; i++)
    Console.WriteLine("Param2[{0}] = {1} ", i,
        (cmd.Parameters[1].Value as Array).GetValue(i));

for (int i = 0; i < 3; i++)
    Console.WriteLine("Param3[{0}] = {1} ", i,
        (cmd.Parameters[2].Value as Array).GetValue(i));

// Close and Dispose OracleConnection object
con.Close();
con.Dispose();
Console.WriteLine("Disconnected");
}
}
```

## Array Binding

The array bind feature enables applications to bind arrays of a type using the `OracleParameter` class. Using the array bind feature, an application can insert multiple rows into a table in a single database round-trip.

The following example inserts three rows into the `Dept` table with a single database round-trip. The `OracleCommand` `ArrayBindCount` property defines the number of elements of the array to use when executing the statement.

```
// C#

using System;
using System.Data;
using Oracle.DataAccess.Client;

class ArrayBindSample
{
    static void Main()
    {
        OracleConnection con = new OracleConnection();
        con.ConnectionString = "User Id=scott;Password=tiger;Data Source=oracle;";
        con.Open();
        Console.WriteLine("Connected successfully");

        int[] myArrayDeptNo = new int[3] { 10, 20, 30 };
        OracleCommand cmd = new OracleCommand();

        // Set the command text on an OracleCommand object
        cmd.CommandText = "insert into dept(deptno) values (:deptno)";
        cmd.Connection = con;

        // Set the ArrayBindCount to indicate the number of values
```

```
cmd.ArrayBindCount = 3;

// Create a parameter for the array operations
OracleParameter prm = new OracleParameter("deptno", OracleDbType.Int32);

prm.Direction = ParameterDirection.Input;
prm.Value = myArrayDeptNo;

// Add the parameter to the parameter collection
cmd.Parameters.Add(prm);

// Execute the command
cmd.ExecuteNonQuery();
Console.WriteLine("Insert Completed Successfully");

// Close and Dispose OracleConnection object
con.Close();
con.Dispose();
}
}
```



#### See Also:

"Value " for more information

## OracleParameter Array Bind Properties

The `OracleParameter` class provides two properties for granular control when using the array bind feature:

- `ArrayBindSize`

The `ArrayBindSize` property is an array of integers specifying the maximum size for each corresponding value in an array. The `ArrayBindSize` property is similar to the `Size` property of an `OracleParameter` object, except the `ArrayBindSize` property specifies the size for each value in an array.

Before the execution, the application must populate the `ArrayBindSize` property; after the execution, ODP.NET populates it.

The `ArrayBindSize` property is used only for parameter types that have variable length such as `Clob`, `Blob`, and `Varchar2`. The size is represented in bytes for binary data types, and characters for the Unicode string types. The count for string types does not include the terminating character. The size is inferred from the actual size of the value, if it is not explicitly set. For an output parameter, the size of each value is set by ODP.NET. The `ArrayBindSize` property is ignored for fixed-length data types.

The maximum `ArrayBindSize` size is 2 GB for both character and binary data.

- `ArrayBindStatus`

The `ArrayBindStatus` property is an array of `OracleParameterStatus` values that specify the status of each corresponding value in an array for a parameter. This property is similar to the `Status` property of the `OracleParameter` object, except that the `ArrayBindStatus` property specifies the status for each array value.

Before the execution, the application must populate the `ArrayBindStatus` property. After the execution, ODP.NET populates the property. Before the execution, an application using the `ArrayBindStatus` property can specify a `NULL` value for the corresponding element in the array for a parameter. After the execution, ODP.NET populates the `ArrayBindStatus` property, indicating whether the corresponding element in the array has a `null` value, or if data truncation occurred when the value was fetched.

## Error Handling for Array Binding

If an error occurs during an array bind execution, it can be difficult to determine which element in the `Value` property caused the error. ODP.NET provides a way to determine the row where the error occurred, making it easier to find the element in the row that caused the error.

When an `OracleException` object is thrown during an array bind execution, the `OracleErrorCollection` object contains one or more `OracleError` objects. Each of these `OracleError` objects represents an individual error that occurred during the execution, and contains a provider-specific property, `ArrayBindIndex`, which indicates the row number at which the error occurred.

The following example demonstrates error handling for array binding:

```
/* Database Setup
connect scott/tiger@oracle
drop table depttest;
create table depttest(deptno number(2));
*/

// C#

using System;
using System.Data;
using Oracle.DataAccess.Client;

class ArrayBindExceptionSample
{
    static void Main()
    {
        OracleConnection con = new OracleConnection();
        con.ConnectionString = "User Id=scott;Password=tiger;Data Source=oracle;";
        con.Open();

        OracleCommand cmd = new OracleCommand();

        // Start a transaction
        OracleTransaction txn = con.BeginTransaction(IsolationLevel.ReadCommitted);

        try
        {
            int[] myArrayDeptNo = new int[3] { 10, 200000, 30 };
            // int[] myArrayDeptNo = new int[3]{ 10,20,30};

            // Set the command text on an OracleCommand object
            cmd.CommandText = "insert into depttest(deptno) values (:deptno)";
            cmd.Connection = con;

            // Set the ArrayBindCount to indicate the number of values
            cmd.ArrayBindCount = 3;
        }
    }
}
```

```

// Create a parameter for the array operations
OracleParameter prm = new OracleParameter("deptno", OracleDbType.Int32);

prm.Direction = ParameterDirection.Input;
prm.Value = myArrayDeptNo;

// Add the parameter to the parameter collection
cmd.Parameters.Add(prm);

// Execute the command
cmd.ExecuteNonQuery();
}
catch (OracleException e)
{
    Console.WriteLine("OracleException {0} occurred", e.Message);
    if (e.Number == 24381)
        for (int i = 0; i < e.Errors.Count; i++)
            Console.WriteLine("Array Bind Error {0} occurred at Row Number {1}",
                e.Errors[i].Message, e.Errors[i].ArrayBindIndex);

    txn.Commit();
}
cmd.Parameters.Clear();
cmd.CommandText = "select count(*) from deptttest";

decimal rows = (decimal)cmd.ExecuteScalar();

Console.WriteLine("{0} row have been inserted", rows);
con.Close();
con.Dispose();
}
}

```



### See Also:

"[ArrayBindIndex](#)" for more information

## OracleParameterStatus Enumeration Types

[Table 3-14](#) lists `OracleParameterStatus` enumeration values.

**Table 3-14 OracleParameterStatus Members**

Member Names	Description
Success	For input parameters, indicates that the input value has been assigned to the column. For output parameters, indicates that the provider assigned an intact value to the parameter.
NullFetched	Indicates that a NULL value has been fetched from a column or an OUT parameter.
NullInsert	Indicates that a NULL value is to be inserted into a column.

**Table 3-14 (Cont.) OracleParameterStatus Members**

Member Names	Description
Truncation	Indicates that truncation has occurred when fetching the data from the column.

## Batch Processing

The `OracleDataAdapter.UpdateBatchSize` property enables batch processing when the `OracleDataAdapter.Update` method is called. `UpdateBatchSize` is a numeric property that indicates how many `DataSet` rows to update the Oracle database for each round-trip.

This enables the developer to reduce the number of round-trips to the database.

 **See Also:**  
"UpdateBatchSize"

## Statement Caching

Statement caching eliminates the need to parse each SQL or PL/SQL statement before execution by caching server cursors created during the initial statement execution. Subsequent executions of the same statement can reuse the parsed information from the cursor, and then execute the statement without reparsing, for better performance.

In order to see performance gains from statement caching, Oracle recommends caching only those statements that will be repeatedly executed. Furthermore, SQL or PL/SQL statements should use parameters rather than literal values. Doing so takes full advantage of statement caching, because parsed information from parameterized statements can be reused even if the parameter values change in subsequent executions. However, if the literal values in the statements are different, the parsed information cannot be reused unless the subsequent statements also have the same literal values.

## Statement Caching Connection String Attributes

The following connection string attributes control the behavior of the ODP.NET statement caching feature:

- `Statement Cache Size`

This attribute enables or disables ODP.NET statement caching. By default, this attribute is set to 0 (disabled). If it is set to a value greater than 0, ODP.NET statement caching is enabled and the value specifies the maximum number of statements that can be cached for a connection. Once a connection has cached up to the specified maximum cache size, the least recently used cursor is freed to make room to cache the newly created cursor.

If self tuning is enabled, then statement caching is enabled as well. The `Statement Cache Size` is configured automatically in such cases.

- `Statement Cache Purge`

This attribute provides a way for connections to purge all statements that are cached when a connection is closed or placed back into the connection pool. By default, this attribute is set to `false`, which means that cursors are not freed when connections are placed back into the pool.

## Enabling Statement Caching through the Registry

To enable statement caching by default for all ODP.NET applications running in a system, without changing the application, set the registry key of `HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\ODP.NET\Assembly_Version\StatementCacheSize` to a value greater than 0. This value specifies the number of cursors that are to be cached on the server.

The default value for the system can be overridden at the connection pool level. The `Statement Cache Size` attribute can be set to a different size than the registry value or it can be turned off. The `Statement Cache Size` can also be configured through an XML configuration file.



### See Also:

[Configuring Oracle Data Provider for .NET](#) for more details.

## Statement Caching Methods and Properties

The following property and method are relevant only when statement caching is enabled:

- `OracleCommand.AddToStatementCache` property

If statement caching is enabled, having this property set to `true` (default) adds statements to the cache when they are executed. If statement caching is disabled or if this property is set to `false`, the executed statement is not cached.

- `OracleConnection.PurgeStatementCache` method

This method purges all the cached statements by closing all open cursors on the database that are associated with the particular connection. Note that statement caching remains enabled after this call.

## Connections and Statement Caching

Statement caching is managed separately for each connection. Therefore, executing the same statement on different connections requires parsing once for each connection and caching a separate cursor for each connection.

## Pooling and Statement Caching

Pooling and statement caching can be used in conjunction. If connection pooling is enabled and the `Statement Cache Purge` attribute is set to `false`, statements executed on each separate connection are cached throughout the lifetime of the pooled connection.

If the `StatementCachePurge` attribute is set to `true`, all the cached cursors are freed when the connection is placed back into the pool. When connection pooling is disabled, cursors are cached during the lifetime of the connection, but the cursors are closed when the `OracleConnection` object is closed or disposed of.

## Self-Tuning

ODP.NET applications can be self-tuned for performance optimization. ODP.NET dynamically monitors application queries during runtime.



### Note:

Self-tuning for applications does not take place if the `Pooling` connection string attribute is set to `false`. Self-tuning is also not supported inside .NET stored procedures.

The statement cache size (`StatementCacheSize`) is tuned automatically by monitoring the statements that are executed by the application. The following sections discuss self-tuning in applications:

- [Self-Tuning Statement Caching](#)
- [Enabling or Disabling Self-Tuning for Applications](#)
- [Tracing Optimization Changes](#)

## Self-Tuning Statement Caching

Statement caching helps improve performance by eliminating the need to re-parse each SQL or PL/SQL statement before execution.

If self-tuning is enabled for an application, then ODP.NET continuously monitors application behavior in order to determine the optimum value for the statement cache size. Any statement cache size value specified in the connection string, configuration file, or registry is ignored.

When the application first initializes, it uses the default value of statement cache size. As the application executes statements, ODP.NET collects statistics that are used to self-tune the value of statement cache size. Self-tuning of statement cache size results in increased performance.



### Note:

To take full advantage of statement caching, you should not dynamically generate statements, with different inline values, for every statement execution. Instead, use parameterized commands to minimize the number of unique statements that need to be executed and cached. This is because only one statement needs to be cached for every unique command text, regardless of the parameter values and the number of times that the statement is executed.

The maximum number of statements that can be cached per connection is determined by the `MaxStatementCacheSize` configuration attribute. The `MaxStatementCacheSize` value can be specified in the Windows registry or XML configuration file.

The `MaxStatementCacheSize` setting is useful in limiting the number of cached statements, as well as the number of open cursors. This is because a cached statement equates to a cursor being opened on the server. For this reason, you should not set `MaxStatementCacheSize` to a value that is greater than the database `OPEN_CURSORS` setting.

The following Windows registry key is used to configure the `MaxStatementCacheSize` configuration attribute:

```
HKLM\Software\Oracle\ODP.NET\version\MaxStatementCacheSize
```

The `MaxStatementCacheSize` key is of type `REG_SZ`. It can be set to an integer value between 0 and `System.Int32.MaxValue`.

The following example sets the `MaxStatementCacheSize` property in an ADO.NET 2.0, or above, configuration file:

```
<?xml version="1.0" encoding="utf-8" ?>
<configuration>
  <oracle.dataaccess.client>
    <settings>
      <add name="MaxStatementCacheSize" value="300"/>
    </settings>
  </oracle.dataaccess.client>
</configuration>
```

If self-tuning is disabled for an application, then the value of statement cache size is determined by the settings in the connection string, configuration file, or the registry. If statement cache size is not specified in any of these sources, then the default value of statement cache size is set to 0. To have ODP.NET configured with the same default settings as previous releases of ODP.NET, disable self-tuning and set the `StatementCacheSize` value to 10.



#### See Also:

["Statement Caching"](#)

## Enabling or Disabling Self-Tuning for Applications

Self-tuning for ODP.NET applications is enabled by default. An application can enable or disable self-tuning using one of the following methods:

- Self-Tuning Connection String Attribute

An application can modify the `Self Tuning` connection string attribute to enable or disable self-tuning for a particular connection pool. The default value for `Self Tuning` is `true`.

- Windows Registry

An application can enable or disable self-tuning for a particular version of ODP.NET by modifying the following registry entry:

```
HKLM\Software\Oracle\ODP.NET\version\SelfTuning
```

The `SelfTuning` key is of type `REG_SZ`. It can be set to either 1 (enabled) or 0 (disabled).

- Configuration File

An ODP.NET application can modify the application configuration file (`app.config`) or Web configuration file (`web.config`) to enable or disable self-tuning.

The following example shows how to enable self-tuning in an ADO.NET 2.0 application configuration file:

```
<?xml version="1.0" encoding="utf-8" ?>
<configuration>
  <oracle.dataaccess.client>
    <settings>
      <add name="SelfTuning" value="1"/>
    </settings>
  </oracle.dataaccess.client>
</configuration>
```

 **Note:**

If the optimal statement cache size is known for an application, then you can disable self-tuning and set `StatementCacheSize` to its optimum value in the registry, configuration file, or the application. If self-tuning is disabled and `StatementCacheSize` is not set at all, then the default value of 0 is used for `StatementCacheSize`.

## Tracing Optimization Changes

Applications can trace optimization changes made by self-tuning. All changes to `StatementCacheSize` are traced. Errors, if any, are also traced.

The `TraceLevel` used for tracing self-tuning is 64 for unmanaged ODP.NET. Managed ODP.NET and ODP.NET Core uses `TraceLevel` to 7.

 **See Also:**

[Table 2-3](#) for details on `TraceLevel` values

## Data Transmission Performance

ODP.NET data transmission performance can be optimized via the Session Data Unit (SDU) size setting. The SDU is a buffer that Oracle uses to place data before transmitting it across the network. Oracle sends the data in the buffer either when requested or when it is full.

Adjusting the size of the SDU buffers relative to the amount of data to send at any one time can improve performance, network utilization, and memory consumption. When large amounts of data are being transmitted, increasing the SDU size can improve

performance and network throughput. SDU size can be adjusted lower or higher to achieve higher throughput for a specific deployment. A larger SDU size allows more data to be sent per buffer, reducing number of database round trips for large amounts of data. To accommodate the larger buffer, more memory consumption occurs.

This buffer size can be set on either the ODP.NET client side or database server side. ODP.NET supports SDU sizes between 256 and 2,097,152 bytes. In ODP.NET, this can be set in the .NET configuration file (.NET Framework), `tnsnames.ora`, or `sqlnet.ora`.

For managed ODP.NET and ODP.NET Core, if the application does not provide a client side SDU value, then connections will use the database server's SDU size. If the client side SDU size is set, then connections will compare it against the DB server's SDU size, and then choose the lower of the two values for the SDU size to use.

Unmanaged ODP.NET SDU setting behavior is the same as the Oracle database client's.



#### See Also:

Optimizing Performance in *Oracle Database Net Services Administrator's Guide* for more SDU details.

## ODP.NET Types Overview

ODP.NET types represent Oracle native data types and PL/SQL data types as a structure or as a class. ODP.NET type structures follow [value semantics](#), while ODP.NET type classes follow [reference semantics](#). ODP.NET types provide safer and more efficient ways of obtaining Oracle native data and PL/SQL data types in a .NET application than .NET types. For example, an `OracleDecimal` structure holds up to 38 digits of precision, while a .NET `Decimal` only holds up to 28.

[Table 3-15](#) lists data types supported by ODP.NET and their corresponding ODP.NET types: data types in the first column refer to both Oracle native data types and PL/SQL data types of that name. Those data types that exist only in PL/SQL are indicated by (PL/SQL only) after the data type name. The entries for the PL/SQL data types also represent the subtypes of the data types, if any. The third column lists the .NET Framework data type that corresponds to the `Value` property of each ODP.NET type.

**Table 3-15 Value Property Type of ODP.NET Type**

Oracle Native Data Type or PL/SQL Data Type	ODP.NET Type	.NET Framework Data Types
BFILE	<code>OracleBFile</code> class	<code>System.Byte[]</code>
BINARY_DOUBLE	<code>OracleDecimal</code> structure	<code>System.Decimal</code>
BINARY_FLOAT	<code>OracleDecimal</code> structure	<code>System.Decimal</code>
BINARY_INTEGER (PL/SQL only)	<code>OracleDecimal</code> structure	<code>System.Decimal</code>
BLOB	<code>OracleBlob</code> class	<code>System.Byte[]</code>
BOOLEAN (PL/SQL only)	<code>OracleBoolean</code> structure	<code>System.Boolean</code>
CHAR	<code>OracleString</code> structure	<code>System.String</code>
CLOB	<code>OracleClob</code> class	<code>System.String</code>

**Table 3-15 (Cont.) Value Property Type of ODP.NET Type**

Oracle Native Data Type or PL/SQL Data Type	ODP.NET Type	.NET Framework Data Types
DATE	OracleDate <b>structure</b>	System.DateTime
INTERVAL DAY TO SECOND	OracleIntervalDS <b>structure</b>	System.TimeSpan
INTERVAL YEAR TO MONTH	OracleIntervalYM <b>structure</b>	System.Int64
JSON	OracleString <b>structure</b>	System.String
LONG	OracleString <b>structure</b>	System.String
LONG RAW	OracleBinary <b>structure</b>	System.Byte[]
NCHAR	OracleString <b>structure</b>	System.String
NCLOB	OracleClob <b>class</b>	System.String
NUMBER	OracleDecimal <b>structure</b>	System.Decimal
NVARCHAR2	OracleString <b>structure</b>	System.String
PLS_INTEGER (PL/SQL only)	OracleDecimal <b>Structure</b>	System.Decimal
RAW	OracleBinary <b>structure</b>	System.Byte[]
REF	OracleRef <b>class</b>	System.String
REF CURSOR (PL/SQL only)	OracleRefCursor <b>class</b>	Not Applicable
ROWID	OracleString <b>structure</b>	System.String
TIMESTAMP	OracleTimeStamp <b>structure</b>	System.DateTime
TIMESTAMP WITH LOCAL TIME ZONE	OracleTimeStampLTZ <b>structure</b>	System.DateTime
TIMESTAMP WITH TIME ZONE	OracleTimeStampTZ <b>structure</b>	System.DateTimeOffset
UROWID	OracleString <b>structure</b>	System.String
VARCHAR2	OracleString <b>structure</b>	System.String
XMLType	OracleXmlType <b>class</b>	System.String

**Deserializing ODP.NET Types into DataSet and DataTable**

Due to a change in all .NET versions to enhance application security, the allowed `DataSet` and `DataTable` data types that can be deserialized are now restricted. This change applies to .NET 5, plus .NET Core and .NET Framework updates. If your `DataSets` and `DataTables` use Oracle data types with one of these new .NET versions, then you will have to add ODP.NET-specific data types to the “allow” list so that they can be deserialized into `DataSet` or `DataTable`. If an attempt is made to deserialize ODP.NET-specific types without adding them to the allow list, an ODP.NET type initializer exception will be encountered.

The most straightforward way to add all ODP.NET data types to the allow list to call the `OracleConfiguration.AddOracleTypesDeserialization` method in your application.

Alternatively, in .NET Framework 4, the specific ODP.NET data types can be added individually to the application .NET configuration file. Here's a sample configuration file for adding all managed ODP.NET 21c data types to the allow list.

```
<?xml version="1.0" encoding="utf-8" ?>
<configuration>
  <configSections>
    <sectionGroup name="system.data.dataset.serialization"
type="System.Data.SerializationSettingsSectionGroup, System.Data, Version=4.0.0.0,
Culture=neutral, PublicKeyToken=b77a5c561934e089">
      <section name="allowedTypes" type="System.Data.AllowedTypesSectionHandler,
System.Data, Version=4.0.0.0, Culture=neutral, PublicKeyToken=b77a5c561934e089"/>
    </sectionGroup>
  </configSections>
  <system.data.dataset.serialization>
    <allowedTypes>
      <!-- <add type="assembly qualified type name" /> -->
      <add type="Oracle.ManagedDataAccess.Types.OracleBinary,
Oracle.ManagedDataAccess, Version=4.122.21.1, Culture=neutral,
PublicKeyToken=89b483f429c47342" />
      <add type="Oracle.ManagedDataAccess.Types.OracleBlob, Oracle.ManagedDataAccess,
Version=4.122.21.1, Culture=neutral, PublicKeyToken=89b483f429c47342" />
      <add type="Oracle.ManagedDataAccess.Types.OracleClob, Oracle.ManagedDataAccess,
Version=4.122.21.1, Culture=neutral, PublicKeyToken=89b483f429c47342" />
      <add type="Oracle.ManagedDataAccess.Types.OracleDate, Oracle.ManagedDataAccess,
Version=4.122.21.1, Culture=neutral, PublicKeyToken=89b483f429c47342" />
      <add type="Oracle.ManagedDataAccess.Types.OracleDecimal,
Oracle.ManagedDataAccess, Version=4.122.21.1, Culture=neutral,
PublicKeyToken=89b483f429c47342" />
      <add type="Oracle.ManagedDataAccess.Types.OracleIntervalDS,
Oracle.ManagedDataAccess, Version=4.122.21.1, Culture=neutral,
PublicKeyToken=89b483f429c47342" />
      <add type="Oracle.ManagedDataAccess.Types.OracleIntervalYM,
Oracle.ManagedDataAccess, Version=4.122.21.1, Culture=neutral,
PublicKeyToken=89b483f429c47342" />
      <add type="Oracle.ManagedDataAccess.Types.OracleRef, Oracle.ManagedDataAccess,
Version=4.122.21.1, Culture=neutral, PublicKeyToken=89b483f429c47342" />
      <add type="Oracle.ManagedDataAccess.Types.OracleString,
Oracle.ManagedDataAccess, Version=4.122.21.1, Culture=neutral,
PublicKeyToken=89b483f429c47342" />
      <add type="Oracle.ManagedDataAccess.Types.OracleTimeStamp,
Oracle.ManagedDataAccess, Version=4.122.21.1, Culture=neutral,
PublicKeyToken=89b483f429c47342" />
      <add type="Oracle.ManagedDataAccess.Types.OracleTimeStampLTZ,
Oracle.ManagedDataAccess, Version=4.122.21.1, Culture=neutral,
PublicKeyToken=89b483f429c47342" />
      <add type="Oracle.ManagedDataAccess.Types.OracleTimeStampTZ,
Oracle.ManagedDataAccess, Version=4.122.21.1, Culture=neutral,
PublicKeyToken=89b483f429c47342" />
      <add type="Oracle.ManagedDataAccess.Types.OracleXmlType,
Oracle.ManagedDataAccess, Version=4.122.21.1, Culture=neutral,
PublicKeyToken=89b483f429c47342" />
      <!-- additional <add /> elements as needed -->
    </allowedTypes>
  </system.data.dataset.serialization>
</configuration>
```

With the .NET configuration file, developers can enable specific ODP.NET data types to allow, rather than enable all of them with `AddOracleTypesDeserialization` method.

**See Also:**

<https://docs.microsoft.com/en-us/dotnet/framework/data/adonet/dataset-datatable-dataview/security-guidance>

## GUIDs

ODP.NET does support GUIDs. GUIDs can be inserted into a `RAW(16)` column which is big enough to hold any GUID value. But caution needs to be taken in order to handle GUIDs appropriately. This is due to the fact that as the .NET Guid structure flips the byte values in reverse order for the integer-based parts of the GUID values when `Guid(byte[])` constructor is used and when the `ToByteArray()` method on the `Guid` struct is invoked.

When the `Guid` is provided to ODP.NET as an input parameter, for example, ODP.NET invokes the `ToByteArray()` method before passing the values to the Oracle Database as raw bytes. This means that if the `Guid` originally has a sequence of bytes of

```
9D4E51F764A940E4854D667F0DD61093
```

then the `byte[]` representation of the GUID would be changed to

```
F7514E9DA964E440854D667F0DD61093
```

after the `ToByteArray()` method invocation that is invoked by ODP.NET internally before it's inserted into the `RAW(16)` column.

And when the same column value is then retrieved from the Oracle database, the value that is obtained is

```
F7514E9DA964E440854D667F0DD61093
```

which is how it was stored in the database. When the `GetGuid()` method is invoked on the `OracleDataReader` object, ODP.NET constructs the `Guid` structure using the `Guid(byte[])` constructor, which flips it back to the original sequence of bytes:

```
9D4E51F764A940E4854D667F0DD61093
```

This means that the sequence of bytes of the GUID in the application is not in the exact same order as how it is stored in the database. In other words, if the application executes a SQL using literal byte values, such as

```
select * from ... where <raw/guid_column> = '9D4E51F764A940E4854D667F0DD61093';
```

there will be no rows returned. The same GUID was inserted into the table as:

```
F7514E9DA964E440854D667F0DD61093
```

The application will be able to query for the row with the matching GUID if the application

- binds the `guid` value using `Guid` structure as an input parameter
- constructs the byte literal value that is to be used in the SQL from the `byte[]` returned from the `ToByteArray()` method invocation on the `Guid` structure.

The application developer should be cautious and mindful as to when the `Guid(byte[])` constructor and the `ToByteArray()` method of the `Guid` structure is called, which can alter the sequence of the bytes. A simple program below demonstrates how the integer-based parts of the GUID values are flipped when `Guid(byte[])` constructor and when the `ToByteArray()` method are invoked.

```
using System;
using System.Text;
using System.Data;
using Oracle.ManagedDataAccess.Client;

class T
{
    static string ByteToString(byte[] data)
    {
        StringBuilder sb = new StringBuilder(16);
        foreach (var b in data)
            sb.Append($"{b:X2}");
        return sb.ToString();
    }

    static void Main()
    {
        try
        {
            OracleConnection con = new OracleConnection("user id=<user
id>;password=<password>;data source=<data source>");
            con.Open();

            //
            // Generate a new GUID
            //
            Guid guid = Guid.NewGuid();
            string original = guid.ToString().ToUpper().Replace("-", "");
            Console.WriteLine("Original Guid           : " + original);

            //
            // Drop the table
            //
            OracleCommand cmd = new OracleCommand("drop table test_guid_table", con);
            try { cmd.ExecuteNonQuery(); } catch {}

            //
            // Create the table
            //
            cmd.CommandText = "create table test_guid_table (col1 RAW(16), col2
VARCHAR2(64))";
            cmd.ExecuteNonQuery();

            //
            // Insert the newly generated GUID to the DB
            //
            cmd.CommandText = "insert into test_guid_table values (:1, 'new guid')";
            cmd.Parameters.Add(string.Empty, OracleDbType.Raw);
            cmd.Parameters[0].Value = guid;
            cmd.ExecuteNonQuery();

            //
            // Query from the test table
            //

```

```

cmd.CommandText = "select * from test_guid_table";
OracleDataReader reader = cmd.ExecuteReader();

while (reader.Read())
{
    //
    // Get the RAW data as byte[]
    //
    byte[] guid_byte_array = (byte[])reader.GetValue(0);
    Console.WriteLine("GetValue() as byte[] / as-is in DB: " +
ByteToString(guid_byte_array));
    Console.WriteLine();

    //
    // Get the RAW data as Guid then convert to byte[]
    //
    Guid retrieved_guid = (Guid)reader.GetGuid(0);
    byte[] retrieved_guid_byte_array = retrieved_guid.ToByteArray();
    Console.WriteLine("GetGuid() then Guid.ToString()      : " +
retrieved_guid_byte_array.ToString());
    Console.WriteLine("GetGuid() then Guid.ToByteArray() : " +
ByteToString(retrieved_guid.ToByteArray()));
}

//
// Find a matching row by binding the original GUID as-is
//
cmd.Parameters.Clear();
Console.WriteLine("\nGuid Input Parameter          : " +
ByteToString(guid.ToByteArray()));
cmd.CommandText = "select count(*) from test_guid_table where coll = :1";
cmd.Parameters.Add(string.Empty, OracleDbType.Raw);
cmd.Parameters[0].Value = guid;
reader = cmd.ExecuteReader();
while (reader.Read())
{
    Console.WriteLine("Rows found by binding GUID      : " +
(decimal)reader.GetValue(0));
}

//
// Find a matching row by binding a byte[] from the original GUID
//
byte[] byte_array_param = guid.ToByteArray();
Console.WriteLine("\nbyte[] Input Parameter          : " +
ByteToString(byte_array_param));
cmd.CommandText = "select count(*) from test_guid_table where coll = :1";
cmd.Parameters.Clear();
cmd.Parameters.Add(string.Empty, OracleDbType.Raw);
cmd.Parameters[0].Value = byte_array_param;
reader = cmd.ExecuteReader();
while (reader.Read())
{
    Console.WriteLine("Rows found by binding byte[]    : " +
(decimal)reader.GetValue(0));
}

//
// Find a matching row by matching the binary/raw data (inline) using
Guid.ToByteArray()
//

```

```

        cmd.CommandText = "select count(*) from test_guid_table where coll = '" +
ByteToString(guid.ToByteArray()) + "'";
        Console.WriteLine("\nLiteral RAW (from byte array)      : " +
ByteToString(guid.ToByteArray()));
        cmd.Parameters.Clear();
        reader = cmd.ExecuteReader();
        while (reader.Read())
        {
            Console.WriteLine("Rows found by inlined data      : " +
(decimal)reader.GetValue(0));
        }

        //
        // Find a matching row by matching the binary/raw data (inline) using
Guid.ToString()
        //
        cmd.CommandText = "select count(*) from test_guid_table where coll = '" +
original + "'";
        Console.WriteLine("\nLiteral RAW (from string)          : " + original);
        cmd.Parameters.Clear();
        reader = cmd.ExecuteReader();
        while (reader.Read())
        {
            Console.WriteLine("Rows found by inlined data      : " +
(decimal)reader.GetValue(0));
        }
    } catch (Exception ex) { Console.WriteLine(ex); }
}
}

```

A sample output from the sample code could be:

```

Original Guid                : D54909F4169541CFA919F6752414909F
GetValue() as byte[] / as-is in DB: F40949D59516CF41A919F6752414909F

GetGuid() then Guid.ToString() : System.Byte[]
GetGuid() then Guid.ToByteArray() : F40949D59516CF41A919F6752414909F

Guid Input Parameter         : F40949D59516CF41A919F6752414909F
Rows found by binding GUID   : 1

byte[] Input Parameter       : F40949D59516CF41A919F6752414909F
Rows found by binding byte[] : 1

Literal RAW (from byte array) : F40949D59516CF41A919F6752414909F
Rows found by inlined data    : 1

Literal RAW (from string)     : D54909F4169541CFA919F6752414909F
Rows found by inlined data    : 0

```



#### Note:

Every execution of the test generates a new or different GUID.

## Obtaining Data from an OracleDataReader Object

The `ExecuteReader` method of the `OracleCommand` object returns an `OracleDataReader` object, which is a read-only, forward-only result set.

This section provides the following information about the `OracleDataReader` object:

- [Typed OracleDataReader Accessors](#)
- [Obtaining LONG and LONG RAW Data](#)
- [Obtaining LOB Data](#)
- [Controlling the Number of Rows Fetched in One Database Round-Trip](#)

### Typed OracleDataReader Accessors

The `OracleDataReader` class provides two types of typed accessors:

- [.NET Type Accessors](#)
- [ODP.NET Type Accessors](#)

### .NET Type Accessors

[Table 3-16](#) lists all the Oracle native database types that ODP.NET supports, and the corresponding .NET types that can represent the Oracle native type. If more than one .NET type can be used to represent an Oracle native type, the first entry is the .NET type that best represents the Oracle native type. The third column indicates the valid typed accessor that can be invoked for an Oracle native type to be obtained as a .NET type. If an invalid typed accessor is used for a column, an `InvalidCastException` is thrown. Oracle native data types depend on the version of the database; therefore, some data types are not available in earlier versions of Oracle Database.

#### See Also:

- ["OracleDataAdapter Class"](#)
- ["OracleDataReader Class"](#)

**Table 3-16** .NET Type Accessors

Oracle Native Data Type	.NET Type	Typed Accessor
BFILE	<code>System.Byte[]</code>	<code>GetBytes</code>
	<code>System.Guid</code>	<code>GetGuid<sup>1</sup></code>
BINARY_DOUBLE	<code>System.Double</code>	<code>GetDouble</code>
	<code>System.Boolean</code>	<code>GetBoolean<sup>1</sup></code>
	<code>System.String</code>	<code>GetString<sup>1</sup></code>

**Table 3-16 (Cont.) .NET Type Accessors**

Oracle Native Data Type	.NET Type	Typed Accessor
BINARY_FLOAT	System.Single	GetFloat
	System.Boolean	GetBoolean <sup>1</sup>
	System.String	GetString <sup>1</sup>
BLOB	System.Byte[]	GetBytes
	System.Guid	GetGuid <sup>1</sup>
BOOLEAN	System.Boolean	GetBoolean
CHAR	System.String	GetString
	System.Char[]	GetChars
CLOB	System.String	GetString
	System.Char[]	GetChars
DATE	System.DateTime	GetDateTime
	System.String	GetString <sup>1</sup>
INTERVAL DAY TO SECOND	System.Timespan	GetTimeSpan
	System.String	GetString <sup>1</sup>
	System.Decimal	GetDecimal <sup>2</sup>
INTERVAL YEAR TO MONTH	System.Int64	GetInt64
	System.String	GetString <sup>1</sup>
	System.Decimal	GetDecimal <sup>2</sup>
LONG	System.String	GetString
	System.Char[]	GetChars
LONG RAW	System.Byte[]	GetBytes
	System.Guid	GetGuid <sup>1</sup>
NCHAR	System.String	GetString
	System.Char[]	GetChars
NCLOB	System.String	GetString
	System.Char[]	GetChars
NUMBER	System.Decimal	GetDecimal
	System.Byte	GetByte
	System.Int16	GetInt16
	System.Int32	GetInt32
	System.Int64	GetInt64
	System.Single	GetFloat
	System.Double	GetDouble
System.Boolean	GetBoolean <sup>1</sup>	
NVARCHAR2	System.String	GetString <sup>1</sup>
	System.Char[]	GetChars
RAW	System.Byte[]	GetBytes
	System.Guid	GetGuid <sup>1</sup>

**Table 3-16 (Cont.) .NET Type Accessors**

Oracle Native Data Type	.NET Type	Typed Accessor
REF	System.String	GetString
ROWID	System.String	GetString
	System.Char[]	GetChars
TIMESTAMP	System.DateTime	GetDateTime
	System.String	GetString <sup>1</sup>
TIMESTAMP WITH LOCAL TIME ZONE	System.DateTime	GetDateTime
	System.String	GetString <sup>1</sup>
TIMESTAMP WITH TIME ZONE	System.DateTimeOffset	GetDateTimeOffset
	System.String	GetString <sup>1</sup>
UROWID	System.String	GetString
	System.Char[]	GetChars
VARCHAR2	System.String	GetString
	System.Char[]	GetChars
XMLType	System.String	GetString
	System.Xml.XmlReader	GetXmlReader

- **Superscript <sup>1</sup>:** The typed accessor is available in managed ODP.NET and ODP.NET Core only. The `GetString` accessors were added starting in ODP.NET 19.10.
- **Superscript <sup>2</sup>:** The typed accessor is available in unmanaged ODP.NET only.

Certain methods and properties of the `OracleDataReader` object require ODP.NET to map a `NUMBER` column to a .NET type based on the precision and scale of the column. These members are:

- `Item` property
- `GetFieldType` method
- `GetValue` method
- `GetValues` method

ODP.NET determines the appropriate .NET type by considering the following .NET types in order, and selecting the first .NET type from the list that can represent the entire range of values of the column:

- `System.Byte`
- `System.Int16`
- `System.Int32`
- `System.Int64`
- `System.Single`
- `System.Double`

- `System.Decimal`

If no .NET type exists that can represent the entire range of values of the column, then an attempt is made to represent the column values as a `System.Decimal` type. If the value in the column cannot be represented as `System.Decimal`, then an exception is raised.

For example, consider two columns defined as `NUMBER(4,0)` and `NUMBER(10,2)`. The first .NET types from the previous list that can represent the entire range of values of the columns are `System.Int16` and `System.Double`, respectively. However, consider a column defined as `NUMBER(20,10)`. In this case, there is no .NET type that can represent the entire range of values on the column, so an attempt is made to return values in the column as a `System.Decimal` type. If a value in the column cannot be represented as a `System.Decimal` type, then an exception is raised.

The `Fill` method of the `OracleDataAdapter` class uses the `OracleDataReader` object to populate or refresh a `DataTable` or `DataSet` with .NET types. As a result, the .NET type used to represent a `NUMBER` column in the `DataTable` or `DataSet` also depends on the precision and scale of the column.

 **See Also:**

- ["OracleDataReader Class"](#)
- ["OracleDataAdapter Class "](#)
- ["Item "](#)
- ["GetFieldType "](#)
- ["GetValues "](#)
- ["GetValue "](#)

## ODP.NET Type Accessors

ODP.NET exposes provider-specific types that natively represent the data types in the database. In some cases, these ODP.NET types provide better performance and functioning than the corresponding .NET types. The ODP.NET types can be obtained from the `OracleDataReader` object by calling their respective typed accessor.

[Table 3-17](#) lists the valid type accessors that ODP.NET uses to obtain ODP.NET types for an Oracle native type.

**Table 3-17 ODP.NET Type Accessors**

Oracle Native Data Type	ODP.NET Type	Typed Accessor
BFILE	<code>OracleBFile</code>	<code>GetOracleBFile</code>
BINARY_DOUBLE	<code>OracleDecimal</code>	<code>GetOracleDecimal</code>
BINARY_FLOAT	<code>OracleDecimal</code>	<code>GetOracleDecimal</code>
BLOB	<code>OracleBlob</code>	<code>GetOracleBlob</code>
	<code>OracleBlob</code>	<code>GetOracleBlobForUpdate</code>
	<code>OracleBinary</code>	<code>GetOracleBinary</code>

**Table 3-17 (Cont.) ODP.NET Type Accessors**

Oracle Native Data Type	ODP.NET Type	Typed Accessor
BOOLEAN	OracleBoolean	GetOracleBoolean
CHAR	OracleString	GetOracleString
CLOB	OracleClob	GetOracleClob
	OracleClob	GetOracleClobForUpdate
	OracleString	GetOracleString
DATE	OracleDate	GetOracleDate
INTERVAL DAY TO SECOND	OracleIntervalDS	GetOracleIntervalDS
INTERVAL YEAR TO MONTH	OracleIntervalYM	GetOracleIntervalYM
LONG	OracleString	GetOracleString
LONG RAW	OracleBinary	GetOracleBinary
NCHAR	OracleString	GetOracleString
NCLOB	OracleString	GetOracleString
NUMBER	OracleDecimal	GetOracleDecimal
NVARCHAR2	OracleString	GetOracleString
RAW	OracleBinary	GetOracleBinary
REF	<b>OracleRef</b>	GetOracleRef
ROWID	OracleString	GetOracleString
TIMESTAMP	OracleTimeStamp	GetOracleTimeStamp
TIMESTAMP WITH LOCAL TIME ZONE	OracleTimeStampLTZ	GetOracleTimeStampLTZ
TIMESTAMP WITH TIME ZONE	OracleTimeStampTZ	GetOracleTimeStampTZ
UROWID	OracleString	GetOracleString
VARCHAR2	OracleString	GetOracleString
XMLType	OracleString	GetOracleString
	OracleXmlType	GetOracleXmlType

**See Also:**

"[ODP.NET Types Overview](#)" for a list of all ODP.NET types

## Obtaining LONG and LONG RAW Data

ODP.NET fetches and caches rows from the database during the `Read` method invocations on the `OracleDataReader` object. The amount of LONG and LONG RAW column data that is retrieved from this operation is determined by `InitialLONGFetchSize`. The different behaviors observed when `InitialLONGFetchSize` is set to 0, greater than 0, and -1 are explained in the following sections.

**Note:**

ODP.NET does not support the `CommandBehavior.SequentialAccess` enumeration value. Therefore, `LONG` and `LONG RAW` data can be fetched randomly.

## Setting InitialLONGFetchSize to Zero or a Value Greater than Zero

The specified amount of `InitialLONGFetchSize` characters or bytes for `LONG` or `LONG RAW` column data is retrieved into the cache during the `Read` method invocations on the `OracleDataReader` object.

By default, `InitialLONGFetchSize` is set to 0. In this case, ODP.NET does not fetch any `LONG` or `LONG RAW` column data during the `Read` method invocations on the `OracleDataReader` object. The `LONG` or `LONG RAW` data is fetched when the typed accessor method is explicitly invoked for the `LONG` or `LONG RAW` column, which incurs a database round-trip because no data is cached.

If `InitialLONGFetchSize` is set to a value greater than 0, that amount of specified data is cached by ODP.NET during the `Read` method invocations on the `OracleDataReader` object. If the application requests an amount of data less than or equal to the `InitialLONGFetchSize` through the typed accessor methods, no database round-trip is incurred. However, an additional database round-trip is required to fetch data beyond `InitialLONGFetchSize`.

To obtain data beyond the `InitialLONGFetchSize` characters or bytes, one of the following must be in the select list:

- Primary key
- ROWID
- Unique columns - (defined as a set of columns on which a unique constraint has been defined or a unique index has been created, where at least one of the columns in the set has a `NOT NULL` constraint defined on it)

To be able to fetch the entire `LONG` or `LONG RAW` data without having a primary key column, a ROWID, or unique columns in the select list, set the size of the `InitialLONGFetchSize` property on the `OracleCommand` object to equal or greater than the number of characters or bytes needed to be retrieved.

The `LONG` or `LONG RAW` data is returned when the appropriate typed accessor method (`GetChars`, `GetOracleString`, or `GetString` for `LONG` or `GetOracleBinary` or `GetBytes` for `LONG RAW`) is called on the `OracleDataReader` object.

## Setting InitialLONGFetchSize to -1

By setting `InitialLONGFetchSize` to -1, it is possible to fetch the entire `LONG` or `LONG RAW` data from the database for a select query, without requiring a primary key, ROWID, or unique column in the select list.

When `InitialLONGFetchSize` is set to -1, the entire `LONG` or `LONG RAW` data is retrieved and cached during `Read` method invocations on the `OracleDataReader` object. Calls to `GetString`, `GetOracleString`, `GetChars`, `GetBytes`, or `GetOracleBinary` in the `OracleDataReader` return the entire column data.

## Obtaining LOB Data

ODP.NET fetches and caches rows from the database during the `Read` method invocations on the `OracleDataReader` object. The amount of LOB column data that is retrieved from this operation is determined by `InitialLOBFetchSize`.

The following is a complete list of typed accessor methods that an application can call for the `CLOB` and `BLOB` columns, if `InitialLOBFetchSize` is set to 0, greater than 0, or -1:

- **Methods callable for `BLOB` column**

- `GetBytes`
- `GetValue`
- `GetValues`
- `GetOracleBinary`
- `GetOracleBlob`
- `GetOracleBlobForUpdate`
- `GetOracleValue`
- `GetOracleValues`

- **Methods callable for `CLOB` column**

- `GetChars`
- `GetString`
- `GetValue`
- `GetValues`
- `GetOracleString`
- `GetOracleClob`
- `GetOracleClobForUpdate`
- `GetOracleValue`
- `GetOracleValues`

The following sections explain the different behaviors observed when `InitialLOBFetchSize` is set to 0, greater than 0, and -1.

### Setting `InitialLOBFetchSize` to Zero

By default, the `InitialLOBFetchSize` property is 0. This value dictates to ODP.NET that any LOBs selected will have their client LOB data fetches deferred until after the `OracleDataReader` `Read`, such as when using the an accessor. Each LOB value is retrieved only at the point it is individually accessed.

The advantage of using this retrieval strategy is that it conserves client memory and bandwidth. If the LOBs selected are either very large or not necessary to be immediately consumed by the end user, or both, then the application can perform better if LOBs are retrieved as needed, rather than all at once.

## Setting InitialLOBFetchSize to a Value Greater than Zero

If `InitialLOBFetchSize` is set to a value greater than 0, ODP.NET caches LOB data up to `InitialLOBFetchSize` characters or bytes for each LOB selected during the `Read` method invocations on the `OracleDataReader` object. The maximum value is 2,147,483,647 (2GB). If the total size of a selected LOB is less than this number, the entire LOB data will be read.

By pre-fetching all LOB entries in one or more database round trips, applications can perform faster by reducing round trips. This approach is most advantageous when most LOBs are either small in size, or consumed by the end user almost immediately, or both. The down side of a large fetch size is higher memory consumption.

This section discusses the ways to fetch beyond the `InitialLOBFetchSize` characters or bytes that are cached.

The remaining LOB data is returned when a typed accessor is invoked, regardless of the value set to the `InitialLOBFetchSize` property. Primary key, ROWID, or unique columns are not required to be in the query select list to obtain data beyond the specified `InitialLOBFetchSize`.

The `GetOracleBlob`, `GetOracleClob`, `GetOracleBlobForUpdate`, and `GetOracleClobForUpdate` methods can now be invoked even if `InitialLOBFetchSize` is greater than 0.

## Setting InitialLOBFetchSize to -1

To fetch all LOB data selected during the read operation and not be bound by a set limit per LOB, set `InitialLOBFetchSize` to -1. A new default behavior has been introduced for ODP.NET Release 12.1.0.2 and higher when `InitialLobFetchSize` is set to -1.

When `LegacyEntireLOBFetch` = 0, which is the default value, the following operations are invoked for a LOB column:

- `OracleDataReader.GetOracleClob()`: returns `OracleClob` object
- `OracleDataReader.GetOracleBlob()` : returns `OracleBlob` object
- `OracleDataReader.GetOracleClobForUpdate()`: returns `OracleClob` object
- `OracleDataReader.GetOracleBlobForUpdate()`: returns `OracleBlob` object
- `OracleDataReader.GetOracleValue()`: returns `OracleClob` object for a CLOB column
- `OracleDataReader.GetOracleValue()`: returns `OracleBlob` object for a BLOB column
- `OracleDataAdapter.Fill()` with `ProviderSpecificTypes=true`: populates `DataTable` with `OracleClob` for a CLOB column
- `OracleDataAdapter.Fill()` with `ProviderSpecificTypes=true`: populates `DataTable` with `OracleBlob` for a BLOB column

To use the old behavior, set `LegacyEntireLobFetch` = 1 in the ODP.NET configuration.

When `LegacyEntireLobFetch` = 1 and `InitialLOBFetchSize` = -1, `GetOracleClob`, `GetOracleClobForUpdate`, `GetOracleBlob`, and `GetOracleBlobForUpdate` methods are not supported. The following operations are invoked for a LOB column in this scenario:

- `OracleDataReader.GetOracleClob()`: throws `InvalidCastException()`

- `OracleDataReader.GetOracleBlob():` throws `InvalidCastException()`
- `OracleDataReader.GetOracleClobForUpdate():` throws `InvalidCastException()`
- `OracleDataReader.GetOracleBlobForUpdate():` throws `InvalidCastException()`
- `OracleDataReader.GetOracleValue():` returns `OracleString` object for a CLOB column
- `OracleDataReader.GetOracleValue():` returns `OracleBinary` object for a BLOB column
- `OracleDataAdapter.Fill()` with `ProviderSpecificTypes=true:` populates `DataTable` with `OracleString` for a CLOB column
- `OracleDataAdapter.Fill()` with `ProviderSpecificTypes=true:` populates `DataTable` with `OracleBinary` for a BLOB column

For releases prior to ODP.NET 12.1.0.2, by setting `InitialLOBFetchSize` to `-1`, it is possible to fetch the entire LOB data from the database for a select query, without requiring a primary key, `ROWID`, or unique column in the select list. When `InitialLOBFetchSize` is set to `-1`, the entire LOB column data is fetched and cached during the `Read` method invocations on the `OracleDataReader` object. Calls to `GetString`, `GetOracleString`, `GetChars`, `GetBytes`, or `GetOracleBinary` in the `OracleDataReader` allow retrieving all data.

## Methods Supported for InitialLOBFetchSize of -1 and LegacyEntireLobFetch of 1

This section lists supported and not supported methods for the CLOB and BLOB data types when the `InitialLOBFetchSize` property is set to `-1` and `LegacyEntireLobFetch` property is set to `1`.

[Table 3-18](#) lists supported and not supported methods for the CLOB data types.

**Table 3-18 Supported OracleDataReader CLOB Methods for InitialLOBFetchSize of -1 and LegacyEntireLobFetch of 1**

OracleDataReader CLOB Methods	Supported
<code>GetChars</code>	Yes
<code>GetString</code>	Yes
<code>GetValue</code>	Yes
<code>GetValues</code>	Yes
<code>GetOracleString</code>	Yes
<code>GetOracleValue</code>	Yes
<code>GetOracleValues</code>	Yes
<code>GetOracleClob</code>	No
<code>GetOracleClobForUpdate</code>	No

[Table 3-19](#) lists supported and not supported methods for the BLOB data types.

**Table 3-19 Supported OracleDataReader BLOB Methods for InitialLOBFetchSize of -1 and LegacyEntireLobFetch of 1**

OracleDataReader BLOB Methods	Supported
GetBytes	Yes
GetValue	Yes
GetValues	Yes
GetOracleBinary	Yes
GetOracleValue	Yes
GetOracleValues	Yes
GetOracleBlob	No
GetOracleBlobForUpdate	No

## Performance Considerations Related to the InitialLOBFetchSize Property

This section discusses the advantages and disadvantages of the various `InitialLOBFetchSize` property settings in different situations.

An application does not have to choose between performance and `OracleBlob` and `OracleClob` functionality. Setting the `InitialLOBFetchSize` property results in a performance boost and still gives the flexibility to use the `OracleBlob` and `OracleClob` objects.

If the size of the LOB data is unknown or if the LOB data size varies irregularly, then it is better to leave the `InitialLOBFetchSize` property to its default value of 0. This still gives better performance in most cases.

Setting the `InitialLOBFetchSize` property to a size equal to or greater than the LOB data size for most rows improves performance. It is generally recommended that the `InitialLOBFetchSize` property be set to a value larger than the size of the LOB data for more than 80% of the rows returned by the query. For example, if the size of the LOB data is less than 1 KB in 80% of the rows, and more than 1 MB for 20% of the rows, set the `InitialLOBFetchSize` property to 1 KB.

### See Also:

- ["LOB Support"](#)
- ["InitialLOBFetchSize"](#)
- ["InitialLONGFetchSize"](#)

## Controlling the Number of Rows Fetched in One Database Round-Trip

Application performance depends on the number of rows the application needs to fetch, and the number of database round-trips that are needed to retrieve them.

## Use of FetchSize

The `FetchSize` property represents the total memory size in bytes that ODP.NET allocates to cache the data fetched from a database round-trip.

The `FetchSize` property can be set on the `OracleCommand`, `OracleDataReader`, or `OracleRefCursor` object, depending on the situation. It controls the fetch size for filling a `DataSet` or `DataTable` using an `OracleDataAdapter`.

If the `FetchSize` property is set on the `OracleCommand` object, then the newly created `OracleDataReader` object inherits the `FetchSize` property of the `OracleCommand` object. This inherited `FetchSize` value can be left as is, or modified to override the inherited value. The `FetchSize` property of the `OracleDataReader` object can be changed before the first `Read` method invocation, which allocates memory specified by the `FetchSize` property. All subsequent fetches from the database use the same cache allocated for that `OracleDataReader` object. Therefore, changing the `FetchSize` value after the first `Read` method invocation has no effect.

## Fine-Tuning FetchSize

By fine-tuning the `FetchSize` property, applications can control memory usage and the number of rows fetched in one database round-trip for better performance.

For example, if a query returns 100 rows and each row takes 1024 bytes, then setting the `FetchSize` property to 102400 takes just one database round-trip to fetch 100 rows. For the same query, if the `FetchSize` property is set to 10240, it takes 10 database round-trips to retrieve 100 rows. If the application requires all the rows to be fetched from the result set, the first scenario is faster than the second. However, if the application requires just the first 10 rows from the result set, the second scenario can perform better because it fetches only 10 rows, not 100 rows. When the next 10 rows are fetched, then the memory allocated for rows 1-10 is reused for rows 11-20.

The larger the `FetchSize`, the more system memory is used. Developers should not set large fetch sizes if their client systems have limited memory resources.

## Using the RowSize Property

The `RowSize` property of the `OracleCommand` or `OracleRefCursor` object is populated with the row size (in bytes) after an execution of a `SELECT` statement. The `FetchSize` property can then be set to a value relative to the `RowSize` property by setting it to the result of multiplying the `RowSize` value times the number of rows to fetch for each database round-trip.

For example, setting the `FetchSize` to `RowSize * 10` forces the `OracleDataReader` object to fetch exactly 10 rows for each database round-trip. Note that the `RowSize` value does not change due to the data length in each individual column. Instead, the `RowSize` value is determined strictly from the metadata information of the database table(s) that the `SELECT` statement is executed against.

The `RowSize` property can be used to set the `FetchSize` property at design time or at run time, as described in the following sections.

## Setting FetchSize Value in the Registry

The `HKLM\Software\Oracle\ODP.NET\ version\FetchSize` registry entry can be set to specify the default result set fetch size (in bytes) for all applications that use that particular version of ODP.NET or the `FetchSize` attribute in the application configuration or `web.config` file can specify the default value for a given application. By default, the fetch size is 131072 bytes. This value can be overridden programmatically by having the applications set the `FetchSize` property on either the `OracleCommand` or the `OracleDataReader` at run time.

## Setting FetchSize Value at Design Time

If the row size for a particular `SELECT` statement is already known from a previous execution, the `FetchSize` value of the `OracleCommand` object can be set at design time to the result of multiplying that row size times the number of rows the application wishes to fetch for each database round-trip. The `FetchSize` value set on the `OracleCommand` object is inherited by the `OracleDataReader` object that is created by the `ExecuteReader` method invocation on the `OracleCommand` object. Rather than setting the `FetchSize` value on the `OracleCommand` object, the `FetchSize` value can also be set on the `OracleDataReader` object directly. In either case, the `FetchSize` value is set at design time, without accessing the `RowSize` property value at run time.

## Setting FetchSize Value at Run Time

Applications that do not know the row size at design time can use the `RowSize` property of the `OracleCommand` object to set the `FetchSize` property of the `OracleDataReader` object. The `RowSize` property provides a dynamic way of setting the `FetchSize` property based on the size of a row.

After an `OracleDataReader` object is obtained by invoking the `ExecuteReader` method on the `OracleCommand` object, the `RowSize` property is populated with the size of the row (in bytes). By using the `RowSize` property, the application can dynamically set the `FetchSize` property of the `OracleDataReader` object to the product of the `RowSize` property value multiplied by the number of rows the application wishes to fetch for each database round-trip. In this scenario, the `FetchSize` property is set by accessing the `RowSize` property at run time.

# PL/SQL REF CURSOR and OracleRefCursor

The `REF CURSOR` is a data type in the Oracle PL/SQL language. It represents a cursor or a result set in Oracle Database. The `OracleRefCursor` object is a corresponding ODP.NET type for the `REF CURSOR` type.

This section discusses the following aspects of using the `REF CURSOR` data type and `OracleRefCursor` objects:

- [Obtaining an OracleRefCursor Object](#)
- [Obtaining a REF CURSOR Data Type](#)
- [Populating an OracleDataReader from a REF CURSOR](#)
- [Populating the DataSet from a REF CURSOR](#)
- [Populating an OracleRefCursor from a REF CURSOR](#)
- [Updating a DataSet Obtained from a REF CURSOR](#)

- [Behavior of ExecuteScalar Method for REF CURSOR](#)
- [Passing a REF CURSOR to a Stored Procedure](#)

## Obtaining an OracleRefCursor Object

There are no constructors for `OracleRefCursor` objects. They can be acquired only as parameter values from PL/SQL stored procedures, stored functions, or anonymous blocks.

An `OracleRefCursor` object is a connected object. The connection used to execute the command returning an `OracleRefCursor` object is required for its lifetime. Once the connection associated with an `OracleRefCursor` object is closed, the `OracleRefCursor` object cannot be used.

## Obtaining a REF CURSOR Data Type

A `REF CURSOR` data type can be obtained as an `OracleDataReader`, `DataSet`, or `OracleRefCursor` object. If the `REF CURSOR` data type is obtained as an `OracleRefCursor` object, it can be used to create an `OracleDataReader` object or populate a `DataSet` from it. When accessing a `REF CURSOR` data type, always bind it as an `OracleDbType.RefCursor` parameter.

## Populating an OracleDataReader from a REF CURSOR

A `REF CURSOR` data type can be obtained as an `OracleDataReader` object by calling the `ExecuteReader` method of the `OracleCommand` object. The output parameter with the `OracleDbType` property set is bound to `OracleDbType.RefCursor`. None of the output parameters of type `OracleDbType.RefCursor` is populated after the `ExecuteReader` method is invoked.

If there are multiple output `REF CURSOR` parameters, use the `NextResult` method of the `OracleDataReader` object to access the next `REF CURSOR` data type. The `OracleDataReader.NextResult` method provides sequential access to the `REF CURSOR` data types; only one `REF CURSOR` data type can be accessed at a given time.

The order in which `OracleDataReader` objects are created for the corresponding `REF CURSOR` data types depends on the order in which the parameters are bound. If a PL/SQL stored function returns a `REF CURSOR` data type, then it becomes the first `OracleDataReader` object and all the output `REF CURSOR` data types follow the order in which the parameters are bound.

## Populating the DataSet from a REF CURSOR

For the `Fill` method to populate the `DataSet` properly, the `SelectCommand` property of the `OracleDataAdapter` class must be bound with an output parameter of type `OracleDbType.RefCursor`. If the `Fill` method is successful, the `DataSet` is populated with a `DataTable` that represents a `REF CURSOR` data type.

If the command execution returns multiple `REF CURSOR` data types, the `DataSet` is populated with multiple `DataTable` objects.

With Oracle Data Provider for .NET release 11.1.0.6.20, the extended property, `REFCursorName`, has been introduced on the `DataTable`, to identify the `REF CURSOR` that populates the `DataTable`.

This property is particularly useful when a `DataSet` is being populated with more than one `REF CURSOR`, one or more of which is `NULL`. For example, if a `DataSet` is populated by executing a stored procedure that returns three `REF CURSORS` and the second `REF CURSOR` is `NULL`, the `REFCursorName` property value for the first `DataTable` is `REFCursor` and for the second `DataTable`, `REFCursor2`. No `DataTable` is populated for the `NULL REF CURSOR`.

## Populating an OracleRefCursor from a REF CURSOR

When the `ExecuteNonQuery` method is invoked on a command that returns one or more `REF CURSOR` data types, each of the `OracleCommand` parameters that are bound as an `OracleDbType.RefCursor` gets a reference to an `OracleRefCursor` object.

To create an `OracleDataReader` object from an `OracleRefCursor` object, invoke the `GetDataReader` method from the `OracleRefCursor` object. Subsequent calls to the `GetDataReader` method return a reference to the same `OracleDataReader` object.

To populate a `DataSet` with an `OracleRefCursor` object, the application can invoke a `Fill` method of the `OracleDataAdapter` class that takes an `OracleRefCursor` object. Similar to the `OracleDataReader` object, an `OracleRefCursor` object is forward-only. Therefore, once a row is read from an `OracleRefCursor` object, that same row cannot be obtained again from it unless it is populated again from a query.

When multiple `REF CURSOR` data types are returned from a command execution as `OracleRefCursor` objects, the application can choose to create an `OracleDataReader` object or populate a `DataSet` with a particular `OracleRefCursor` object. All the `OracleDataReader` objects or `DataSet` objects created from the `OracleRefCursor` objects are active at the same time, and can be accessed in any order.

## Updating a DataSet Obtained from a REF CURSOR

`REF CURSOR` types cannot be updated. However, data that is retrieved into a `DataSet` can be updated. Therefore, the `OracleDataAdapter` class requires a custom SQL statement to flush any `REF CURSOR` data updates to the database.

The `OracleCommandBuilder` object cannot be used to generate SQL statements for `REF CURSOR` updates.

## Behavior of ExecuteScalar Method for REF CURSOR

The `ExecuteScalar` method returns the value of the first column of the first row of the `REF CURSOR` if it is one of the following:

- A return value of a stored function execution
- The first bind parameter of a stored procedure execution

 **See Also:**

*Oracle Database SecureFiles and Large Objects Developer's Guide* for more information

## Passing a REF CURSOR to a Stored Procedure

An application can retrieve a `REF CURSOR` type from a PL/SQL stored procedure or function and pass it to another stored procedure or function. This feature is useful in scenarios where a stored procedure or a function returns a `REF CURSOR` type to the .NET application, and based on the application logic, the application passes this `REF CURSOR` to another stored procedure for processing. Note that if you retrieve the data from a `REF CURSOR` type in the .NET application, you cannot pass it back to another stored procedure.

The following example demonstrate passing a `REF CURSOR`:

```
/*
connect scott/tiger@oracle
create table test (col1 number);
insert into test(col1) values (1);
commit;

create or replace package testPkg as type empCur is REF Cursor;
end testPkg;
/

create or replace procedure testSP(param1 IN testPkg.empCur, param2 OUT NUMBER)
as
begin
FETCH param1 into param2;
end;
/
*/

// C#

using System;
using Oracle.DataAccess.Client;
using System.Data;

class InRefCursorParameterSample
{
    static void Main()
    {
        OracleConnection conn = new OracleConnection
            ("User Id=scott; Password=tiger; Data Source=oracle");

        conn.Open(); // Open the connection to the database

        // Command text for getting the REF Cursor as OUT parameter
        String cmdTxt1 = "begin open :1 for select col1 from test; end;";

        // Command text to pass the REF Cursor as IN parameter
        String cmdTxt2 = "begin testSP (:1, :2); end;";
    }
}
```

```
// Create the command object for executing cmdTxt1 and cmdTxt2
OracleCommand cmd = new OracleCommand(cmdTxt1, conn);

// Bind the Ref cursor to the PL/SQL stored procedure
OracleParameter outRefPrm = cmd.Parameters.Add("outRefPrm",
    OracleDbType.RefCursor, DBNull.Value, ParameterDirection.Output);

cmd.ExecuteNonQuery(); // Execute the anonymous PL/SQL block

// Reset the command object to execute another anonymous PL/SQL block
cmd.Parameters.Clear();
cmd.CommandText = cmdTxt2;

// REF Cursor obtained from previous execution is passed to this
// procedure as IN parameter
OracleParameter inRefPrm = cmd.Parameters.Add("inRefPrm",
    OracleDbType.RefCursor, outRefPrm.Value, ParameterDirection.Input);

// Bind another Number parameter to get the REF Cursor column value
OracleParameter outNumPrm = cmd.Parameters.Add("outNumPrm",
    OracleDbType.Int32, DBNull.Value, ParameterDirection.Output);

cmd.ExecuteNonQuery(); //Execute the stored procedure

// Display the out parameter value
Console.WriteLine("out parameter is: " + outNumPrm.Value.ToString());
}
}
```

## Implicit REF CURSOR Binding

ODP.NET enables applications to run stored procedures with REF CURSOR parameters without using explicit binding for these parameters in the .NET code. ODP.NET unmanaged and managed drivers support REF CURSOR implicit binding through configuration done in .NET configuration files.

For a read-only result set, such as a REF CURSOR using `OracleDataReader`, REF CURSOR schema information is retrieved automatically.

For some scenarios, such as when updateable REF CURSORS or Entity Framework is used, developers need to define the REF CURSOR schema information so that the application can bind the implicit REF CURSOR. Entity Framework applications use implicit REF CURSOR binding to instantiate complex types from REF CURSOR data. Applications must specify REF CURSOR bind and metadata information in the `app.config`, `web.config`, or `machine.config` .NET configuration file.

The attributes supplied in the .NET configuration file are also used when the application requests for schema information from the `OracleDataReader` object that represents a REF CURSOR. This means that for REF CURSORS that are created using a SELECT from a single table, the application can update that table through the use of `OracleDataAdapter` and `OracleCommandBuilder`.

When using the Entity Framework, function imports can return an implicitly-bound REF CURSOR. The REF CURSOR can be returned as a collection of complex types or entity types. To return a complex type collection, the .NET configuration file needs to define the REF CURSOR bind and metadata information. To return an entity type collection, only the bind information needs to be defined in the .NET configuration file.

This section contains the following topics:

- [Specifying REF CURSOR Bind and Metadata Information in the .NET Configuration File](#)
- [Sample Configuration File and Application](#)
- [Usage Considerations](#)

## Specifying REF CURSOR Bind and Metadata Information in the .NET Configuration File

Specify the REF CURSOR information in the `oracle.dataaccess.client` configuration section of the .NET configuration file. Use an `<add>` element for each piece of information. The `add` element uses `name-value` attributes to specify REF CURSOR information. Use the following format to specify bind information:

```
<add
name="SchemaName.PackageName.StoredProcedureName.RefCursor.RefCursorParameterPositionOrName"
value="implicitRefCursor bindinfo='mode=InputOutput|Output|ReturnValue'" />
```

Use the following format to specify metadata information:

```
<add
name="SchemaName.PackageName.StoredProcedureName.RefCursorMetaData.RefCursorParameterPositionOrName.Column.ColumnOrdinal"
value="implicitRefCursor metadata=AttributesList" />
```

Each REF CURSOR column needs to have an `add` element defined for it. For example, if you have a REF CURSOR returning five columns, then you need to define five `add` elements in the config file.

Each `add` element contains the `name` and `value` attributes. The `value` attribute must begin with the word `implicitRefCursor` followed by the `bindinfo` or `metadata` attribute for specifying bind or metadata information.

The `bindinfo` information is used by ODP.NET for binding REF CURSOR parameters. The `metadata` information is used by ODP.NET to associate the schema information with the appropriate REF CURSOR. The metadata comprises of an attributes list that includes parameters together with their values.

The `SchemaName`, `PackageName`, and `StoredProcedureName` are case-sensitive. In order to run a stored procedure with implicit REF CURSOR binding, the `SchemaName.PackageName.StoredProcedureName` portion of the `name` attribute must exactly match the name specified in the data dictionary for that stored procedure.

### Note:

If the application uses implicit REF CURSOR binding feature outside of Entity Framework, then the .NET configuration file and `OracleCommand.CommandText` do not require the schema name concatenated before the stored procedure name.

If any schema, package, or stored procedure name in the database contains lowercase characters, then it must be enclosed within double quotation marks (") in the config file to preserve the case. Double quotation marks are used within the `name` attribute by using `&quot;`; when needed. For example, if the schema name is `HrSchema`, the package name is `HrPackage`, and the stored procedure name is `HrStoredProcedure` in the database, the config file should use the following:

```
<add
name="&quot;HrSchema&quot;.&quot;HrPackage&quot;.&quot;HrStoredProcedure&quot;.&quot;RefCursorMetadata . . . />
```

By default, Oracle Database stores these names as uppercase characters. ODP.NET assumes default behavior, and converts all names to uppercase characters unless you explicitly preserve the case by using double quotation marks.

 **Note:**

The *SchemaName*, *PackageName*, *StoredProcedureName*, or *ParameterName* cannot contain a period (".") in the name. For example, `P.0` is an unacceptable parameter name.

Depending on whether the application uses bind-by-name or bind-by-position, the *RefCursorParameterPositionOrName* portion of the name attribute must be set with the correct parameter position (for bind by position) or parameter name (for bind by name). For functions, the position is 0-based, where the position 0 represents the return value. For procedures, the position is 1-based, as there are no return values for procedures. For example, if a stored procedure accepts five parameters, returning only two REF CURSORS in the third and fifth parameter positions, then the .NET config REF CURSOR bind information should contain one entry for position 3 and one entry for position 5.

If bind-by-name is used, the attribute name is used to identify the REF CURSOR parameter. The name should use the same name and case as the one specified in the data dictionary for that stored procedure.

For `bindinfo`, the `mode` specifies the parameter direction of the parameter. The mode must be either `InputOutput`, `Output`, or `ReturnValue`.

 **Note:**

Implicit REF CURSOR binding for an input REF CURSOR parameter is not supported.

An exception is thrown at runtime if the .NET configuration file contains an entry for a REF CURSOR whose `mode` is set to `Input`.

For `metadata`, The *AttributesList* contains the list of parameters. [Table 3-20](#) describes the parameters that can be included in the *AttributesList*.

[Example 3-5](#) shows a sample `add` element that uses `bindinfo`. Here, the schema name is `SCOTT` and the stored procedure name is `TESTPROC`. The parameter name is `parameter1`. The mode is `output`.

[Example 3-6](#) shows a sample `add` element that uses `metadata`.

**Table 3-20 Allowed Parameters in Attributes List**

Name	Type	Required/Optional for Entity Framework	Description
ColumnName	System.String	Required	The name of the column.
ProviderType	Oracle.DataAccess.Client.OracleDbType	Required	The database column type (OracleDbType) of the column
NativeDataType	System.String	Required	The Oracle type. For example, NCLOB.
BaseColumnName	System.String	Optional	The name of the column in the database if an alias is used for the column.
BaseSchemaName	System.String	Optional	The name of the schema in the database that contains the column.
BaseTableName	System.String	Optional	The name of the table or view in the database that contains the column.
ColumnSize	System.Int64	Optional	The maximum possible length of a value in the column
NumericPrecision	System.Int16	Optional	The maximum precision of the column, if the column is a numeric data type.
NumericScale	System.Int16	Optional	The maximum scale of the column, if the column is a numeric data type.
IsUnique	System.Boolean	Optional	Indicates whether or not the column is unique.
IsKey	System.Boolean	Optional	Indicates whether or not the column is a key column. For a table to be updated with the REF CURSOR information, at least one of the columns in the REF CURSOR metadata should have this value set to <code>true</code>
IsRowID	System.Boolean	Optional	<code>true</code> if the column is a ROWID, otherwise <code>false</code> .
DataType	System.RuntimeType	Optional	Maps to the common language runtime type.
AllowDBNull	System.Boolean	Optional	<code>true</code> if null values are allowed, otherwise <code>false</code>
IsAliased	System.Boolean	Optional	<code>true</code> if the column is an alias; otherwise <code>false</code> .

**Table 3-20 (Cont.) Allowed Parameters in Attributes List**

Name	Type	Required/Optional for Entity Framework	Description
IsByteSemantic	System.Boolean	Optional	IsByteSemantic is: <ul style="list-style-type: none"> <li>true if the ColumnSize value uses bytes semantics</li> <li>false if ColumnSize uses character semantics</li> </ul>
IsExpression	System.Boolean	Optional	true if the column is an expression, else false.
IsHidden	System.Boolean	Optional	true if the column is hidden, else false.
IsReadOnly	System.Boolean	Optional	true if the column is read-only, else false
IsLong	System.Boolean	Optional	true if the column is of LONG, LONG RAW, BLOB, CLOB, or BFILE type, else false.
UdtTypeName	System.String	Optional	The type name of the UDT.
ProviderDbType	System.Data.DbType	Optional	System.Data.DbType
ObjectName	System.String	Optional	Represents the name of the object.

Some of the attributes, listed in [Table 3-20](#), automatically have their values set using the result set's metadata. Developers can override these default values by setting a value explicitly.

You may have to explicitly define some attributes listed as optional for certain operations. For example, updateable REF CURSOR requires the developer to define key information.

#### Example 3-5 Using the add Element with bindinfo

```
<add name="SCOTT.TESTPROC.RefCursor.parameter1" value="implicitRefCursor
  bindinfo='mode=Output'" />
```

#### Example 3-6 Using the add Element with metadata

```
<add name="scott.TestProc.RefCursorMetaData.parameter1.Column.0"
  value="implicitRefCursor metadata='ColumnName=EMPNO;BaseColumnName=EMPNO;
  BaseSchemaName=SCOTT;BaseTableName=EMP;NativeDataType=number;
  ProviderType=Int32;DataType=System.Int32;ColumnSize=4;AllowDBNull=false;
  IsKey=true'" />
```

## Sample Configuration File and Application

This section builds a sample application to illustrate implicit REF CURSOR binding. It contains the following topics:

- [Sample Stored Procedure and Function](#)
- [Sample Application Configuration File](#)

- [Sample Application That Uses the Configuration File](#)

### Sample Stored Procedure and Function

```
CREATE OR REPLACE FUNCTION GETEMP (
  EMPID IN NUMBER) return sys_refcursor is
  emp sys_refcursor;
BEGIN
  OPEN emp FOR SELECT empno, ename FROM emp where empno = EMPID;
  return emp;
END;
/

CREATE OR REPLACE PROCEDURE "GetEmpAndDept" (
  EMPS OUT sys_refcursor,
  DEPTS OUT sys_refcursor) AS
BEGIN
  OPEN EMPS for SELECT empno, ename from emp;
  OPEN DEPTS for SELECT deptno, dname from dept;
END;
/
```

### Sample Application Configuration File

```
<?xml version="1.0" encoding="utf-8"?>
<configuration>
  <oracle.dataaccess.client>
    <settings>

      <!-- The following is for SCOTT.GETEMP -->
      <add name="SCOTT.GETEMP.RefCursor.0"
        value="implicitRefCursor bindinfo='mode=ReturnValue'" />

      <!-- The following is for SCOTT.GETEMP's REF CURSOR metadata -->
      <add name="SCOTT.GETEMP.RefCursorMetaData.0.Column.0"
        value="implicitRefCursor metadata='ColumnName=EMPNO;
        BaseColumnName=EMPNO;BaseSchemaName=SCOTT;BaseTableName=EMP;
        NativeDataType=number;ProviderType=Int32;ProviderDbType=Int32;
        DataType=System.Int32;ColumnSize=4;NumericPrecision=10;
        NumericScale=3;AllowDBNull=false;IsKey=true'" />

      <add name="SCOTT.GETEMP.RefCursorMetaData.0.Column.1"
        value="implicitRefCursor metadata='ColumnName=ENAME;
        BaseColumnName=ENAME;BaseSchemaName=SCOTT;BaseTableName=EMP;
        NativeDataType=varchar2;ProviderType=Varchar2;
        ProviderDbType=String;DataType=System.String;
        ColumnSize=10;AllowDBNull=true'" />

      <!-- The following is for "SCOTT"."GetEmpAndDept" -->
      <add name="SCOTT.&quot;GetEmpAndDept&quot;.RefCursor.EMPS"
        value="implicitRefCursor bindinfo='mode=Output'" />

      <!-- The following is for SCOTT.GETEMP's EMPS REF CURSOR metadata -->
      <add name="SCOTT.&quot;GetEmpAndDept&quot;.
        RefCursorMetaData.EMPS.Column.0"
        value="implicitRefCursor metadata='ColumnName=EMPNO;
        BaseColumnName=EMPNO;BaseSchemaName=SCOTT;BaseTableName=EMP;
        NativeDataType=number;ProviderType=Int32;ProviderDbType=Int32;
        DataType=System.Int32;ColumnSize=4;NumericPrecision=10;
        NumericScale=3;AllowDBNull=false;IsKey=true'" />
```

```

<add name="SCOTT.&quot;GetEmpAndDept&quot;
      .RefCursorMetaData.EMPS.Column.1"
      value="implicitRefCursor metadata='ColumnName=EName;
      BaseColumnName=EName;BaseSchemaName=SCOTT;BaseTableName=EMP;
      NativeDataType=varchar2;ProviderType=Varchar2;
      ProviderDbType=String;DataType=System.String;
      ColumnSize=10;AllowDBNull=true'" />

<!-- The following is for SCOTT.GETEMP's DEPTS REF CURSOR metadata -->
<add name="SCOTT.&quot;GetEmpAndDept&quot;.RefCursor.DEPTS"
      value="implicitRefCursor bindinfo='mode=Output'" />

<add name="SCOTT.&quot;GetEmpAndDept&quot;
      .RefCursorMetaData.DEPTS.Column.0"
      value="implicitRefCursor metadata='ColumnName=DEPTNO;
      BaseColumnName=DEPTNO;BaseSchemaName=SCOTT;BaseTableName=DEPT;
      NativeDataType=number;ProviderType=Int32;ProviderDbType=Int32;
      DataType=System.Int32;ColumnSize=4;NumericPrecision=10;
      NumericScale=3;AllowDBNull=false;IsKey=true'" />

<add name="SCOTT.&quot;GetEmpAndDept&quot;
      .RefCursorMetaData.DEPTS.Column.1"
      value="implicitRefCursor metadata='ColumnName=DNAME;
      BaseColumnName=DNAME;BaseSchemaName=SCOTT;BaseTableName=DEPT;
      NativeDataType=varchar2;ProviderType=Varchar2;
      ProviderDbType=String;DataType=System.String;
      ColumnSize=10;AllowDBNull=true'" />
</settings>
</oracle.dataaccess.client>
</configuration>

```

### Sample Application That Uses the Configuration File

```

using System;
using System.Data;
using Oracle.DataAccess.Client;

class Program
{
    static void Main(string[] args)
    {
        try
        {
            // Open a connection
            string constr =
                "User Id=scott;Password=tiger;Data Source=inst1";
            OracleConnection con = new OracleConnection(constr);
            con.Open();

            // Use implicit REF CURSOR binding
            // to execute SCOTT.GETEMP function
            // Use bind by position as configured
            // in app.config for SCOT.GETEMP
            OracleCommand cmd = con.CreateCommand();
            cmd.CommandText = "SCOTT.GETEMP";
            cmd.CommandType = CommandType.StoredProcedure;
            cmd.BindByName = false;
            OracleParameter empid = cmd.Parameters.Add("empid",
                OracleDbType.Int32, ParameterDirection.Input);
            empid.Value = 7654;

```

```
// Populate the DataSet
OracleDataAdapter adapter = new OracleDataAdapter(cmd);
DataSet ds = new DataSet();
adapter.Fill(ds);
Console.WriteLine("Retrieved {0} row from EMP",
    ds.Tables[0].Rows.Count);

// Use implicit REF CURSOR binding
// to execute "SCOTT"."GetEmpAndDept" procedure
// Use bind by name as configured
// in app.config for "SCOTT"."GetEmpAndDept"
cmd = con.CreateCommand();
cmd.CommandText = "\"SCOTT\".\"GetEmpAndDept\"";
cmd.CommandType = CommandType.StoredProcedure;
cmd.BindByName = true;
adapter = new OracleDataAdapter(cmd);
adapter.Fill(ds);
Console.WriteLine("Retrieved {0} rows from DEPT",
    ds.Tables[1].Rows.Count);
}
catch (Exception ex)
{
    // Output the message
    Console.WriteLine(ex.Message);
    if (ex.InnerException != null)
    {
        // If any details are available regarding
        // errors in the app.config, print them out
        Console.WriteLine(ex.InnerException.Message);
        if (ex.InnerException.InnerException != null)
        {
            Console.WriteLine(
                ex.InnerException.InnerException.Message);
        }
    }
}
}
```

## Usage Considerations

This section discusses the following usage considerations when using implicit REF CURSOR:

- [CommandText Property Considerations](#)
- [Bind Considerations](#)
- [Overloaded Stored Procedures](#)
- [Type Initialization Exceptions](#)
- [Using Stored Functions with Function Import](#)

## CommandText Property Considerations

ODP.NET applications should ensure that the stored procedure name and the `OracleCommand.CommandText` match exactly. Let's take a scenario where the stored procedure name in the database is `SCOTT.TESTPROC`. Now, if the `CommandText` uses `TESTPROC`, ODP.NET will look for entries matching `TESTPROC` only. The current schema

name will not be automatically appended to `TESTPROC`. So, the correct `CommandText` to use in this scenario would be `SCOTT.TESTPROC`.

Also, the `CommandText` is case-sensitive and must use the same case as the stored procedure name in the database. So if the stored procedure name in the database is `SCOTT.Testproc`, then the `CommandText` must use `SCOTT.Testproc`.

## Bind Considerations

If information about a `REF CURSOR` parameter has been added to the configuration file, then applications should not try to explicitly bind the `REF CURSOR` parameter to `OracleCommand`. ODP.NET automatically binds the `REF CURSOR` parameter at the appropriate locations based on the information provided in the configuration file. If the application stored procedure also has non-`REF CURSOR` parameters, then these parameters must still be explicitly bound to `OracleCommand`.

If the information specified in the configuration file for a stored procedure identifies the `REF CURSOR` parameter by name, then all the other non-`REF CURSOR` parameters should also be bound by name. Also the `BindByName` property for the `OracleCommand` object should be set to `true` in this case. Entity Framework always uses `BindByName` to run stored procedures. Your `.NET` configuration file parameter names must use the same case that was used when creating the stored procedure in the database.

If the `OracleCommand BindByName` property is set to `false` (default), then ODP.NET assumes that the parameters have been bound based on their position, and all parameters have been specified in the correct order. For such cases, the parameters specified in the configuration file are bound in the same order in which they appear in the configuration file.

## Overloaded Stored Procedures

ODP.NET does not support multiple stored procedures with the same name inside the configuration file. If an ODP.NET application uses an overloaded stored procedure, the application can store only one overloaded stored procedure information in the configuration file.

## Type Initialization Exceptions

Type initialization exceptions can be caused by invalid `.NET` configuration file entries. Evaluate the exception that is caught as well as its inner exceptions to determine the `.NET` configuration file entry or the attribute setting that is causing the exception.

ODP.NET tracing logs the valid and invalid `.NET` configuration file entries that ODP.NET has parsed. To look for `.NET` configuration file related entries, set the `TraceLevel` to the *Entry*, *exit*, and *SQL statement information* level setting. Trace entries related to implicit `REF CURSOR` binding have a `(REFCURSOR)` entry along with `(ERROR)`, if any errors are encountered.

## Using Stored Functions with Function Import

Function Import only supports stored procedures, and does not support functions. When using the **Add Function Import** dialog for the Entity Data Model that you have created, the **Get Column Information** button does not return the metadata information for the `REF CURSOR` that is being returned by a stored function, even if it is configured properly in the `.NET` configuration file.

# LOB Support

ODP.NET provides an easy and optimal way to access and manipulate large object (LOB) data types.

**Note:**

SecureFiles can be used with existing ODP.NET LOB classes.

This section includes the following topics:

- [Large Character and Large Binary Data Types](#)
- [Oracle Data Provider for .NET LOB Objects](#)
- [Updating LOBs Using a DataSet](#)
- [Updating LOBs Using OracleCommand and OracleParameter](#)
- [Updating LOBs Using ODP.NET LOB Objects](#)
- [Temporary LOBs](#)

## Large Character and Large Binary Data Types

Oracle Database supports large character and large binary data types.

### Large Character Data Types

- CLOB - Character data can store up to 4 gigabytes.
- NCLOB - Unicode National character set data can store up to 4 gigabytes.

### Large Binary Data Types

- BLOB - Unstructured binary data can store up to 4 gigabytes.
- BFILE - Binary data stored in external file can store up to 4 gigabytes.

**Note:**

LONG and LONG RAW data types are made available for backward compatibility in Oracle9i, but should not be used in new applications.

## Oracle Data Provider for .NET LOB Objects

ODP.NET provides three objects for manipulating LOB data: `OracleBFile`, `OracleBlob`, and `OracleClob`.

[Table 3-21](#) shows the proper ODP.NET object to use for a particular Oracle LOB type.

**Table 3-21 ODP.NET LOB Objects**

Oracle LOB Type	ODP.NET LOB Object
BFILE	OracleBFile
BLOB	OracleBlob
CLOB	OracleClob
NCLOB	OracleClob

The ODP.NET LOB objects can be obtained by calling the proper typed accessor on the `OracleDataReader` object, or by calling the proper typed accessor as an output parameter on a command execution with the proper bind type.

All ODP.NET LOB objects inherit from the .NET `Stream` class to provide generic `Stream` operations. The LOB data (except for `BFILE` types) can be updated using the ODP.NET LOB objects by using methods such as `Write`. Data is not cached in the LOB objects when read and write operations are carried out. Therefore, each read or write request incurs a database round-trip. The `OracleClob` object overloads the `Read` method, providing two ways to read data from a `CLOB`. The `Read` method that takes a `byte[]` as the buffer populates it with `CLOB` data as Unicode byte array. The `Read` method that takes a `char[]` as the buffer populates it with Unicode characters.

Additional methods can also be found on the `OracleBFile` object. An `OracleBFile` object must be explicitly opened using the `OpenFile` method before any data can be read from it. To close a previously opened `BFILE`, use the `CloseFile` method.

Every ODP.NET LOB object is a connected object and requires a connection during its lifetime. If the connection associated with a LOB object is closed, then the LOB object is not usable and should be disposed of.

If an ODP.NET LOB object is obtained from an `OracleDataReader` object through a typed accessor, then its `Connection` property is set with a reference to the same `OracleConnection` object used by the `OracleDataReader` object. If a LOB object is obtained as an output parameter, then its `Connection` property is set with a reference to the same `OracleConnection` property used by the `OracleCommand` object. If a LOB object is obtained by invoking an ODP.NET LOB object constructor to create a temporary LOB, the `Connection` property is set with a reference to the `OracleConnection` object provided in the constructor.

The ODP.NET LOB object `Connection` property is read-only and cannot be changed during its lifetime. In addition, the ODP.NET LOB types object can be used only within the context of the same `OracleConnection` referenced by the ODP.NET LOB object. For example, the ODP.NET LOB `Connection` property must reference the same connection as the `OracleCommand` object if the ODP.NET LOB object is a parameter of the `OracleCommand`. If that is not the case, ODP.NET raises an exception when the command is executed.



#### See Also:

*Oracle Database SecureFiles and Large Objects Developer's Guide* for complete information about Oracle Database 10g LOBs and how to use them

## Updating LOBs Using a DataSet

`BFILE` and `BLOB` data are stored in the `DataSet` as byte arrays while `CLOB` and `NCLOB` data are stored as strings. In a similar manner to other types, an `OracleDataAdapter` object can be used to fill and update LOB data changes along with the use of the `OracleCommandBuilder` object for automatically generating SQL.

Note that an Oracle LOB column can store up to 4 GB of data. When the LOB data is fetched into the `DataSet`, the actual amount of LOB data the `DataSet` can hold for a LOB column is limited to the maximum size of a .NET string type, which is 2 GB. Therefore, when fetching LOB data that is greater than 2 GB, ODP.NET LOB objects must be used to avoid any data loss.

## Updating LOBs Using OracleCommand and OracleParameter

To update LOB columns, LOB data can be bound as a parameter for SQL statements, anonymous PL/SQL blocks, or stored procedures. The parameter value can be set as a .NET Framework type, ODP.NET type, or as an ODP.NET LOB object type. For example, when inserting .NET string data into a LOB column in an Oracle9i database or later, that parameter can be bound as `OracleDbType.Varchar2`. For a parameter whose value is set to an `OracleClob` object, the parameter should be bound as `OracleDbType.Clob`.

## Updating LOBs Using ODP.NET LOB Objects

Oracle `BFILES` cannot be updated; therefore, `OracleBFile` objects do not allow updates to `BFILE` columns.

Two requirements must be met to update LOB data using ODP.NET LOB objects:

1. A transaction must be started before a LOB column is selected.

The transaction must be started using the `BeginTransaction` method on the `OracleConnection` object before the command execution, so that the lock can be released when the `OracleTransaction.Commit` or `Rollback` method is invoked.

2. The row in which the LOB column resides must be locked; as part of an entire result set, or on a row-by-row basis.

- a. Locking the entire result set

Add the `FOR UPDATE` clause to the end of the `SELECT` statement. After execution of the command, the entire result set is locked.

- b. Locking the row - there are two options:

- Invoke one of the `OracleDataReader` typed accessors (`GetOracleClobForUpdate` or `GetOracleBlobForUpdate`) on the `OracleDataReader` object to obtain an ODP.NET LOB object, while also locking the current row.

This approach requires a primary key, unique column(s), or a `ROWID` in the result set because the `OracleDataReader` object must uniquely identify the row to re-select it for locking.

- Execute an `INSERT` or an `UPDATE` statement that returns a LOB in the `RETURNING` clause.

## Temporary LOBs

Temporary LOBs can be instantiated for `BLOB`, `CLOB`, and `NCLOB` objects. To instantiate an ODP.NET LOB object that represents a temporary LOB, the `OracleClob` or the `OracleBlob` constructor can be used.

Temporary ODP.NET LOB objects can be used for the following purposes:

- To initialize and populate a LOB column with empty or non-empty LOB data.
- To pass a LOB type as an input parameter to a SQL statement, an anonymous PL/SQL block, or a stored procedure.
- To act as the source or the destination of data transfer between two LOB objects as in the `CopyTo` operation.

 **Note:**

Temporary LOBs are not transaction aware. Commit and rollback operations do not affect the data referenced by a temporary LOB.

## Native JSON Support

Oracle Database 20c adds a native JavaScript Object Notation (JSON) data type. ODP.NET Core, managed, and unmanaged drivers support this native JSON data type starting with version 21.

In ODP.NET, the database JSON data type can be retrieved or passed to the database. When using a `.NET` string or `OracleString`, it can be bound as a parameter using the `OracleDbType.Json` enumeration value. This enumeration value directs ODP.NET to perform decoding from and encoding to the native Oracle Database JSON binary format, OSON, on the client side, offloading the task from the server side.

Alternatively, JSON data can be bound as parameters to other ODP.NET and `.NET` data types or not use the `OracleDbType.Json` enumeration value. Oracle Database will then implicitly encode to and decode from OSON to the desired data type format instead of the client in these cases. In `DataSet`, the Oracle JSON type is converted to and stored as either a `.NET` string or `OracleString`.

Managed ODP.NET and ODP.NET Core JSON features require the `System.Text.Json` assembly be included as a project dependency. ODP.NET does not add the `System.Text.Json` package as a dependency itself. In many cases, `.NET Core 3.1` and higher does automatically include this assembly with the `.NET` runtime, while `.NET Framework 4.8` does not.

Unmanaged ODP.NET does not have a requirement for `System.Text.Json`.

### JSON Numeric Values

For managed ODP.NET and ODP.NET Core, JSON documents bound as `OracleDbType.Json` input parameters have a 28 precision upper limit for numeric values. In all other cases, up to

38 precision will be retained for JSON numeric values when sent to or retrieved from the database.

Unmanaged ODP.NET supports JSON numeric values with a maximum precision of 38, as does the database.

If a JSON document bound as `OracleDbType.Json` contains numeric values with higher precision than can be retained, then ODP.NET will round the value to the maximum supported precision. If more precision must be retained than the maximum, then store the numeric value as a string by placing double quotes around the JSON value before binding the JSON document as an input parameter.

## ODP.NET XML Support

ODP.NET allows the extraction of data from relational and object-relational tables and views as XML documents. The use of XML documents for insert, update, and delete operations to the database is also allowed. Oracle Database supports XML natively in the database, through Oracle XML DB, a distinct group of technologies related to high-performance XML storage and retrieval. Oracle XML DB is an evolution of the database that encompasses both SQL and XML data models in a highly interoperable manner, providing native XML support.

ODP.NET, Managed Driver follows XPath 1.0 specification and hence it does not support default XML namespaces. XML namespaces must be explicitly added to search or update nodes. This behavior differs from ODP.NET, Unmanaged Driver.

For samples related to ODP.NET XML support in ODAC installations done using Oracle Universal Installer, see the following directory:

```
ORACLE_BASE\ORACLE_HOME\ODACsamples
```

This section includes these topics:

- [Supported XML Features](#)
- [OracleXmlType and Connection Dependency](#)
- [Updating XMLType Data in the Database](#)
- [Updating XML Data in OracleXmlType](#)
- [Characters with Special Meaning in XML](#)
- [Retrieving Query Result Set as XML](#)
- [Data Manipulation Using XML](#)

## Supported XML Features

XML support in ODP.NET provides the ability to do the following:

- Store XML data natively in the database as the Oracle database native type, `XMLType`.
- Access relational and object-relational data as XML data from an Oracle Database instance into the Microsoft .NET environment, and process the XML using the Microsoft .NET Framework.
- Save changes to the database using XML data.
- Execute XQuery statements.

For the .NET application developer, these features include the following:

- Enhancements to the `OracleCommand`, `OracleConnection`, and `OracleDataReader` classes.
- The following XML-specific classes:
  - `OracleXmlType`  
`OracleXmlType` objects are used to retrieve Oracle native `XMLType` data.
  - `OracleXmlStream`  
`OracleXmlStream` objects are used to retrieve XML data from `OracleXmlType` objects as a read-only .NET `Stream` object.
  - `OracleXmlQueryProperties`  
`OracleXmlQueryProperties` objects represent the XML properties used by the `OracleCommand` class when the `XmlCommandType` property is `Query`.
  - `OracleXmlSaveProperties`  
`OracleXmlSaveProperties` objects represent the XML properties used by the `OracleCommand` class when the `XmlCommandType` property is `Insert`, `Update`, or `Delete`.

#### See Also:

- ["XQuery Support"](#)
- ["OracleCommand Class"](#)
- ["OracleXmlType Class"](#)
- ["OracleXmlStream Class"](#)
- ["OracleXmlQueryProperties Class"](#)
- ["OracleXmlSaveProperties Class"](#)
- *Oracle XML DB Developer's Guide*

## XQuery Support

ODP.NET supports the XQuery language through a native implementation of SQL/XML functions, `XMLQuery` and `XMLTable`. When executing XQuery statements, Oracle XML DB generally evaluates XQuery expressions by compiling them into the same underlying structures as relational queries. Queries are optimized, leveraging both relational-database and XQuery-specific optimization technologies, so that Oracle XML DB serves as a native XQuery engine. The treatment of all XQuery expressions, whether natively compiled or evaluated functionally, is transparent: programmers do not need to change their code to take advantage of XQuery optimizations.

**See Also:**

*Oracle XML DB Developer's Guide* to learn more about Oracle's XQuery support

## OracleXmlType and Connection Dependency

The read-only `Connection` property of the `OracleXmlType` class holds a reference to the `OracleConnection` object used to instantiate the `OracleXmlType` class.

How the `OracleXmlType` object obtains a reference to an `OracleConnection` object depends on how the `OracleXmlType` class is instantiated:

- Instantiated from an `OracleDataReader` class using the `GetOracleXmlType`, `GetOracleValue`, or `GetOracleValues` method:  
The `Connection` property is set with a reference to the same `OracleConnection` object used by the `OracleDataReader` object.
- Instantiated by invoking an `OracleXmlType` constructor with one of the parameters of type `OracleConnection`:  
The `Connection` property is set with a reference to the same `OracleConnection` object provided in the constructor.
- Instantiated by invoking an `OracleXmlType(OracleClob)` constructor:  
The `Connection` property is set with a reference to the `OracleConnection` object used by the `OracleClob` object.

An `OracleXmlType` object that is associated with one connection cannot be used with a different connection. For example, if an `OracleXmlType` object is obtained using `OracleConnection A`, that `OracleXmlType` object cannot be used as an input parameter of a command that uses `OracleConnection B`. By checking the `Connection` property of the `OracleXmlType` objects, the application can ensure that `OracleXmlType` objects are used only within the context of the `OracleConnection` referenced by its connection property. Otherwise, ODP.NET raises an exception.

## Updating XMLType Data in the Database

Updating `XMLType` columns does not require a transaction. However, encapsulating the entire database update process within a transaction is highly recommended. This allows the updates to be rolled back if there are any errors.

`XMLType` columns in the database can be updated using Oracle Data Provider for .NET in a few ways:

- [Updating with DataSet, OracleDataAdapter, and OracleCommandBuilder](#)
- [Updating with OracleCommand and OracleParameter](#)

### Updating with DataSet, OracleDataAdapter, and OracleCommandBuilder

If the `XMLType` column is fetched into the `DataSet`, the `XMLType` data is represented as a .NET `String`.

Modifying `XMLType` data in the `DataSet` does not require special treatment. `XMLType` data can be modified in the same way as any data that is stored in the `DataSet`. When a change is made and the `OracleDataAdapter.Update` method is invoked, the `OracleDataAdapter` object ensures that the `XMLType` data is handled properly. The `OracleDataAdapter` object uses any custom SQL `INSERT`, `UPDATE`, or `DELETE` statements that are provided. Otherwise, valid SQL statements are generated by the `OracleCommandBuilder` object as needed to flush the changes to the database.

## Updating with `OracleCommand` and `OracleParameter`

The `OracleCommand` class provides a powerful way of updating `XMLType` data, especially with the use of an `OracleParameter` object. To update columns in a database table, the new value for the column can be passed as an input parameter of a command.

### Input Binding

To update an `XMLType` column in the database, a SQL statement can be executed using static values. In addition, input parameters can be bound to SQL statements, anonymous PL/SQL blocks, or stored procedures to update `XMLType` columns. The parameter value can be set as .NET Framework Types, ODP.NET Types, or `OracleXmlType` objects.

While `XMLType` columns can be updated using an `OracleXmlType` object, having an instance of an `OracleXmlType` class does not guarantee that the `XMLType` column in the database can be updated.

## Setting `XMLType` Column to NULL Value

Applications can set an `XMLType` column in the database to a `NULL` value, with or without input binding, as follows:

- **Setting `NULL` values in an `XMLType` column with input binding**

To set the `XMLType` column to `NULL`, the application can bind an input parameter whose value is `DBNull.Value`. This indicates to the `OracleCommand` object that a `NULL` value is to be inserted.

Passing in a null `OracleXmlType` object as an input parameter does not insert a `NULL` value into the `XMLType` column. In this case, the `OracleCommand` object raises an exception.

- **Setting `NULL` Values in an `XMLType` Column without input binding**

The following example demonstrates setting `NULL` values in an `XMLType` column without input binding:

```
// Create a table with an XMLType column in the database
CREATE TABLE XML_TABLE(NUM_COL number, XMLTYPE_COL xmltype);
```

An application can set a `NULL` value in the `XMLType` column by explicitly inserting a `NULL` value or by not inserting anything into that column as in the following examples:

```
insert into xml_table(xmltype_col) values(NULL);

update xml_table t set t.xmltype_col=NULL;
```

## Setting XMLType Column to Empty XML Data

The `XMLType` column can be initialized with empty XML data, using a SQL statement:

```
// Create a table with an XMLType column in the database
CREATE TABLE XML_TABLE (NUM_COL number, XMLTYPE_COL xmltype);

INSERT INTO XML_TABLE (NUM_COL, XMLTYPE_COL) VALUES (4,
XMLType.createxml('<DOC/>'));
```

## Updating XML Data in OracleXmlType

The following are ways that XML data can be updated in an `OracleXmlType` object.

- The XML data can be updated by passing an XPATH expression and the new value to the `Update` method on the `OracleXmlType` object.
- The XML data can be retrieved on the client side as the .NET Framework `XmlDocument` object using the `GetXmlDocument` method on the `OracleXmlType` object. This XML data can then be manipulated using suitable .NET Framework classes. A new `OracleXmlType` can be created with the updated XML data from the .NET Framework classes. This new `OracleXmlType` is bound as an input parameter to an update or insert statement.

## Characters with Special Meaning in XML

The following characters in [Table 3-22](#) have special meaning in XML. For more information, refer to the XML 1.0 specifications

**Table 3-22 Characters with Special Meaning in XML**

Character	Meaning in XML	Entity Encoding
<	Begins an XML tag	&lt;
>	Ends an XML tag	&gt;
"	Quotation mark	&quot;
'	Apostrophe or single quotation mark	&apos;
&	Ampersand	&amp;

When these characters appear as data in an XML element, they are replaced with their equivalent entity encoding.

Also certain characters are not valid in XML element names. When SQL identifiers (such as column names) are mapped to XML element names, these characters are converted to a sequence of hexadecimal digits, derived from the Unicode encoding of the character, bracketed by an introductory underscore, a lowercase `x` and a trailing underscore. A blank space is not a valid character in an XML element name. If a SQL identifier contains a space character, then in the corresponding XML element name, the space character is replaced by `_x0020_`, which is based on Unicode encoding of the space character.

## Retrieving Query Result Set as XML

This section discusses retrieving the result set from a SQL query as XML data.

### Handling Date and Time Format

The generated XML DATE and TIMESTAMP formats are based on the standard XML Schema formats.

#### See Also:

<http://www.w3.org/TR/2004/REC-xmlschema-2-20041028/datatypes.html#isoformats> for more information on the XML Schema specification.

### Characters with Special Meaning in Column Data

If the data in any of the select list columns in the query contains any characters with special meaning in XML (see [Table 3-22](#)), these characters are replaced with their corresponding entity encoding in the result XML document.

The following examples demonstrate how ODP.NET handles the angle bracket characters in the column data:

```
/* Database Setup
connect scott/tiger@oracle
drop table specialchars;
create table specialchars ("id" number, name varchar2(255));
insert into specialchars values (1, '<Jones>');
commit;
*/

// C#

using System;
using System.Data;
using System.Xml;
using Oracle.DataAccess.Client;

class QueryResultAsXMLSample
{
    static void Main()
    {
        OracleConnection con = new OracleConnection();

        con.ConnectionString = "User Id=scott;Password=tiger;Data Source=oracle;";
        con.Open();

        // Create the command
        OracleCommand cmd = new OracleCommand("", con);

        // Set the XML command type to query.
        cmd.XmlCommandType = OracleXmlCommandType.Query;
```

```

// Set the SQL query
cmd.CommandText = "select * from specialchars";

// Set command properties that affect XML query behavior.
cmd.BindByName = true;

// Set the XML query properties
cmd.XmlQueryProperties.MaxRows = -1;

// Get the XML document as an XmlReader.
XmlReader xmlReader = cmd.ExecuteXmlReader();
XmlDocument xmlDoc = new XmlDocument();

xmlDoc.PreserveWhitespace = true;
xmlDoc.Load(xmlReader);
Console.WriteLine(xmlDoc.OuterXml);

// Close and Dispose OracleConnection object
con.Close();
con.Dispose();
}
}

```

The following XML document is generated for that table: The XML entity encoding that represents the angle brackets appears in bold.

```

<?xml version = '1.0'?>
<ROWSET>
  <ROW>
    <id>1</id >
    <NAME>&lt;Jones&gt;</NAME>
  </ROW>
</ROWSET>

```

## Characters in Table or View Name

If a table or view name has any non-alphanumeric characters other than an underscore (`_`), the table or view name must be enclosed in quotation marks.

For example, to select all entries from a table with the name `test'ing`, the `CommandText` property of the `OracleCommand` object must be set to the following string:

```
"select * from \"test'ing\"";
```

## Case-Sensitivity in Column Name to XML Element Name Mapping

The mapping of SQL identifiers (column names) to XML element names is case-sensitive, and the element names are in exactly the same case as the column names of the table or view.

However, the root tag and row tag names are case-insensitive. The following example demonstrates case-sensitivity in this situation:

```

//Create the following table
create table casesensitive_table ("Id" number, NAME varchar2(255));

//insert name and id
insert into casesensitive_table values(1, 'Smith');

```

The following XML document is generated:

```
<?xml version = '1.0'?>
  <ROWSET>
    <ROW>
      <Id>1</Id>
      <NAME>Smith</NAME>
    </ROW>
  </ROWSET>
```

Note that the element name for the `Id` column matches the case of the column name.

## Column Name to XML Element Name Mapping

For each row generated by the SQL query, the SQL identifier (column name) maps to an XML element in the generated XML document, as shown in the following example:

```
// Create the following table
create table emp_table (EMPLOYEE_ID NUMBER(4), LAST_NAME varchar2(25));
// Insert some data
insert into emp_table values(205, 'Higgins');
```

The SQL query, `SELECT * FROM EMP_TABLE`, generates the following XML document:

```
<?XML version="1.0"?>
  <ROWSET>
    <ROW>
      <EMPLOYEE_ID>205</EMPLOYEE_ID>
      <LAST_NAME>Higgins</LAST_NAME>
    </ROW>
  </ROWSET>
```

The `EMPLOYEE_ID` and `LAST_NAME` database columns of the `employees` table map to the `EMPLOYEE_ID` and `LAST_NAME` elements of the generated XML document.

This section demonstrates how Oracle database handles the mapping of SQL identifiers to XML element names, when retrieving query results as XML from the database. The demonstration uses the `specialchars` table involving the `some id` column.

```
// Create the specialchars table
create table specialchars ("some id" number, name varchar2(255));
```

Note that the `specialchars` table has a column named `some id` that contains a blank space character. The space character is not allowed in an XML element name.

When retrieving the query results as XML, the SQL identifiers in the query select list can contain characters that are not valid in XML element names. When these SQL identifiers (such as column names) are mapped to XML element names, each of these characters is converted to a sequence of hexadecimal digits, derived from the Unicode encoding of the characters, bracketed by an introductory underscore, a lowercase `x`, and a trailing underscore.

Thus, the SQL query in the following example can be used to get a result as an XML document from the `specialchars` table:

```
select "some id", name from specialchars;
```

**See Also:**["Characters with Special Meaning in XML"](#)

## Improving Default Mapping

You can improve the default mapping of SQL identifiers to XML element names by using the following techniques:

- Modify the source. Create an object-relational view over the source schema, and make that view the new source.
- Use cursor subqueries and cast-multiset constructs in the SQL query.
- Create an alias for the column or attribute names in the SQL query. Prefix the aliases with an at sign (@) to map them to XML attributes instead of XML elements.
- Modify the XML document. Use [Extensible Stylesheet Language Transformation \(XSLT\)](#) to transform the XML document. Specify the XSL document and parameters. The transformation is done automatically after the XML document is generated from the relational data. Note that this may have an impact on performance.
- Specify the name of the root tag and row tag used in the XML document.

## Object-Relational Data

ODP.NET can generate an XML document for data stored in object-relational columns, tables, and views, as shown in the following example:

```
// Create the following tables and types
CREATE TYPE "EmployeeType" AS OBJECT (EMPNO NUMBER, ENAME VARCHAR2(20));
/
CREATE TYPE EmployeeListType AS TABLE OF "EmployeeType";
/
CREATE TABLE mydept (DEPTNO NUMBER, DEPTNAME VARCHAR2(20),
                     EMPLIST EmployeeListType)
                     NESTED TABLE EMPLIST STORE AS EMPLIST_TABLE;
INSERT INTO mydept VALUES (1, 'depta',
                           EmployeeListType("EmployeeType"(1, 'empa')));
```

The following XML document is generated for the table:

```
<?xml version = "1.0"?>
<ROWSET>
  <ROW>
    <DEPTNO>1</DEPTNO>
    <DEPTNAME>depta</DEPTNAME>
    <EMPLIST>
      <EmployeeType>
        <EMPNO>1</EMPNO>
        <ENAME>empa</ENAME>
      </EmployeeType>
    </EMPLIST>
  </ROW>
</ROWSET>
```

ODP.NET encloses each item in a collection element, with the database type name of the element in the collection. The `mydept` table has a collection in the `EMPLIST` database column and each item in the collection is of type `EmployeeType`. Therefore, in the XML document, each item in the collection is enclosed in the type name `EmployeeType`, which appears in bold in the example.

## NULL Values

If any database row has a column with a `NULL` value, then that column does not appear for that row in the generated XML document.

## Data Manipulation Using XML

This section discusses making changes to the database data using XML.

## Handling Date and Time Format

The generated XML `DATE` and `TIMESTAMP` formats are based on the standard XML Schema formats.



### See Also:

<http://www.w3.org/TR/2004/REC-xmlschema-2-20041028/datatypes.html#isoformats> for more information on the XML Schema specification.

## Saving Changes Using XML

Changes can be saved to database tables and views using XML data. However, insert, update, and delete operations cannot be combined in a single XML document. ODP.NET cannot accept a single XML document and determine which are insert, update, or delete changes.

The insert change must be in an XML document containing only rows to be inserted, the update changes only with rows to be updated, and the delete changes only with rows to be deleted.

For example, using the `employees` table that comes with the HR sample schema, you can specify the following query:

```
select employee_id, last_name from employees where employee_id = 205;
```

The following XML document is generated:

```
<?xml version = '1.0'?>
<ROWSET>
  <ROW>
    <EMPLOYEE_ID>205</EMPLOYEE_ID>
    <LAST_NAME>Higgins</LAST_NAME>
  </ROW>
</ROWSET>
```

To change the name of employee 205 from **Higgins** to **Smith**, specify the `employees` table and the XML data containing the changes as follows:

```
<?xml version = '1.0'?>
<ROWSET>
  <ROW>
    <EMPLOYEE_ID>205</EMPLOYEE_ID>
    <LAST_NAME>Smith</LAST_NAME>
  </ROW>
</ROWSET>
```

## Characters with Special Meaning in Column Data

If the data in any of the elements in the XML document contains characters that have a special meaning in XML (see [Table 3-22](#)), these characters must be replaced with appropriate entity encoding, or be preceded by an escape character in the XML document, so that the data is stored correctly in the database table column. Otherwise, ODP.NET throws an exception.

The following example demonstrates how ODP.NET handles the angle bracket special characters in the column data, using entity encoding:

```
// Create the following table
create table specialchars ("id" number, name varchar2(255));
```

The following XML document can be used to insert values (1, '**<Jones>**') into the `specialchars` table. The XML entity encoding that represents the angle brackets appears in **bold**.

```
<?xml version = '1.0'?>
<ROWSET>
  <ROW>
    <id>1</id >
    <NAME>&lt;Jones&gt;</NAME>
  </ROW>
</ROWSET>
```

## Characters with Special Meaning in Table or View Name

If a table or view name has any non-alphanumeric characters other than an underscore (`_`), the table or view name must be enclosed in quotation marks.

For example, to save changes to a table with the name `test'ing`, the `OracleCommand.XmlSaveProperties.TableName` property must be set to `"test'ing"`.

## Case-Sensitivity in XML Element Name to Column Name Mapping

For each XML element that represents a row of data in the XML document, the child XML elements map to database column names. The mapping of the child element name to the column name is always case-sensitive, but the root tag and row tag names are case-insensitive. The following example demonstrates this case-sensitivity:

```
//Create the following table
create table casesensitive_table ("Id" number, NAME varchar2(255));
```

The following XML document can be used to insert values (1, Smith) into the `casesensitive_table`:

```
<?xml version = '1.0'?>
  <ROWSET>
    <ROW>
      <Id>1</Id>
      <NAME>Smith</NAME>
    </ROW>
  </ROWSET>
```

Note that the element name for the `Id` column matches the case of the column name.

## XML Element Name to Column Name Mapping

This section describes how Oracle database handles the mapping of XML element names to column names when using XML for data manipulation in the database. The following `specialchars` table involving the `some id` column demonstrates this handling.

```
// Create the specialchars table
create table specialchars ("some id" number, name varchar2(255));
```

Note that the `specialchars` table has a column named `some id` that contains a blank space character. The space character is not allowed in an XML element name.

## Saving Changes to a Table Using an XML Document

When an XML document is used to save changes to a table or view, the `OracleCommand.XmlSaveProperties.UpdateColumnsList` property is used to specify the list of columns to update or insert.

When an XML document is used to save changes to a column in a table or view, and the corresponding column name contains any of the characters that are not valid in an XML element name, the escaped column name must be specified in the `UpdateColumnsList` property as in the following example.

The following XML document can be used to insert values (2, `<Jones>`) into the `specialchars` table:

```
<?xml version = '1.0'?>
  <ROWSET>
    <ROW>
      <some_x0020_id>2</some_x0020_id>
      <NAME>&lt;Jones&gt;</NAME>
    </ROW>
  </ROWSET>
```

The following example specifies the list of columns to update or insert:

```
/* Database Setup
connect scott/tiger@oracle
drop table specialchars;
create table specialchars ("some id" number, name varchar2(255));
insert into specialchars values (1, '<Jones>');
commit;
*/

// C#

using System;
using System.Data;
using System.Xml;
```

```
using Oracle.DataAccess.Client;

class InsertUsingXmlDocSample
{
    static void Main()
    {
        OracleConnection con = new OracleConnection();

        con.ConnectionString = "User Id=scott;Password=tiger;Data Source=oracle;";
        con.Open();
        Console.WriteLine("Connected Successfully");

        // Create the command
        OracleCommand cmd = new OracleCommand("", con);

        // Set the XML command type to query.
        cmd.XmlCommandType = OracleXmlCommandType.Insert;

        // Set the XML document
        cmd.CommandText = "<?xml version = '1.0'?>\n" + "<ROWSET>\n" + "<ROW>\n" +
            "<some_x0020_id>2</some_x0020_id>\n" + "<NAME>&lt;Jones&gt;</NAME>\n" +
            "</ROW>\n" + "</ROWSET>\n";
        cmd.XmlSaveProperties.Table = "specialchars";

        string[] ucols = new string[2];

        ucols[0] = "some_x0020_id";
        ucols[1] = "NAME";
        cmd.XmlSaveProperties.UpdateColumnsList = ucols;

        // Insert rows
        int rows = cmd.ExecuteNonQuery();

        Console.WriteLine("Number of rows inserted successfully : {0} ", rows);

        // Close and Dispose OracleConnection object
        con.Close();
        con.Dispose();
    }
}
```

## Improving Default Mapping

You can improve the default mapping by using the following techniques:

- Modify the target. Create an object-relational view over the target schema, and make the view the new target.
- Modify the XML document. Use XSLT to transform the XML document. Specify the XSL document and parameters. The transformation is done before the changes are saved. Note that this may have an impact on performance.
- Specify the name of the row tag used in the XML document.

## Object-Relational Data

Changes in an XML document can also be saved to object-relational data. Each item in a collection can be specified in one of the following ways in the XML document:

- By enclosing the database type name of the item as the XML element name.

- By enclosing the name of the database column holding the collection with `_ITEM` appended as the XML element name.

## Multiple Tables

Oracle Database does not save changes to multiple relational tables that have been joined together. Oracle recommends that you create a view on those relational tables, and then update that view. If the view cannot be updated, triggers can be used instead.



### See Also:

*Oracle Database SQL Language Reference* for the description and syntax of the `CREATE VIEW` statement

## Commit Transactions

When the changes in an XML document are made, either all the changes are committed, or if an error occurs, all changes are rolled back.

# Oracle User-Defined Types (UDTs) and .NET Custom Types

ODP.NET has the ability to represent Oracle UDTs found in the database as custom types in .NET applications. UDTs are useful in representing complex entities as a single object that can be shared among applications. Oracle products, such as Oracle Spatial and Oracle XML DB, use their own complex types frequently.

To represent Oracle UDTs as .NET custom types, applications must apply .NET attributes to custom classes and structs, and to their public fields and properties.

To convert between UDTs and custom types, ODP.NET uses custom interfaces.

Starting with version 21.2, managed ODP.NET and ODP.NET Core support Oracle UDTs and .NET custom types. These providers are near-parity with unmanaged ODP.NET UDT APIs and features, which makes migrating to managed or core more straightforward for developers. Only a few code changes may be needed.

This section discusses the ODP.NET UDT topics below. All the topics, except [Using UDTs with Managed ODP.NET and ODP.NET Core](#) and [Migrating from Unmanaged ODP.NET to Managed or Core](#), discuss unmanaged ODP.NET UDT features and Oracle UDTs generally. These two topics contrast unmanaged ODP.NET UDTs with managed ODP.NET and ODP.NET Core UDTs.

- [Oracle User-Defined Types \(UDTs\)](#)
- [Custom Types](#)
- [Specifying Custom Type Mappings](#)
- [Converting Between Custom Types and Oracle UDTs](#)
- [Oracle UDT Attribute Mappings](#)
- [Oracle UDT Retrieval from OracleDataReader](#)
- [Oracle UDT Metadata Retrieval from OracleDataReader](#)

- [Oracle UDT Parameter Binding with OracleParameter](#)
- [Populating the DataSet with Oracle UDTs](#)
- [UDT Method Invocation](#)
- [Configuration Settings for Oracle UDTs](#)
- [Using UDTs with Managed ODP.NET and ODP.NET Core](#)
- [Migrating from Unmanaged ODP.NET to Managed or Core](#)
- [Handling NULL Attribute Values in UDTs](#)

## Oracle User-Defined Types (UDTs)

Oracle Data Provider for .NET supports Oracle object types or user-defined types (UDTs), which are defined in the Oracle database.

There are two kinds of UDTs:

- Object types (Oracle Object)
- Collection types (which can be `VARRAY` types or nested table types)

Additionally, ODP.NET supports references (`REF`) to object types.

The term UDT is used interchangeably with Oracle object types and abstract data types (ADTs).

The name of the Oracle UDT is case-sensitive and must be in the form `schema_name.type_name`.

### See Also:

- [OracleRef Class](#)
- *Oracle Database Object-Relational Developer's Guide* for complete descriptions of object types
- UDT samples are available online on GitHub in the UDT directory:

<https://github.com/oracle/dotnet-db-samples/tree/master/samples>

## Custom Types

Oracle Data Provider for .NET supports UDTs by representing Oracle UDTs defined in the database as .NET types, that is, custom types. For every Oracle UDT that the application wishes to fetch and manipulate, one custom type factory and one custom type are needed. The custom factory class is solely responsible for instantiating the custom type. ODP.NET uses the interfaces implemented on the custom factory classes to instantiate custom types at run time. Custom types define the mapping between the Oracle UDT attributes or elements to the .NET members. ODP.NET uses the interfaces implemented on the custom type instances to transfer values between the Oracle UDT and the custom type at run time.

Custom types can be .NET classes or structures. They can represent either Oracle Objects or Oracle Collections. Custom types can be implemented manually by the application developer or generated through an ODP.NET code generation tool.

Once the factory class and the custom type are defined and meet the implementation requirements, the application may set ODP.NET to automatically discover the mapping between the Oracle UDT and the custom type. This discovery process is based on the attribute that is applied on the custom factory class. Alternatively, the application can provide an explicit mapping through a configuration file.

Oracle Collections can be represented as an array of .NET Types. For example, an Oracle Collection type of `NUMBER` can be mapped to an `int[]`. Moreover, an Oracle Collection type of an Oracle UDT can be mapped to an array of the custom type.

Custom types must adhere to certain requirements in order for ODP.NET to represent Oracle UDTs as custom types. These requirements are as follows:

## Required Custom Type Implementations

This section lists the required implementations for a custom .NET class or structure.

- `Oracle.DataAccess.Types.IOracleCustomType` interface implementation

This interface is used for conversions between custom types and Oracle UDTs.

The interface methods are implemented using the static methods of the `OracleUdt` class.

- Custom Type Factories

A custom type factory is used to create an instance of a custom type. A custom type factory is an implementation of either the `IOracleCustomTypeFactory` interface, the `IOracleArrayTypeFactory` interface, or both interfaces, as follows:

- To create a custom type that represents an Oracle Object, the custom type or a separate custom type factory class must implement the `Oracle.DataAccess.Types.IOracleCustomTypeFactory` interface.
- To create a custom type that represents an Oracle Collection, the custom type or a separate custom type factory class must implement the `Oracle.DataAccess.Types.IOracleCustomTypeFactory` interface and the `Oracle.DataAccess.Types.IOracleArrayTypeFactory` interface.
- To create an array type that represents an Oracle Collection, a custom type factory class must implement the `Oracle.DataAccess.Types.IOracleArrayTypeFactory` interface.

- Custom Type Member Mapping Attributes

The custom type member mapping attributes specify the mapping between custom type members and either Oracle object attributes or Oracle collection elements.

There are two types of custom type member mapping attributes:

- `OracleObjectMappingAttribute`

This attribute specifies the mapping between custom type members and Oracle object attributes for custom types that represent Oracle objects. This attribute must be applied to each custom type member (either field or property) that represents an Oracle Object attribute.

 **Note:**

Not all Oracle object attributes need to be mapped to custom type members. If there is no `OracleObjectMappingAttribute` for a particular object attribute, ODP.NET ignores that object attribute when converting between Oracle objects and custom types.

- `OracleArrayMappingAttribute`

This attribute specifies the custom type member that stores the elements of an Oracle collection for custom types representing Oracle collections. The attribute must be specified on only one of the custom type members.

- `Oracle.DataAccess.Types.INullable` interface implementation

This interface is used to determine if an instance of a custom type represents a null UDT. The `IsNull` property of the interface enables applications and ODP.NET to determine whether or not the UDT is null.

- Static Null field

The public static `Null` property is used to return a null UDT. This property returns a custom type with an `IsNull` property that returns true.

## Optional Custom Type Implementations

The following are optional:

- `IXMLSerializable`

The `IXMLSerializable` interface is used in the .NET 2.0 framework to enable conversion between the custom type and its XML representation. This interface is only used if the serialization and deserialization of a custom type is needed in the `DataSet`.

- Static `Parse` and Public `ToString` methods

These methods enable conversion between the custom type and its string representation.

These methods are invoked when a `DataGrid` control is used to accept changes and display instance values.

- Type Inheritance

Type Inheritance refers to the process of deriving an Oracle UDT in the database from a super type.

If the custom type represents an Oracle UDT that is derived from a super type, the custom class should follow the same type hierarchy, that is, the custom class should be derived from another custom class that represents the super type defined in the database.

- `OracleCustomTypeMappingAttribute`

The `OracleCustomTypeMappingAttribute` object specifies the mapping between a custom type (or an array type) and an Oracle UDT.

There must be a unique custom type factory for each Oracle UDT used by the application as follows:

- Oracle Object Types:  
The custom type factory must return a custom type that only represents the specified Oracle Object Type.
- Oracle Collection Types:  
The custom type factory may return a custom type that can be used by other Oracle Collection Types. This is common when an array type is used to represent an Oracle Collection, for example, when an `int[]` is used to represent a collection of `NUMBERS`.

If the `OracleCustomTypeMappingAttribute` is not specified, then custom type mappings must be specified through XML configuration files, that is, `machine.config`, and either `app.config` for Windows applications or `web.config` for web applications.

#### See Also:

- ["IOracleCustomType Interface"](#)
- ["OracleRef Class"](#)
- ["IOracleCustomTypeFactory Interface"](#)

## Specifying Custom Type Mappings

After creating a custom type, the application must specify a custom type mapping that maps the custom type to an Oracle UDT in the database. This can be done using a custom type factory or XML in configuration files.

Using XML to specify custom type mappings has priority, if both techniques have been implemented. At run time, if ODP.NET finds custom type mappings specified in configuration files, it ignores any custom type mappings specified through the `OracleCustomTypeMappingAttribute` object. If a .NET application dynamically loads .NET assemblies, which contain .NET classes that Oracle UDTs are mapped to, then the mapping between .NET classes and Oracle UDTs must be configured using a .NET config file.

Custom type mappings cannot be specified using synonyms, regardless of whether or not the mapping is provided through the `OracleCustomTypeMappingAttribute` object or the XML configuration file.

#### See Also:

*Oracle Developer Tools for Visual Studio help* sections on User-Defined Types Node under Server Explorer in Visual Studio for further information on UDT mapping.

This section contains these topics:

- ["Using a Custom Type Factory to Specify Custom Type Mappings"](#)
- ["Using XML in Configuration Files to Specify Custom Type Mappings"](#)

## Using a Custom Type Factory to Specify Custom Type Mappings

The application can specify a custom type mapping using a custom type factory. The application supplies the name of the Oracle UDT, in the format `schema_name.type_name`, to an `OracleCustomTypeMappingAttribute` object and applies the name to the corresponding custom type factory. A custom type factory is a class or struct that implements either or both the `IOracleCustomTypeFactory` and `IOracleArrayTypeFactory` interfaces.

Note that for each Oracle UDT used by the application, there must be a unique custom type factory. Additionally, for Oracle Object Types, the custom type factory must return a custom type that uniquely represents the specified Oracle Object Type. For Oracle Collection Types, the custom type factory returns a custom type that can be used by other Oracle Collection Types. This is common when an custom type that is an array type represents an Oracle Collection, that is, when an `int[]` is used to represent a collection of `NUMBERS`.

At run time, using reflection programming, ODP.NET discovers all the custom type mappings specified by the application through the `OracleCustomTypeMappingAttribute` object.



### Note:

The UDT name that is specified in the `OracleCustomTypeMappingAttribute` may not contain a period.

## Using XML in Configuration Files to Specify Custom Type Mappings

The application can specify a custom type mapping with XML in configuration files, for example: using `machine.config`, and either `app.config` for Windows applications or `web.config` for web applications.

The custom type mappings must be specified in the `oracle.dataaccess.client` configuration section group. Each custom type mapping must be added to the collection of custom type mappings using the XML element `<add>`.

Each custom type mapping consists of a name attribute and a value attribute. The name attribute may be any user-specified name that represents the custom type mapping. The value attribute must begin with `udtMapping` and be followed by the required and optional attributes listed below.

### Required Attributes

- `factoryName`

The case-sensitive assembly qualified name of the custom type factory class or struct.

If the assembly that defines the custom type factory does not have a strong name, then a partial assembly name consisting of just the assembly name is sufficient. In the case of strongly named assemblies, a complete assembly name is required. It must include the assembly name, the `Version`, `Culture`, `PublicKeyToken`.

- `typeName`  
The case-sensitive name of the UDT defined in the database. By default all UDTs are created in the database with upper case names
- `schemaName`  
The case-sensitive schema in which the UDT is defined in the database. By default all schemas are created in the database with upper case names

## Optional Attributes

- `dataSource`  
If specified, indicates that the custom type mapping applies only to Oracle UDTs defined in the database that the application connects to, as specified by the TNS name alias.  
The Data Source is case-insensitive.

The following is an example of the format of the XML that can be specified in the configuration file for .NET 2.0:

```
<oracle.dataaccess.client>
  <settings>
    <add name="Person" value="udtMapping factoryName='Sample.PersonFactory,
      Sample, Version=1.0.0.0, Culture=neutral, PublicKeyToken=null'
      typeName='PERSON' schemaName='SCOTT' dataSource='oracle'"/>
    <add name="Student" value="udtMapping factoryName='Sample.StudentFactory,
      Sample, Version=1.0.0.0, Culture=neutral, PublicKeyToken=null'
      typeName='STUDENT' schemaName='SCOTT'"/>
  </settings>
</oracle.dataaccess.client>
```

## Using Custom Type Mappings

During data retrieval, the application uses the custom type mappings to convert an Oracle UDT to a custom type. When data is provided back to the database through an input or input/output parameter, or by an update through an Oracle REF, the application uses the mappings to convert the custom type to an Oracle UDT.

In the case of input and input/output parameters, the application must also set the `OracleParameter.UdtTypeName` property to the user-defined type name of the parameter.

In certain cases, where Oracle UDTs are part of a type hierarchy, the custom type must be instantiated as a specific type in the type hierarchy. The Oracle UDT provided by the custom type mapping must be a subtype of the Oracle UDT specified by the `OracleParameter.UdtTypeName` property.

For example, the parameter for a stored procedure is of type, `SCOTT.PERSON` and has a subtype, `SCOTT.STUDENT`. The application has a custom class instance that represents `SCOTT.STUDENT`. The `UdtTypeName` is set to `SCOTT.PERSON`, but the custom type mapping indicates that the custom class is mapped to `SCOTT.STUDENT` and overrides the `UdtTypeName` when it instantiates the Oracle UDT. Thus, ODP.NET instantiates and binds Oracle UDTs appropriately when the custom object represents an Oracle UDT that is a subtype of the parameter type.

## Converting Between Custom Types and Oracle UDTs

ODP.NET can convert between Oracle UDTs and custom types, if the proper attribute mappings are specified and the custom types are defined properly.

ODP.NET performs a conversion whenever an Oracle UDT is fetched as:

- In, out, in/out parameters bound for SQL or PL/SQL execution  
The `DbType` property of `OracleParameter` must be set to `DbType.Object` or the `OracleDbType` property must be set to `OracleDbType.Object` or `OracleDbType.Array`.  
For parameters that are user-defined types, the `UdtTypeName` property of the `OracleParameter` object must be always set to the parameter type.  
**Note:** The `UdtTypeName` may differ from the Oracle UDT specified in the custom type mapping. This is the case when the parameter type is a super type of the Oracle UDT that the custom type represents.
- Column value retrieved from an `OracleDataReader` object  
If the application requests for the value either through the `GetValue`, `GetValues`, `GetOracleValue`, `GetOracleValues`, `GetProviderSpecificValue`, or `GetProviderSpecificValues` methods or the `Item[]` property for a UDT column, ODP.NET finds the corresponding custom type that represents the Oracle UDT and carries out the proper conversion.
- Part of a Resultset that populates the `DataSet`  
If the application populates the `DataSet` with a result that contains UDTs using the `Fill` method on the `OracleDataAdapter`, the `DataSet` is populated with custom types that represent Oracle UDTs. With ADO.NET 2.0, the `DataSet` is populated with custom types for UDT columns regardless of whether the `ReturnProviderSpecificTypes` on the `OracleDataAdapter` is set to `true` or `false`.
- A Object referenced through a REF  
When an Object referenced by a REF is retrieved, the custom type that represents the Oracle UDT is returned.  
The application can use the `OracleUdtFetchOption` method to control the copy of the Object that is returned as follows:
  - If the `OracleUdtFetchOption.Cache` option is specified and a cached copy of the object exists, the cached copy is immediately returned. If no cached copy exists, the latest object copy from the database is cached and returned.
  - If the `OracleUdtFetchOption.Server` option is specified, the latest object copy from the database is cached and returned. If the object is already cached, the latest object copy overwrites the existing one.
  - If the `OracleUdtFetchOption.TransactionCache` option is specified, there are two possibilities within the same transaction:
    - \* If the object copy was previously retrieved using the `Server` or `TransactionCache` option, the `TransactionCache` option behavior becomes equivalent to the `Cache` option behavior.

- \* If the object copy was not previously retrieved using the `Server` or `TransactionCache` option, the `TransactionCache` option behavior becomes equivalent to the `Server` option behavior.

## Oracle UDT Attribute Mappings

[Table 3-23](#) lists valid mappings of attributes (for objects) and elements (for collections), between Oracle UDT types and custom object types which can be either .NET types or Oracle provider-specific types (ODP.NET types).

Oracle collections do not have to map to a custom class. They can map to arrays of a specific type. [Table 3-23](#) indicates those collections with elements of a specified Oracle type that can map to arrays of a .NET Type or a provider-specific type. For example, if an Oracle Collection is a `VARRAY` of `NUMBER(8)`, it can map to a `typeof(int[])`. This eliminates the need to construct a class that only holds an `int[]`.

For .NET 2.0, Oracle Collections can be mapped to Nullable types. This allows .NET 2.0 applications to obtain a nullable `int[]` which can hold null values in the `int[]`.

Note that Oracle UDT attributes and elements cannot be mapped to `object` or `object[]`.

**Table 3-23 Attribute Mappings Between UDTs and Custom Object Types**

Type of UDT Attribute or Element	.NET Type	ODP.NET Type
BFILE	<code>System.Byte[]</code>	<code>OracleBFile</code>
BINARY FLOAT	<code>System.Byte</code> , <code>System.Int16</code> , <code>System.Int32</code> , <code>System.Int64</code> , <code>System.Single</code> , <code>System.Double</code> , <code>System.Decimal</code>	<code>OracleDecimal</code>
BINARY DOUBLE	<code>System.Byte</code> , <code>System.Int16</code> , <code>System.Int32</code> , <code>System.Int64</code> , <code>System.Single</code> , <code>System.Double</code> , <code>System.Decimal</code>	<code>OracleDecimal</code>
BLOB	<code>System.Byte[]</code>	<code>OracleBlob</code>
CHAR	<code>System.Char[]</code> , <code>System.String</code>	<code>OracleString</code>
CLOB	<code>System.Char[]</code> , <code>System.String</code>	<code>OracleClob</code>
DATE	<code>System.DateTime</code>	<code>OracleDate</code>
INTERVAL DAY TO SECOND	<code>System.TimeSpan</code> ,	<code>OracleIntervalDS</code>
INTERVAL YEAR TO MONTH	<code>System.Int64</code>	<code>OracleIntervalYM</code>
LONG RAW	<code>System.Byte[]</code>	<code>OracleBinary</code>
NCHAR	<code>System.Char[]</code> , <code>System.String</code>	<code>OracleString</code>

**Table 3-23 (Cont.) Attribute Mappings Between UDTs and Custom Object Types**

Type of UDT Attribute or Element	.NET Type	ODP.NET Type
NCLOB	System.Char[], System.String	OracleClob
Nested Table	<i>custom type, .NET type[], or custom type[]</i>	<i>ODP Type[]</i>
NUMBER	System.Byte, System.Int16, System.Int32, System.Int64, System.Single, System.Double, System.Decimal	OracleDecimal
NVARCHAR2	System.Char[], System.String	OracleString
Object Type	<i>custom type</i>	N/A
RAW	System.Byte[]	OracleBinary
REF	System.String	OracleRef
TIMESTAMP	System.DateTime	OracleTimeStamp
TIMESTAMP WITH LOCAL TIME ZONE	System.DateTime	OracleTimeStampLTZ
TIMESTAMP WITH TIME ZONE	System.DateTime	OracleTimeStampTZ
VARCHAR2	System.Char[], System.String	OracleString
VARRAY	<i>custom type, .NET type[], or custom type[]</i>	<i>ODP Type[]</i>
XMLTYPE	System.Char[], System.String	OracleXmlType

**Notes:**

1. Conversion from a `System.Byte[]` to a BFILE is not supported, and therefore, `System.Byte[]` only represents a BFILE in read-only scenarios.

## Oracle UDT Retrieval from OracleDataReader

In order to retrieve Oracle UDTs from the `OracleDataReader`, an application must specify a custom type mapping that determines the type that will represent the Oracle UDT. Once a custom type mapping has been specified and any necessary custom types have been created, the application can retrieve Oracle UDTs.

[Table 3-24](#) shows the type and value returned from an `OracleDataReader` object based on the method invoked, the column type, and whether or not there is a valid Custom type mapping.



**Note:**

*PS Object* refers to a provider-specific object.

**Table 3-24 Type and Value Returned from OracleDataReader Object**

OracleDataReader method/ property invocation	Column Data Type	Custom Type Mapping	Value Returned for Oracle UDT	NULL Value Returned for Oracle UDT
Item[index], Item[name], GetValue(), GetValues()	Object, Collection	none	Exception thrown	Exception thrown
Item[index], Item[name], GetValue(), GetValues()	Object	<i>schema.type</i>	<i>custom object</i>	DBNull.Value
Item[index], Item[name], GetValue(), GetValues()	Collection	<i>schema.type</i>	<i>custom object</i>   <i>custom object[]</i>   <i>.NET Type[]</i>   <i>PS</i> <i>object[]</i>	DBNull.Value
Item[index], Item[name], GetValue(), GetValues()	REF	none   <i>schema.type</i>	<i>string</i> (HEX)	DBNull.Value
GetString()	REF	none   <i>schema.type</i>	<i>string</i> (HEX)	Exception thrown
GetProviderSpecificVal ue(), GetProviderSpecificVal ues(), GetOracleValue(), GetOracleValues()	Object, Collection	<i>schema.type</i>	<i>custom object</i>	<i>custom</i> <i>type.Null</i>
GetProviderSpecificVal ue(), GetProviderSpecificVal ues(), GetOracleValue(), GetOracleValues()	Collection	<i>schema.type</i>	<i>custom object[]</i>   <i>.NET Type[]</i>   <i>PS</i> <i>object[]</i>	null
GetProviderSpecificVal ue(), GetProviderSpecificVal ues(), GetOracleValue(), GetOracleValues(), GetOracleRef()	REF	none   <i>schema.type</i>	OracleRef	OracleRef.Null
GetOracleString()	REF	none   <i>schema.type</i>	OracleString (HEX)	OracleString.N ull



**See Also:**

"Obtaining Data from an OracleDataReader Object"

## Oracle UDT Metadata Retrieval from OracleDataReader

An `OracleDataReader` object can return metadata used to determine the custom type that represents an Oracle UDT when a .NET Type or Provider-Specific Type accessor is invoked. The same custom type is used when populating the `DataSet` using the `OracleDataAdapter.Fill` method.

[Table 3-25](#) shows the values returned from the `OracleDataReader` `GetFieldType` and `GetProviderSpecificFieldType` methods that specify the .NET type of the column.

**Table 3-25 Values Returned from OracleDataReader Methods**

OracleDataReader Method/Property invocation	Column Data Type	Custom Type Mapping	Return Value
<code>GetFieldType(index)</code>	Object, Collection	none	Exception thrown
<code>GetFieldType(index)</code>	Object	<i>schema.type</i>	<code>typeof(custom type)</code>
<code>GetFieldType(index)</code>	Collection	<i>schema.type</i>	<code>typeof(custom type)   typeof(custom type[])   typeof(.NET type[])   typeof(PS type[])</code>
<code>GetFieldType(index)</code>	REF	none   <i>schema.type</i>	<code>typeof(string)</code>
<code>GetProviderSpecificFieldType(index)</code>	Object, Collection	none	Exception thrown
<code>GetProviderSpecificFieldType(index)</code>	Object,	<i>schema.type</i>	<code>typeof(custom type)</code>
<code>GetProviderSpecificFieldType(index)</code>	Collection	<i>schema.type</i>	<code>typeof(custom type)   typeof(custom type[])   typeof(.NET type[])   typeof(PS type[])</code>
<code>GetProviderSpecificFieldType(index)</code>	REF	none   <i>schema.type</i>	<code>typeof(OracleRef)</code>

## Oracle UDT Parameter Binding with OracleParameter

This section discusses using UDT output and input parameter bindings with an `OracleParameter` object.

 **See Also:**  
"Parameter Binding"

This section contains these topics:

- [Guidelines for Binding UDT Input and Output Parameters](#)

- [UDT Input Parameter Binding with OracleParameters](#)
- [UDT Output Parameter Binding with OracleParameters](#)

## Guidelines for Binding UDT Input and Output Parameters

Developers must consider the following when using UDT parameter bindings with an `OracleParameter` object.

- The `UdtTypeName` property must be set. Binding is based on the `UdtTypeName` property regardless of the parameter direction.

### Note:

The `UdtTypeName` may differ from the Oracle UDT specified in the custom type mapping. This occurs when the parameter type is a super type of the Oracle UDT that the custom type represents.

- In case of Input/Output binding, the behavior is the same as Input and Output parameters.
- For Input parameter values, the bind value is converted to the UDT specified by the custom type mapping.
- For Output parameters:
  - If the value being returned is an Oracle Object or Collection, it is converted to a custom type or array type as specified by the custom type mapping. The value returned is always a custom type or an array type, regardless of whether the property most recently set was `DbType` or `OracleDbType`.
  - If the value being returned is a `REF`, then no custom type mapping is required.

## UDT Input Parameter Binding with OracleParameters

Only certain combinations of these `OracleParameter` property values, `DbType`, `OracleDbType`, and `UdtTypeName`, can exist on the `OracleParameter` object. `OracleParameter` objects cannot be set to combinations that are not listed.

[Table 3-26](#) describes the valid ways of binding input parameters for Oracle UDTs.

The last column indicates the Oracle type that ODP.NET converts the `OracleParameter` value to before binding.

**Table 3-26 Valid Ways to Bind Input Parameters for Oracle UDTs**

OracleParameter. Value	OracleParameter. DbType or OracleParameter. OracleDbType	OracleParameter . UdtTypeName	Custom Type Mappings	Oracle Type converted to before Binding
<i>custom object</i>   <i>custom object[]</i>   <i>.NET object[]</i>   <i>PS object[]</i>   String (HEX)   OracleString(HE X)   OracleRef	DbType.Object   OracleDbType.Object   OracleDbType.Array   OracleDbType.Ref	not set	none   <i>schema.type</i>	Exception thrown
<i>custom object[]</i>   <i>.NET object[]</i>   <i>PS object[]</i>	DbType.Object   OracleDbType.Object   OracleDbType.Array	<i>schema.type</i>	none	Exception thrown
<i>custom object</i>	DbType.Object	<i>schema.type</i>	<i>schema.type</i>	Specified UDT is instantiated. Value is bound as Object or Collection, based on the UdtTypeName property
<i>custom object</i>	OracleDbType.Object	<i>schema.type</i>	<i>schema.type</i>	Specified UDT is instantiated. <i>schema.type</i> must represent an object.
<i>custom object</i>	OracleDbType.Array	<i>schema.type</i>	<i>schema.type</i>	Specified UDT is instantiated. <i>schema.type</i> must represent a collection.
<i>.NET object[]</i>   <i>PS object[]</i>   <i>custom object[]</i>	DbType.Object   OracleDbType.Array	<i>schema.type</i>	<i>schema.type</i>	UDT specified by OracleParameter.UdtTy peName is instantiated.
<i>.NET object[]</i>   <i>PS object[]</i>   <i>custom object[]</i>	OracleDbType.Object	<i>schema.type</i>	none   <i>schema.type</i>	Exception thrown
<i>custom object</i>   <i>.NET object[]</i>   <i>PS object[]</i>   <i>custom object[]</i>	OracleDbType.Ref	<i>schema.type</i>	none   <i>schema.type</i>	Exception thrown
String (HEX)   OracleString (HEX)   OracleRef	DbType.Object   OracleDbType.Object   OracleDbType.Array	<i>schema.type</i>	none   <i>schema.type</i>	Exception thrown
Char[] (HEX)   String (HEX)   OracleString (HEX)   OracleRef	OracleDbType.Ref	<i>schema.type</i>	none   <i>schema.type</i>	A REF

## UDT Output Parameter Binding with OracleParameters

Only certain combinations of these `OracleParameter` property values, `DbType`, `OracleDbType`, and `UdtTypeName`, can exist on the `OracleParameter` object. `OracleParameter` objects cannot be set to combinations that are not listed.

Table 3-27 shows the supported ODP.NET output parameter bindings of Oracle database objects.

The last column indicates the type that ODP.NET converts the `OracleParameter` value to before binding.

**Table 3-27 Valid Ways to Bind Output Parameters for Oracle UDTs**

Type returned from Oracle	<code>OracleParameter.DbType</code>	<code>OracleParameter.UdtTypeName</code>	Custom Type Mappings	Type converted to
Object/ Collection/REF	<code>DbType.Object</code>   <code>OracleDbType.Object</code>   <code>OracleDbType.Array</code>   <code>OracleDbType.Ref</code>	not set	none   <code>schema.type</code>	Exception thrown
Object/ Collection	<code>DbType.Object</code>   <code>OracleDbType.Object</code>   <code>OracleDbType.Array</code>	<code>schema.type</code>	none	Exception thrown
Object	<code>DbType.Object</code>   <code>OracleDbType.Object</code>	<code>schema.type</code>	<code>schema.type</code>	<i>custom object</i>
Object	<code>OracleDbType.Array</code>   <code>OracleDbType.Ref</code>	<code>schema.type</code>	none   <code>schema.type</code>	Exception thrown
Collection	<code>OracleDbType.Array</code>   <code>DbType.Object</code>	<code>schema.type</code>	<code>schema.type</code>	<i>custom object</i>   <i>custom object[]</i>   <i>.NET object[]</i>   <i>PS object[]</i>
Collection	<code>OracleDbType.Ref</code>   <code>OracleDbType.Object</code>	<code>schema.type</code>	none   <code>schema.type</code>	Exception thrown
REF	<code>DbType.Object</code>   <code>OracleDbType.Object</code>   <code>OracleDbType.Array</code>	<code>schema.type</code>	none   <code>schema.type</code>	Exception thrown
REF	<code>OracleDbType.Ref</code>	<code>schema.type</code>	none   <code>schema.type</code>	<code>OracleRef</code>

#### See Also:

- ["Parameter Binding"](#)
- ["Typed OracleDataReader Accessors"](#)

## Populating the DataSet with Oracle UDTs

The `DataSet` is a disconnected result set. With ADO.NET 2.0, both .NET types and provider-specific types can be used to populate the `DataSet`. This section describes the types used to populate the `DataSet` when the column is an Oracle UDT.

Table 3-28 lists the types that populate the `DataSet` column, based on the Oracle column type, the `ReturnProviderSpecificTypes` property of the `DataAdapter`, the existence of a custom type mapping, the `DataSet` column type, the `DataSet` column value, and the `DataSet` column null value.

**Table 3-28** Types that Populate the DataSet with ADO.NET 2.0

Oracle Column Type	ReturnProvider-SpecificTypes Property	Custom Type Mappings	DataSet Column Type	DataSet Column Value	DataSet Column Null Value
Object / Collection	False/True	none	Exception thrown	Exception thrown	Exception thrown
Object / Collection	False	schema.type	typeof(custom type)	custom object	DBNull.Value
Object / Collection	True	schema.type	typeof(custom type)	custom object	custom object.Null
Collection	False	schema.type	typeof(custom type[])  typeof(.NET type[]) typeof(PS type[])	.NET type[] PS object[] custom object[]	DBNull.Value
Collection	True	schema.type	typeof(custom type[])  typeof(.NET type[]) typeof(PS type[])	.NET type[] PS object[] custom object[]	null
REF	False	none   schema.type	typeof(string)	string/HEX	DBNull.Value
REF	True	none   schema.type	typeof(OracleRef)	OracleRef	OracleRef.Null

## UDT Method Invocation

ODP.NET supports invocation of methods defined for a UDT on the database. This can be accomplished by doing the following:

1. Set the `CommandType` as `CommandType.StoredProcedure`.
2. Set the `CommandText` as `"type_name.procedure_name"`
3. Execute the command using any of the `Execute` methods on the `OracleCommand` object.

For instance functions, the parameters are as follows:

- The first parameter must be the return value.
- The second parameter must be the UDT instance on which the instance method is invoked, which is the instance of the .NET custom object.
- Subsequent parameters are for the function.

For instance procedures, the first parameter must be the UDT instance.

For static methods, the UDT instance is not needed.

## Configuration Settings for Oracle UDTs

ODP.NET exposes two configuration settings to determine how ODP.NET handles Oracle UDTs.

- [StatementCacheWithUdts](#)
- [UdtCacheSize](#)

These configuration settings can be specified as machine-wide settings for a particular version of ODP.NET, using the registry key with the name that exists under `HKEY_LOCAL_MACHINE\SOFTWARE\ORACLE\ODP.NET\Assembly_Version`. The configuration settings specified in the registry can be overridden if an entry is created in the `machine.config` for .NET framework-wide settings, or in the `app.config` or `web.config` for application-specific settings.



### See Also:

[Configuring Oracle Data Provider for .NET](#) for details on configuring ODP.NET.

## StatementCacheWithUdts

`StatementCacheWithUdts` specifies whether or not ODP.NET caches Oracle UDTs retrieved by a `SELECT` statement along with the statement when it is returned to the statement cache. Possible values are 1 - Yes (the default) or 0 - No.

For the value of 1, the Oracle UDTs are cached along with the statements. Therefore, the memory that contained the UDTs can be re-used; subsequent executions of the same statement do not require additional memory. This may result in an overall higher performance.

For the value of 0, ODP.NET frees the memory for the retrieved Oracle UDTs before the statement is returned to the statement cache. This may result in poorer performance because subsequent executions will require new memory allocations.

## UdtCacheSize

`UdtCacheSize` specifies the size of the object cache for each connection that ODP.NET uses when retrieving and manipulating Oracle UDTs. The value for this setting must be specified in kilobytes (KB) with the default 4096KB, equivalent to 4 MB.

This configuration setting is used to determine how frequently the objects in the object cache will be purged (using an LRU approach) as the limit of the object cache size approaches.

## Using UDTs with Managed ODP.NET and ODP.NET Core

Managed ODP.NET and ODP.NET Core support the same or similar UDT APIs and features as unmanaged ODP.NET. The differences are listed in this documentation section.

Managed ODP.NET and ODP.NET Core UDT features require connecting to Oracle Database 12.1 or higher versions.

## XML Configuration Files Not Supported

Managed ODP.NET and ODP.NET Core do not support Oracle custom type mapping via XML configuration files, such as in `app.config` or `web.config`. For these providers, custom type mapping occurs through using the `OracleCustomTypeMapping` attribute.

## OracleUdt FromCustomObject and ToCustomObject Method Changes

The unmanaged ODP.NET `OracleUdt FromCustomObject` and `ToCustomObject` method declarations are as follows:

- `FromCustomObject(OracleConnection con, IntPtr pObject)`
- `ToCustomObject(OracleConnection con, IntPtr pObject)`

For managed ODP.NET and ODP.NET Core, the declarations are, respectively:

- `FromCustomObject(OracleConnection con, object pObject)`
- `ToCustomObject(OracleConnection con, object pObject)`

The second parameter is an object instead of a pointer.

## OracleUdt Static Methods

`OracleUdt` static methods, `GetValue`, `IsDBNull`, and `SetValue`, and their overloads all have one `IntPtr` parameter. For managed ODP.NET and ODP.NET Core, the `IntPtr` is replaced with an object that represents the UDT. In unmanaged ODP.NET, the static methods are as follows:

- `GetValue`
  - `GetValue(OracleConnection con, IntPtr pUdt, string attrName)`
  - `GetValue(OracleConnection con, IntPtr pUdt, int attrIndex)`
  - `GetValue(OracleConnection con, IntPtr pUdt, string attrName, out object statusArray)`
  - `GetValue(OracleConnection con, IntPtr pUdt, int attrIndex, out object statusArray)`
- `IsDBNull`
  - `IsDBNull(OracleConnection con, IntPtr pUdt, string attrName)`
  - `IsDBNull(OracleConnection con, IntPtr pUdt, int attrIndex)`
- `SetValue`
  - `SetValue(OracleConnection con, IntPtr pUdt, string attrName, object value)`
  - `SetValue(OracleConnection con, IntPtr pUdt, int attrIndex, object value)`
  - `SetValue(OracleConnection con, IntPtr pUdt, string attrName, object value, object statusArray)`
  - `SetValue(OracleConnection con, IntPtr pUdt, int attrIndex, object value, object statusArray)`

The managed ODP.NET and ODP.NET Core static methods are, respectively:

- GetValue
  - GetValue(OracleConnection con, object udt, string attrName)
  - GetValue(OracleConnection con, object udt, int attrIndex)
  - GetValue(OracleConnection con, object udt, string attrName, out object statusArray)
  - GetValue(OracleConnection con, object udt, int attrIndex, out object statusArray)
- IsDBNull
  - IsDBNull(OracleConnection con, object udt, string attrName)
  - IsDBNull(OracleConnection con, object udt, int attrIndex)
- SetValue
  - SetValue(OracleConnection con, object udt, string attrName, object value)
  - SetValue(OracleConnection con, object udt, int attrIndex, object value)
  - SetValue(OracleConnection con, object udt, string attrName, object value, object statusArray)
  - SetValue(OracleConnection con, object udt, int attrIndex, object value, object statusArray)

### OracleConnection Class Changes

Managed ODP.NET and ODP.NET Core do not support the following `OracleConnection` method:

- FlushCache()

### OracleRef Class Changes

Managed ODP.NET and ODP.NET Core do not support object caches and other functionality without a managed code implementation. Thus, the following unmanaged ODP.NET class members are *not* supported in managed and core:

- Constructors
  - OracleRef(OracleConnection conn, string udtTypeName, string objTableName)
  - OracleRef(OracleConnection conn, string hexStr)
- Methods
  - Flush()
  - GetCustomObject(OracleUdtFetchOption fetchOption, int depthLevel)
  - GetCustomObjectForUpdate(bool bWait)
  - GetCustomObjectForUpdate(bool bWait, int depthLevel)
  - Lock(bool bWait)
- Properties
  - HasChanges {get}

– ObjectTableName {get}

The following `OracleRef` class members are supported in a modified manner:

**Table 3-29 OracleRef class members**

Method in Unmanaged	Equivalent Core/Managed Method	Core/Managed Behavior
Delete (bool bFlush)	Delete ()	Equivalent to Delete (true) in unmanaged ODP.NET.
GetCustomObject (OracleUdt dtFetchOption fetchOption)	GetCustomObject ()	Always retrieves object from database. No object cache.
Update (object customObject, bool bFlush)	Update (object customObject)	Equivalent to Update (customObject, true) in unmanaged ODP.NET.

## Migrating from Unmanaged ODP.NET to Managed or Core

The following changes are required to migrate UDT applications from unmanaged ODP.NET to either managed ODP.NET or ODP.NET Core:

- **Assembly:** Reference managed ODP.NET or ODP.NET Core assembly (i.e. `Oracle.ManagedDataAccess.dll`) in your .NET project.
- **Namespace:** Use the `Oracle.ManagedDataAccess.*` namespace in your source files.
- **Configuration:** Use `OracleCustomTypeMapping` attribute to define the custom type mapping.
- **API:** Use the managed/core `OracleUdt FromCustomObject` and `ToCustomObject` methods in the custom class.
- **API:** Use the managed/core `OracleUdt` static methods.
- **API:** Change `OracleRef` class invocation, including constructors, properties, and methods, to the members managed/core `OracleRef` class use.

## Handling NULL Attribute Values in UDTs

A UDT attribute can be mapped to either a .NET type or to a provider-specific type.

To be able to properly represent `NULL` UDT attribute values as .NET types within the .NET custom classes, they can be defined as nullable .NET types. For example, if the UDT has a `DATE` attribute that can be `NULL`, then it can be mapped to a `DateTime? nullable` type rather than `DateTime`. This is due to fact that `DateTime` cannot be used to represent `NULL` values.

But when it comes to mapping UDT attributes as provider-specific types, then the .NET custom classes should simply have the non-nullable provider-specific type, for example, `OracleDate`. Each provider type can represent a `NULL` value through the provider-specific type's `Null` static field, for example, `OracleDate.Null`.

## Bulk Copy

ODP.NET provides a Bulk Copy feature which enables applications to efficiently load large amounts of data from a table in one database to another table in the same or a different database.

The ODP.NET Bulk Copy feature uses a direct path load approach, which is similar to, but not the same as Oracle SQL\*Loader. Using direct path load is faster than conventional loading (using conventional SQL `INSERT` statements). Conventional loading formats Oracle data blocks and writes the data blocks directly to the data files. Bulk Copy eliminates considerable processing overhead.

The ODP.NET Bulk Copy feature can load data into older Oracle databases.

The ODP.NET Bulk Copy feature is subject to the same basic restrictions and integrity constraints for direct path loads, as discussed in the next few sections.

ODP.NET Bulk Copy supports local transactions.



### See Also:

"[System Requirements](#)" to learn which versions of the Oracle Database ODP.NET interoperates with

## Data Types Supported by Bulk Copy

Bulk Copy supports the following Oracle database data types:

- NUMBER
- BINARY\_DOUBLE
- BINARY\_FLOAT
- CHAR
- JSON
- NCHAR
- VARCHAR2
- NVARCHAR2
- LONG
- CLOB
- BLOB
- DATE
- TIMESTAMP
- TIMESTAMP WITH TIME ZONE
- TIMESTAMP WITH LOCAL TIME ZONE

- INTERVAL YEAR TO MONTH
- INTERVAL DAY TO SECOND

Bulk copy does not support overwrites.

## Restrictions on Oracle Bulk Copy of a Single Partition

- The table that contains the partition cannot have any global indexes defined on it.
- The tables that the partition is a member of cannot have referential and check constraints enabled.
- Enabled triggers are not allowed.

## Integrity Constraints Affecting Oracle Bulk Copy

During a Oracle bulk copy, some integrity constraints are automatically enabled or disabled, as follows:

### Enabled Constraints

During an Oracle bulk copy, the following constraints are automatically enabled by default:

- NOT NULL
- UNIQUE
- PRIMARY KEY (unique-constraints on not-null columns)

NOT NULL constraints are checked at column array build time. Any row that violates the NOT NULL constraint is rejected.

UNIQUE constraints are verified when indexes are rebuilt at the end of the load. The index is left in an Index Unusable state if it violates a UNIQUE constraint.

### Disabled Constraints

During an Oracle bulk copy, the following constraints are automatically disabled by default:

- CHECK constraints
- Referential constraints (FOREIGN KEY)

If the `EVALUATE CHECK_CONSTRAINTS` clause is specified, then CHECK constraints are not automatically disabled. The CHECK constraints are evaluated during a direct path load and any row that violates the CHECK constraint is rejected.

## Database Insert Triggers

Table insert triggers are disabled when a direct path load begins. After the rows are loaded and indexes rebuilt, any triggers that were disabled are automatically reenabled. The log file lists all triggers that were disabled for the load. There should be no errors reenabling triggers.

Unlike integrity constraints, insert triggers are not reapplied to the whole table when they are enabled. As a result, insert triggers do not fire for any rows loaded on the

direct path. When using the direct path, the application must ensure that any behavior associated with insert triggers is carried out for the new rows.

## Field Defaults

Default column specifications defined in the database are not available with direct path loading. Fields for which default values are desired must be specified with the `DEFAULTIF` clause. If a `DEFAULTIF` clause is not specified and the field is `NULL`, then a null value is inserted into the database.



### See Also:

[Oracle Data Provider for .NET Bulk Copy Classes](#)

## Oracle Database Advanced Queuing Support

Oracle Database Advanced Queuing (AQ) provides database-integrated message queuing functionality. Oracle Database AQ leverages the functions of Oracle Database so that messages can be stored persistently, propagated between queues on different computers and databases, and transmitted using Oracle Net Services and HTTP(S).



### Note:

ODP.NET, Managed Driver and ODP.NET Core do not support the AQ .NET classes.

As Oracle Database AQ is implemented in database tables, all operational benefits of high availability, scalability, and reliability are also applicable to queue data. Oracle Database AQ supports standard database features such as recovery, restart, and security.

The following items discuss Oracle Database AQ concepts:

- **Queues and Queue Tables**

Messages enqueued in a queue are stored in a queue table. A queue table must be created before creating a queue based on it. Use the `DBMS_AQADM` PL/SQL package or Oracle Developer Tools for Visual Studio to create and administer queue tables and queues.

Queues are represented by `OracleAQQueue` objects.
- **Single-Consumer and Multiple-Consumer Queues**

A single-consumer queue is created based on a single consumer queue table. Messages enqueued in a single-consumer queue can be dequeued by only a single consumer.

A multiple-consumer queue is based on a multiple-consumer queue table. This queue supports queue subscribers and message recipients.
- **Message Recipients**

A message producer can submit a list of recipients when enqueueing a message. This allows for a unique set of recipients for each message in the queue. The recipient list associated with the message overrides the subscriber list, if any, associated with the queue. The recipients need not be in the subscriber list. However, recipients can be selected from among the subscribers. The `Recipients` property of an `OracleAQMessage` can be used to specify the recipients to a specific message in terms of `OracleAQAgent` objects.

- Enqueue

Messages are enqueue when producer applications push the messages into a queue. This is accomplished by calling the `Enqueue` method on an `OracleAQQueue` object. Multiple messages can be enqueue using the `EnqueueArray` method.

- Dequeue

Messages are dequeue when consumer applications pull the messages from a queue. This is accomplished by calling the `Dequeue` method on an `OracleAQQueue` object. Multiple messages can be dequeue using the `DequeueArray` method.

- Listen

Subscriber applications can use a `Listen` call to monitor multiple queues for subscriptions on different queues. This is a more scalable solution for cases where a subscriber application has subscribed to many queues and wishes to receive messages that arrive in any of the queues. This is accomplished by calling the `Listen` method of the `OracleAQQueue` class, passing the list of subscriptions in form of an array.

- Notification

Subscriber applications can utilize the notification mechanism to get notifications about message availability in a queue. The applications can decide to skip or dequeue the message from the queue based on the information received.

A subscriber application must register for event notification on the queues from which it wants to receive notifications. This is represented by the `MessageAvailable` event on `OracleAQQueue`. The event is triggered when messages matching the subscriptions arrive.

Notifications can be registered as regular or grouping notifications. A time out value for these notifications can also be specified. Various notification options can be set using the `OracleAQQueue.Notification` property. Notifications set on an `OracleAQQueue` object gets cancelled automatically when the object gets disposed.

- Buffered Messaging

In buffered messaging, messages reside in a shared memory area. This makes it faster than persistent messaging. The messages are written to disk only when the total memory consumption of buffered messages approaches the available shared memory limit. Buffered messaging is ideal for applications that do not require the reliability and transaction support of Oracle Database AQ persistent messaging.

Buffered and persistent messages use the same single-consumer or multi-consumer queues, and the same administrative and operational interfaces. They are distinguished from each other by a delivery mode parameter. When an application enqueues a message to an Oracle Database AQ queue, it sets the delivery mode parameter as well.

The delivery mode parameter can be set on `OracleAQMessage` by modifying the `DeliveryMode` property. Buffered messaging is supported in all queue tables created with compatibility 8.1 or higher.



**See Also:**

- ["OracleAQQueue Class"](#)
- ["Recipients"](#)
- ["OracleAQAgent Class"](#)
- ["Enqueue"](#)
- ["EnqueueArray"](#)
- ["Dequeue"](#)
- ["DequeueArray"](#)
- ["Listen"](#)
- ["MessageAvailable Event"](#)
- ["Notification"](#)
- ["DeliveryMode"](#)
- *Oracle Database Advanced Queuing User's Guide*

## Using ODP.NET for Advanced Queuing

.NET applications can use ODP.NET to access all the operational features of AQ such as Enqueuing, Dequeuing, Listen, and Notification.

[Table 3-30](#) maps the AQ features to their corresponding ODP.NET implementation.

**Table 3-30 Mapping AQ Features with their ODP.NET Implementation**

Functionality	ODP.NET Implementation
Create a Message	Create an <code>OracleAQMessage</code> object
Enqueue a single message	Specify the message as <code>OracleAQMessage</code> , queue as <code>OracleAQQueue</code> and enqueue options on <code>OracleAQQueue</code> , call <code>OracleAQQueue.Enqueue</code>
Enqueue multiple messages	Specify the messages as an <code>OracleAQMessage</code> array in <code>OracleAQQueue.EnqueueArray</code>
Dequeue a single message	Specify dequeue options on <code>OracleAQQueue</code> and call <code>OracleAQQueue.Dequeue</code>
Dequeue multiple messages	Call <code>OracleAQQueue.DequeueArray</code>
Listen for messages on Queue(s)	Call <code>OracleAQQueue.Listen</code> . To listen on multiple queues use static <code>Listen</code> method of <code>OracleAQQueue</code>
Message Notifications	Use <code>OracleAQQueue.MessageAvailable Event</code> along with the <code>NotificationConsumers</code> property

 **Note:**

AQ samples are provided in the `ORACLE_BASE\ORACLE_HOME\ODP.NET\Samples` directory in ODAC installations done using Oracle Universal Installer.

## Enqueuing and Dequeuing Example

The following example demonstrates enqueuing and dequeuing messages using a single consumer queue. The first part of the example performs the requisite database setup for the database user, SCOTT. The second part of the example demonstrates enqueuing and dequeuing messages.

```
-- Part I: Database setup required for this demo

-----
-- SQL to grant appropriate privilege to database user, SCOTT
-----
SQL> ALTER USER SCOTT ACCOUNT UNLOCK IDENTIFIED BY Pwd4Sct;
User altered.
SQL> GRANT ALL ON DBMS_AQADM TO scott;

-----
-- PL/SQL to create queue-table and queue and start queue for SCOTT
-----
BEGIN
  DBMS_AQADM.CREATE_QUEUE_TABLE(
    queue_table=>'scott.test_q_tab',
    queue_payload_type=>'RAW',
    multiple_consumers=>FALSE);

  DBMS_AQADM.CREATE_QUEUE(
    queue_name=>'scott.test_q',
    queue_table=>'scott.test_q_tab');

  DBMS_AQADM.START_QUEUE(queue_name=>'scott.test_q');
END;
/

-----
-- PL/SQL to stop queue and drop queue & queue-table from SCOTT
-----
BEGIN
  DBMS_AQADM.STOP_QUEUE('scott.test_q');

  DBMS_AQADM.DROP_QUEUE(
    queue_name => 'scott.test_q',
    auto_commit => TRUE);

  DBMS_AQADM.DROP_QUEUE_TABLE(
    queue_table => 'scott.test_q_tab',
    force => FALSE,
    auto_commit => TRUE);
END;
/
-- End of Part I, database setup.
```

```
//Part II: Enqueuing and dequeuing messages
//C#
using System;
using System.Text;
using Oracle.DataAccess.Client;
using Oracle.DataAccess.Types;

namespace ODPSample
{
    /// <summary>
    /// Demonstrates Enqueuing and Dequeuing raw message
    /// using a single consumer queue
    /// </summary>
    class EnqueueDequeue
    {
        static void Main(string[] args)
        {
            // Create connection
            string constr = "user id=scott;password=Pwd4Sct;data source=oracle";
            OracleConnection con = new OracleConnection(constr);

            // Create queue
            OracleAQQueue queue = new OracleAQQueue("scott.test_q", con);

            try
            {
                // Open connection
                con.Open();

                // Begin txn for enqueue
                OracleTransaction txn = con.BeginTransaction();

                // Set message type for the queue
                queue.MessageType = OracleAQMessageType.Raw;

                // Prepare message and RAW payload
                OracleAQMessage enqMsg = new OracleAQMessage();
                byte[] bytePayload = { 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 };
                enqMsg.Payload = bytePayload;

                // Prepare to Enqueue
                queue.EnqueueOptions.Visibility = OracleAQVisibilityMode.OnCommit;

                // Enqueue message
                queue.Enqueue(enqMsg);

                Console.WriteLine("Enqueued Message Payload      : "
                    + ByteArrayToString(enqMsg.Payload as byte[]));
                Console.WriteLine("MessageId of Enqueued Message : "
                    + ByteArrayToString(enqMsg.MessageId));

                // Enqueue txn commit
                txn.Commit();

                // Begin txn for Dequeue
                txn = con.BeginTransaction();

                // Prepare to Dequeue
                queue.DequeueOptions.Visibility = OracleAQVisibilityMode.OnCommit;
                queue.DequeueOptions.Wait = 10;
            }
        }
    }
}
```

```
// Dequeue message
OracleAQMessage deqMsg = queue.Dequeue();

Console.WriteLine("Dequeued Message Payload      : "
    + ByteArrayToString(deqMsg.Payload as byte[]));
Console.WriteLine("MessageId of Dequeued Message : "
    + ByteArrayToString(deqMsg.MessageId));

// Dequeue txn commit
txn.Commit();
}
catch (Exception e)
{
    Console.WriteLine("Error: {0}", e.Message);
}
finally
{
    // Close/Dispose objects
    queue.Dispose();
    con.Close();
    con.Dispose();
}
}

// Function to convert byte[] to string
static private string ByteArrayToString(byte[] byteArray)
{
    StringBuilder sb = new StringBuilder();
    for (int n = 0; n < byteArray.Length; n++)
    {
        sb.Append((int.Parse(byteArray[n].ToString()).ToString("X"));
    }
    return sb.ToString();
}
}
```

## Continuous Query Notification Support

Oracle Data Provider for .NET provides a notification framework that supports Continuous Query Notification, enabling applications to receive client-side notifications when there is a change in a query result set, schema objects, or the state of the database, even if no Oracle Data Provider for .NET database connection exists. Using Continuous Query Notification, an application can maintain the validity of the client-side cache (for example, the ADO.NET `DataSet`) easily. Continuous Query Notification was previously known as Database Change Notification.



### Note:

Continuous Query Notification is not supported in a .NET stored procedure.

Using the notification framework, applications can specify a query result set as a registered query for notification request on the database, and create this notification registration to maintain the validity of the query result set. When there is a change on

the database that could affect the client-side cache's query results, the notification framework notifies the application.

 **Note:**

The content of a change notification is referred to as an *invalidation message*. It indicates that the query result set is now invalid and provides information about the changes.

Based on the information provided by the invalidation message, the application can then act accordingly. For example, the application might need to refresh its own copy of the data for the registered query that is stored locally in the application.

 **Note:**

If a registered object is dropped from the database and a new one is created with the same name in the same schema, re-registration is required to receive notifications for the newly created object.

Firewalls, such as Windows Firewall, may be set up to block TCP network ports, which blocks incoming database notifications. Ensure the firewall is configured so that database applications can use the designated port for Continuous Query Notification. If the firewall configuration cannot be changed to allow notifications be sent to the client, consider enabling Client Initiated Continuous Query Notifications.

Continuous Query Notification queries can be query-based (default) or object-based. The query-based registrations allow ODP.NET to notify applications when the selected rows have changed in the database. The object-based registrations allow ODP.NET to notify applications for any changes that occur in the table(s) containing the selected rows.

Query-based registrations have two modes: guaranteed mode and best-effort mode. In guaranteed mode, any continuous query notification ensures that a change occurred to something contained in the queried result set. However, if a query is complex, then it cannot be registered in guaranteed mode. Best-effort mode is used in such cases.

Best-effort mode simplifies the query for query-based registration. No notifications are lost from the simplification. However, the simplification may cause false positives, as the simpler version's query result could change when the original query result would not. There still remain some restrictions on which queries can have best-effort mode query-based registrations. In such cases, developers can use object-based registrations, which can register most query types. Object-based registrations generate notifications when the query object changes, even if the actual query result does not. This also means that object-based registrations are more prone to false positives than query-based registrations. Developers should be aware of the relative strengths and weaknesses of each continuous query notification option and choose the one that best suits their requirements.

If a large number of rows are modified at once, consuming significant shared pool resources, the application will not receive any change notifications with specific row information that had undergone changes. Rather, it will receive a notification with

`OracleNotificationEventArgs.Info` property set to `OracleNotificationInfo.Error`.

This section contains the following topics:

- [Client Initiated Continuous Query Notifications](#)
- [Continuous Query Notification Classes](#)
- [Supported Operations](#)
- [Requirements of Notification Registration](#)
- [Using Continuous Query Notification](#)
- [Continuous Query Notification Support](#)
- [Best Practice Guidelines and Performance Considerations](#)

#### See Also:

- [Configuring a Port to Listen for Database Notifications](#)
- *Oracle Database Administrator's Reference for Microsoft Windows* for details on configuring the Windows Firewall
- *Oracle Database Development Guide* for more information on Continuous Query Notification

## Client Initiated Continuous Query Notifications

ODP.NET 21c introduces support for Client Initiated Continuous Query Notifications (CICQN). Traditional Continuous Query Notification (CQN) communicates database change notifications back to clients using a listening end point, a client's IP/hostname and a port. In cloud deployments or when firewalls between the database server and client cannot be configured to permit messages to the listening end point, these notifications will be blocked.

CICQN uses a dedicated connection instead of the listening end point. This connection aggregates all the database change notifications for the pool's users. ODP.NET attempts to always keep this connection open. It does not count toward `Min Pool Size` and `Max Pool Size` limits.

ODP.NET CICQN requires Oracle Database 21c or higher. It can be enabled by setting the `OracleConfiguration.UseClientInitiatedCQN` static Boolean property or .NET Framework configuration file `UseClientInitiatedCQN` setting to `true`. By default, it is `false`.

For most on-premises deployments, traditional CQN is recommended.

## Continuous Query Notification Classes

The following classes are associated with Continuous Query Notification Support:

- `OracleDependency`

Represents a dependency between an application and an Oracle database based on the database events which the application is interested in. It contains information about the dependency and provides the mechanism to notify the

application when specified database events occurs. The `OracleDependency` class is also responsible for creating the notification listener to listen for database notifications. There is only one database notification listener for each application domain. This notification listener terminates when the application process terminates.

The dependency between the application and the database is not established when the `OracleDependency` object is created. The dependency is established when the command that is associated with this `OracleDependency` object is executed. That command execution creates a continuous query notification registration in the database.

When a change has occurred in the database, the `HasChanges` property of the `OracleDependency` object is set to `true`. Furthermore, if an event handler was registered with the `OnChange` event of the `OracleDependency` object, the registered event handler function will be invoked.

- `OracleNotificationRequest`

Represents a notification request to be registered in the database. It contains information about the request and the properties of the notification.

- `OracleNotificationEventArgs`

Represents the [invalidation message](#) generated for a notification when a specified database event occurs and contains details about that database event.

#### See Also:

- ["OracleDependency Class"](#)
- ["OracleNotificationRequest Class"](#)
- ["OracleNotificationEventArgs Class"](#)

## Supported Operations

The ODP.NET notification framework in conjunction with Continuous Query Notification supports the following activities:

- Creating a notification registration by:
  - Creating an `OracleDependency` instance and binding it to an `OracleCommand` instance.
- Grouping multiple notification requests into one registration by:
  - Using the `OracleDependency.AddCommandDependency` method.
  - Setting the `OracleCommand.Notification` request using the same `OracleNotificationRequest` instance.
- Registering for Continuous Query Notification by:
  - Executing the `OracleCommand`. If either the notification property is null or `NotificationAutoEnlist` is `false`, the notification will not be made.
- Removing notification registration by:
  - Using the `OracleDependency.RemoveRegistration` method.
  - Setting the `Timeout` property in the `OracleNotificationRequest` instance before the registration is created.

- Setting the `IsNotifiedOnce` property to `true` in the `OracleNotificationRequest` instance before the registration is created. The registration is removed once a database notification is sent.
- Ensuring Change Notification Persistence by:
  - Specifying whether or not the invalidation message is queued persistently in the database before delivery. If an invalidation message is to be stored persistently in the database, then the change notification is guaranteed to be sent. If an invalidation message is stored in an in-memory queue, the change notification can be received faster, however, it could be lost upon database shutdown or crashes.
- Retrieving notification information including:
  - The changed object name.
  - The schema name of the changed object.
  - Database events that cause the notification, such as insert, delete, and so on.
  - The `RowID` of the modified object row.

In Oracle SQL, the `ROWIDTOCHAR (ROWID)` and `ROWIDTONCHAR (ROWID)` functions convert a `ROWID` value to `VARCHAR2` and `NVARCHAR` data types, respectively. If these functions are used within a SQL statement, `ROWIDs` are not returned in the `OracleNotificationEventArgs` object that is passed to the continuous query notification callback.

- Defining the listener port number.

By default, the static `OracleDependency.Port` property is set to `-1`. This indicates that the ODP.NET listens on a port that is randomly picked when ODP.NET registers a continuous query notification request for the first time during the execution of an application.

ODP.NET creates only one listener that listens on one port within an application domain. Once ODP.NET starts the listener, the port number cannot be changed; Changes to the static `OracleDependency.Port` property will generate an error if a listener has already been created.



#### See Also:

- ["OracleCommand Class"](#)
- ["Notification"](#)
- ["NotificationAutoEnlist"](#)
- ["OracleDependency Class"](#)
- ["OracleNotificationEventArgs Class"](#)

## Requirements of Notification Registration

The connected user must have the `CHANGE NOTIFICATION` privilege to create a notification registration.

This SQL statement grants the `CHANGE NOTIFICATION` privilege:

```
grant change notification to user name
```

This SQL statement revokes the `CHANGE NOTIFICATION` privilege:

```
revoke change notification from user name
```

## Using Continuous Query Notification

This section describes what the application should do, and the flow of the process, when an application uses Continuous Query Notification to receive notifications for any changes in the registered query result set.

### Application Steps

The application should do the following:

1. Create an `OracleDependency` instance.
2. Assign an event handler to the `OracleDependency.OnChange` event property if the application wishes to have an event handler invoked when database changes are detected. Otherwise, the application can choose to poll on the `HasChanges` property of the `OracleDependency` object. This event handler is invoked when the change notification is received.
3. Set the port number for the listener to listen on. The application can specify the port number for one notification listener to listen on. If the application does not specify a port number, a random one is used by the listener.
4. Bind the `OracleDependency` instance to an `OracleCommand` instance that contains the actual query to be executed. Internally, the Continuous Query Notification request (an `OracleNotificationRequest` instance) is created and assigned to the `OracleCommand.Notification` property.

### Flow of Notification Process

1. When the command associated with the notification request is executed, the notification registration is created in the database. The command execution must return a result set, or contain one or more `REF` cursors for a PL/SQL stored procedure.
2. ODP.NET starts the application listener on the first successful notification registration.
3. When a change related to the registration occurs in the database, the application is notified through the event delegate assigned to the `OracleDependency.OnChange` event property, or the application can poll the `OracleDependency.HasChanges` property.

The following example demonstrates the continuous query notification feature.

```
// Database Setup
// NOTE: unless the following SQL command is executed,
// ORA-29972 will be obtained from running this sample
/*
grant change notification to scott;
*/
using System;
using System.Threading;
using System.Data;
using Oracle.DataAccess.Client;
using Oracle.DataAccess.Types;
```

```
//This sample shows the continuous query notification feature in ODP.NET.
//Application specifies to get a notification when emp table is updated.
//When emp table is updated, the application will get a notification
//through an event handler.
namespace NotificationSample
{
    public class MyNotificationSample
    {
        public static bool IsNotified = false;

        public static void Main(string[] args)
        {
            //To Run this sample, make sure that the change notification privilege
            //is granted to scott.
            string constr = "User Id=scott;Password=tiger;Data Source=oracle";
            OracleConnection con = null;
            OracleDependency dep = null;

            try
            {
                con = new OracleConnection(constr);
                OracleCommand cmd = new OracleCommand("select * from emp", con);
                con.Open();

                // Set the port number for the listener to listen for the notification
                // request
                OracleDependency.Port = 1005;

                // Create an OracleDependency instance and bind it to an OracleCommand
                // instance.
                // When an OracleDependency instance is bound to an OracleCommand
                // instance, an OracleNotificationRequest is created and is set in the
                // OracleCommand's Notification property. This indicates subsequent
                // execution of command will register the notification.
                // By default, the notification request is using the Database Change
                // Notification.
                dep = new OracleDependency(cmd);

                // Add the event handler to handle the notification. The
                // OnMyNotification method will be invoked when a notification message
                // is received from the database
                dep.OnChange +=
                    new OnChangeEventHandler(MyNotificationSample.OnMyNotificaton);

                // The notification registration is created and the query result sets
                // associated with the command can be invalidated when there is a
                // change. When the first notification registration occurs, the
                // notification listener is started and the listener port number
                // will be 1005.
                cmd.ExecuteNonQuery();

                // Updating emp table so that a notification can be received when
                // the emp table is updated.
                // Start a transaction to update emp table
                OracleTransaction txn = con.BeginTransaction();
                // Create a new command which will update emp table
                string updateCmdText =
                    "update emp set sal = sal + 10 where empno = 7782";
                OracleCommand updateCmd = new OracleCommand(updateCmdText, con);
                // Update the emp table
                updateCmd.ExecuteNonQuery();
            }
        }
    }
}
```

```
        //When the transaction is committed, a notification will be sent from
        //the database
        txn.Commit();
    }
    catch (Exception e)
    {
        Console.WriteLine(e.Message);
    }

    con.Close();
    // Loop while waiting for notification
    while(MyNotificationSample.IsNotified == false)
    {
        Thread.Sleep(100);
    }
}

public static void OnMyNotificaton(object src,
    OracleNotificationEventArgs arg)
{
    Console.WriteLine("Notification Received");
    DataTable changeDetails = arg.Details;
    Console.WriteLine("Data has changed in {0}",
        changeDetails.Rows[0]["ResourceName"]);
    MyNotificationSample.IsNotified = true;
}
}
```

## Best Practice Guidelines and Performance Considerations

This section provides guidelines for working with Continuous Query Notification and the ODP.NET notification framework, and discusses the performance impacts. Every change notification registration consumes database memory, storage or network resources, or some combination thereof. The resource consumption further depends on the volume and size of the [invalidation message](#). In order to scale well with a large number of mid-tier clients, Oracle recommends that the client implement these best practices:

- Few and mostly read-only tables

There should be few registered objects, and these should be mostly read-only, with very infrequent invalidations. If an object is extremely volatile, then a large number of invalidation notifications are sent, potentially requiring a lot of space (in memory or on disk) in the invalidation queue. This is also true if a large number of objects are registered.

- Few rows updated for each table

Transactions should update (or insert or delete) only a small number of rows within the registered tables. Depending on database resources, a whole table could be invalidated if too many rows are updated within a single transaction, for a given table.

This policy helps to contain the size of a single invalidation message, and reduces disk storage for the invalidation queue.



### Oracle Date Type to .NET DateTime Type

The Oracle data type `DATE` can represent dates in BC whereas the .NET `DateTime` type cannot. If a `DATE` that goes to BC get retrieved into a .NET `DateTime` type, it loses data.

[Table 3-32](#) lists the maximum and minimum values for Oracle `Date` and .NET `DateTime` types.

**Table 3-32 Oracle Date to .NET DateTime Comparisons**

Value Limits	Oracle Date	.NET DateTime
Maximum	Dec 31, 9999 AD	Dec 31, 9999 AD 23:59:59.9999999
Minimum	Jan 1, 4712 BC	Jan 1, 0001 AD 00:00:00.0000000

### Oracle TimeStamp Type to .NET DateTime Type

Similar to the `DATE` data type, the Oracle `TimeStamp` data type can represent a date in BC, and a .NET `DateTime` type cannot. If a `TimeStamp` that goes to BC is retrieved into a .NET `DateTime` type, it loses data. The Oracle `TimeStamp` type can represent values in units of e-9; the .NET `DateTime` type can represent only values in units of e-7. The Oracle `TimeStamp` with time zone data type can store time zone information, and the .NET `DateTime` type cannot.

[Table 3-33](#) lists the maximum and minimum values for Oracle `TimeStamp` and .NET `DateTime` types.

**Table 3-33 Oracle TimeStamp to .NET DateTime Comparisons**

Value Limits	Oracle TimeStamp	.NET DateTime
Maximum	Dec 31, 9999 AD 23:59:59.999999999	Dec 31, 9999 AD 23:59:59.9999999
Minimum	Jan 1, 4712 BC 00:00:00.000000000	Jan 1, 0001 AD 00:00:00.0000000

### Oracle INTERVAL DAY TO SECOND to .NET TimeSpan

The Oracle data type `INTERVAL DAY TO SECOND` can hold up to 9 precision, and the .NET `TimeSpan` type can hold up to 7 precision. If an `INTERVAL DAY TO SECOND` data type that has more than 7 precision is retrieved into a .NET `TimeSpan` type, it loses precision. The Oracle `INTERVAL DAY TO SECOND` type can represent values in units of e-9, and the .NET `TimeSpan` type can represent only values in units of e-7.

[Table 3-34](#) lists the maximum and minimum values for Oracle `INTERVAL DAY TO SECOND` and .NET `DateTime` types.

**Table 3-34 Oracle INTERVAL DAY TO SECOND to .NET TimeSpan Comparisons**

Value Limits	Oracle INTERVAL DAY TO SECOND	.NET TmeSpan
Maximum	+999999999 23:59:59.999999999	+10675199 02:48:05.4775807
Minimum	-999999999 23:59:59.999999999	-10675199 02:48:05.4775808

## SafeMapping Property

The `OracleDataAdapter` Safe Type Mapping feature prevents data loss when populating Oracle data for any of these types into a `.NET DataSet`. By setting the `SafeMapping` property appropriately, these types can be safely represented in the `DataSet`, as either of the following:

- `.NET byte[]` in Oracle format
- `.NET String`

By default, Safe Type Mapping is disabled.

## Using Safe Type Mapping

To use the Safe Type Mapping feature, the `OracleDataAdapter.SafeMapping` property must be set with a hash table of key-value pairs. The key-value pairs must map database table column names (of type `string`) to a `.NET` type (of type `Type`). ODP.NET supports Safe Type Mapping to `byte[]` and `String` types. Any other type mapping causes an exception.

In situations where the column names are not known at design time, an asterisk ("`*`") can be used to map all occurrences of database types to a safe `.NET` type. If both the valid column name and the asterisk are present, the column name is used.



### Note:

- Database table column names are case-sensitive.
- Column names in the hash table that correspond to invalid column names are ignored.

Safe Type Mapping as a string is more readable without further conversion. Converting certain Oracle data types to a string requires extra conversion, which can be slower than converting it to a `byte[]`. Conversion of `.NET` strings back to ODP.NET types relies on the formatting information of the session.

### SafeTyping Example

```
// C#  
  
using System;  
using System.Data;  
using Oracle.DataAccess.Client;  
  
class SafeMappingSample  
{  
    static void Main()  
    {  
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";  
  
        // In this SELECT statement, EMPNO, HIREDATE and SALARY must be  
        // preserved using safe type mapping.  
        string cmdstr = "SELECT EMPNO, ENAME, HIREDATE, SAL FROM EMP";
```

```
// Create the adapter with the selectCommand txt and the connection string
OracleDataAdapter adapter = new OracleDataAdapter(cmdstr, constr);

// Get the connection from the adapter
OracleConnection connection = adapter.SelectCommand.Connection;

// Create the safe type mapping for the adapter
// which can safely map column data to byte arrays, where
// applicable. By executing the following statement, EMPNO, HIREDATE AND
// SALARY columns will be mapped to byte[]
adapter.SafeMapping.Add("*", typeof(byte[]));

// Map HIREDATE to a string
// If the column name in the EMP table is case-sensitive,
// the safe type mapping column name must be case-sensitive.
adapter.SafeMapping.Add("HIREDATE", typeof(string));

// Map EMPNO to a string
// If the column name in the EMP table is case-sensitive,
// the safe type mapping column name must also be case-sensitive.
adapter.SafeMapping.Add("EMPNO", typeof(string));
adapter.SafeMapping.Add("SAL", typeof(string));

// Create and fill the DataSet using the EMP
DataSet dataset = new DataSet();
adapter.Fill(dataset, "EMP");

// Get the EMP table from the dataset
DataTable table = dataset.Tables["EMP"];

// Get the first row from the EMP table
DataRow row = table.Rows[0];

// Print out the row info
Console.WriteLine("EMPNO Column: type = " + row["EMPNO"].GetType() +
    "; value = " + row["EMPNO"]);
Console.WriteLine("ENAME Column: type = " + row["ENAME"].GetType() +
    "; value = " + row["ENAME"]);
Console.WriteLine("HIREDATE Column: type = " + row["HIREDATE"].GetType()+
    "; value = " + row["HIREDATE"]);
Console.WriteLine("SAL Column: type = " + row["SAL"].GetType() +
    "; value = " + row["SAL"]);
}
}
```

**See Also:**["SafeMapping"](#)

## OracleDataAdapter Requery Property

The `OracleDataAdapter Requery` property controls whether or not queries are reexecuted for `OracleDataAdapter Fill` calls after the initial `Fill` call.

The `OracleDataAdapter.Fill` method allows appending or refreshing data in the `DataSet`. When appending the `DataSet` using the same query with subsequent `Fill` calls, reexecuting the query may not be desirable.

When the `Requery` property is set to `true`, each subsequent `Fill` call reexecutes the query and fills the `DataSet`. This is an expensive operation, and if the reexecution is not required, set `Requery` to `false`. If any of the `SelectCommand` properties or associated parameters must be changed, `Requery` must be set to `true`.

When the `Requery` property is set to `false`, the `DataSet` has all the data as a snapshot at a particular time. The query is executed only for the first `Fill` call; subsequent `Fill` calls fetch the data from a cursor opened with the first execution of the query. This feature is supported only for forward-only fetches. `Fill` calls that try to fetch rows before the last fetched row raise an exception. The connection used for the first `Fill` call must be available for subsequent `Fill` calls.

When filling a `DataSet` with an `OracleRefCursor` object, the `Requery` property can be used in a similar manner. When the `Requery` property is set to `false`, both the connection used for the first `Fill` call and the `OracleRefCursor` object must be available for the subsequent `Fill` calls.



#### See Also:

- ["Requery"](#)
- ["SelectCommand"](#)

## Guaranteeing Uniqueness in Updating DataSet to Database

This section describes how the `OracleDataAdapter` object configures the `PrimaryKey` and `Constraints` properties of the `DataTable` object which guarantee uniqueness when the `OracleCommandBuilder` object is updating `DataSet` changes to the database.

Using the `OracleCommandBuilder` object to dynamically generate DML statements to be executed against the database is one of the ways to reconcile changes made in a single `DataTable` object with the database.

In this process, the `OracleCommandBuilder` object must not be allowed to generate DML statements that may affect (update or delete) more than a single row in the database when reconciling a single `DataRow` change. Otherwise the `OracleCommandBuilder` could corrupt data in the database.

To guarantee that each `DataRow` object change affects only a single row, there must be a set of `DataColumn` objects in the `DataTable` for which all rows in the `DataTable` have a unique set of values. The set of `DataColumn` objects indicated by the properties `DataTable.PrimaryKey` and `DataTable.Constraints` meets this requirement. The `OracleCommandBuilder` object determines uniqueness in the `DataTable` by checking if the `DataTable.PrimaryKey` is not a null value or if there exists a `UniqueConstraint` object in the `DataTable.Constraints` collection.

This discussion first explains what constitutes uniqueness in `DataRow` objects and then explains how to maintain that uniqueness while updating, through the `DataTable` property configuration.

This section includes the following topics:

- [What Constitutes Uniqueness in DataRow Objects?](#)
- [Configuring PrimaryKey and Constraints Properties](#)
- [Updating Without PrimaryKey and Constraints Configuration](#)

## What Constitutes Uniqueness in DataRow Objects?

This section describes the minimal conditions that must be met to guarantee uniqueness of `DataRow` objects. The condition of uniqueness must be guaranteed before the `DataTable.PrimaryKey` and `DataTable.Constraints` properties can be configured, as described in the next section.

Uniqueness is guaranteed in a `DataTable` object if any one of the following is true:

- All the columns of the primary key are in the select list of the `OracleDataAdapter.SelectCommand` property.
- All the columns of a unique constraint are in the select list of the `OracleDataAdapter.SelectCommand` property, with at least one involved column having a `NOT NULL` constraint defined on it.
- All the columns of a unique index are in the select list of the `OracleDataAdapter.SelectCommand` property, with at least one of the involved columns having a `NOT NULL` constraint defined on it.
- A `ROWID` is present in the select list of the `OracleDataAdapter.SelectCommand` property.

### Note:

A set of columns, on which a unique constraint has been defined or a unique index has been created, requires at least one column that cannot be null for the following reason: if all the columns of the column set can be null, then multiple rows could exist that have a `NULL` value for each column in the column set. This would violate the uniqueness condition that each row has a unique set of values for the column set.

## Configuring PrimaryKey and Constraints Properties

If the minimal conditions described in "[What Constitutes Uniqueness in DataRow Objects?](#)" are met, then the `DataTable.PrimaryKey` or `DataTable.Constraints` properties can be set.

After these properties are set, the `OracleCommandBuilder` object can determine uniqueness in the `DataTable` by checking the `DataTable.PrimaryKey` property or the presence of a `UniqueConstraint` object in the `DataTable.Constraints` collection. Once uniqueness is determined, the `OracleCommandBuilder` object can safely generate DML statements to update the database.

The `OracleDataAdapter.FillSchema` method attempts to set these properties according to this order of priority:

1. If the primary key is returned in the select list, it is set as the `DataTable.PrimaryKey` property.
2. If a set of columns that meets the following criteria is returned in the select list, it is set as the `DataTable.PrimaryKey` property.  
  
Criteria: The set of columns has a unique constraint defined on it or a unique index created on it, with each column having a `NOT NULL` constraint defined on it.
3. If a set of columns that meets the following criteria is returned in the select list, a `UniqueConstraint` object is added to the `DataTable.Constraints` collection, but the `DataTable.PrimaryKey` property is not set.  
  
Criteria: The set of columns has a unique constraint defined on it or a unique index created on it, with at least one column having a `NOT NULL` constraint defined on it.
4. If a `ROWID` is part of the select list, it is set as the `DataTable.PrimaryKey` property.

Additionally, the `OracleDataAdapter.FillSchema` method performs as follows:

- Setting the `DataTable.PrimaryKey` property implicitly creates a `UniqueConstraint` object.
- If a column is part of the `DataTable.PrimaryKey` property or the `UniqueConstraint` object, or both, it will be repeated for each occurrence of the column in the select list.

## Updating Without PrimaryKey and Constraints Configuration

If the `DataTable.PrimaryKey` or `Constraints` properties have not been configured, for example, if the application has not called the `OracleDataAdapter.FillSchema` method, the `OracleCommandBuilder` object directly checks the select list of the `OracleDataAdapter.SelectCommand` property to determine if it guarantees uniqueness in the `DataTable`. However this check results in a database round-trip to retrieve the metadata for the `SELECT` statement of the `OracleDataAdapter.SelectCommand`.

Note that `OracleCommandBuilder` object cannot update a `DataTable` created from PL/SQL statements because they do not return any key information in their metadata.

## Globalization Support

ODP.NET globalization support enables applications to manipulate culture-sensitive data appropriately. This feature ensures proper string format, date, time, monetary, numeric, sort order, and calendar conventions depending on the Oracle globalization settings.

 **Note:**

- ODP.NET, Managed Driver and ODP.NET Core are not `NLS_LANG` sensitive. They are only .NET locale sensitive.
- ODP.NET, Managed Driver and ODP.NET Core do not support thread-based globalization.

 **See Also:**

["OracleGlobalization Class"](#)

This section includes the following:

- [Globalization Settings](#)
- [Globalization-Sensitive Operations](#)

## Globalization Settings

An `OracleGlobalization` object can be used to represent the following:

- [Client Globalization Settings](#)
- [Session Globalization Settings](#)
- [Thread-Based Globalization Settings](#)

## Client Globalization Settings

Client globalization settings are derived from the Oracle globalization setting (`NLS_LANG`) in the Windows registry of the local computer. The client globalization parameter settings are read-only and remain constant throughout the lifetime of the application. These settings can be obtained by calling the `OracleGlobalization.GetClientInfo` static method.

The following example retrieves the client globalization settings:

```
// C#  
  
using System;  
using Oracle.DataAccess.Client;  
  
class ClientGlobalizationSample  
{  
    static void Main()  
    {  
        OracleGlobalization ClientGlob = OracleGlobalization.GetClientInfo();  
  
        Console.WriteLine("Client machine language: " + ClientGlob.Language);  
        Console.WriteLine("Client character set: " + ClientGlob.ClientCharacterSet);  
    }  
}
```

The properties of the `OracleGlobalization` object provide the Oracle globalization value settings.

## Session Globalization Settings

Session globalization parameters are initially identical to client globalization settings. Unlike client settings, session globalization settings can be updated. However, they can be obtained only after establishing a connection against the database. The session globalization settings can be obtained by calling the `GetSessionInfo` method on the `OracleConnection` object. Invoking this method returns an instance of an `OracleGlobalization` class whose properties represent the globalization settings of the session.

When the `OracleConnection` object establishes a connection, it implicitly opens a session whose globalization parameters are initialized with those values specified by the client computer's Oracle globalization (or (NLS)) registry settings. The session settings can be updated and can change during its lifetime.

The following example changes the date format setting on the session:

```
// C#

using System;
using Oracle.DataAccess.Client;

class SessionGlobalizationSample
{
    static void Main()
    {
        OracleConnection con = new OracleConnection();

        con.ConnectionString = "User Id=scott;Password=tiger;Data Source=oracle;";
        con.Open();

        OracleGlobalization SessionGlob = con.GetSessionInfo();

        // SetSessionInfo updates the Session with the new value
        SessionGlob.DateFormat = "YYYY/MM/DD";
        con.SetSessionInfo(SessionGlob);
        Console.WriteLine("Date Format successfully changed for the session");

        // Close and Dispose OracleConnection object
        con.Close();
        con.Dispose();
    }
}
```

## Thread-Based Globalization Settings

Thread-based globalization parameter settings are specific to each thread. Initially, these settings are identical to the client globalization parameters, but they can be changed as specified by the application. When ODP.NET Types are converted to and from strings, the thread-based globalization parameters are used, if applicable.

Thread-based globalization parameter settings are obtained by invoking the `GetThreadInfo` static method of the `OracleGlobalization` class. The `SetThreadInfo` static method of the `OracleGlobalization` class can be called to set the thread's globalization settings.

ODP.NET classes and structures rely solely on the `OracleGlobalization` settings when manipulating culture-sensitive data. They do not use .NET thread culture information. If the application uses only .NET types, `OracleGlobalization` settings have no effect. However, when conversions are made between ODP.NET types and .NET types, `OracleGlobalization` settings are used where applicable.

 **Note:**

Changes to the `System.Threading.Thread.CurrentThread.CurrentCulture` property do not impact the `OracleGlobalization` settings of the thread or the session, or the reverse.

The following example shows how the thread's globalization settings are used by the ODP.NET Types:

```
// C#

using System;
using Oracle.DataAccess.Types;
using Oracle.DataAccess.Client;

class ThreadBasedGlobalizationSample
{
    static void Main(string[] args)
    {
        // Set the thread's DateFormat for the OracleDate constructor
        OracleGlobalization info = OracleGlobalization.GetClientInfo();
        info.DateFormat = "YYYY-MON-DD";
        OracleGlobalization.SetThreadInfo(info);

        // construct OracleDate from a string using the DateFormat specified.
        OracleDate date = new OracleDate("1999-DEC-01");

        // Set a different DateFormat for the thread
        info.DateFormat = "MM/DD/YYYY";
        OracleGlobalization.SetThreadInfo(info);

        // Print "12/01/1999"
        Console.WriteLine(date.ToString());
    }
}
```

The `OracleGlobalization` object validates property changes made to it. If an invalid value is used to set a property, an exception is thrown. Note that changes made to the `Territory` and `Language` properties change other properties of the `OracleGlobalization` object implicitly.

 **See Also:**

*Oracle Database Globalization Support Guide* for more information on the properties affected by `Territory` and `Language` globalization settings

## Globalization-Sensitive Operations

This section lists ODP.NET types and operations that are dependent on or sensitive to globalization settings.

### Operations Dependent on Client Computer's Globalization Settings

The `OracleString` structure depends on the `OracleGlobalization` settings of the client computer. The client character set of the local computer is used when it converts a Unicode string to a `byte[]` in the `GetNonUnicode` method and when it converts a `byte[]` of ANSI characters to Unicode in the `OracleString` constructor that accepts a `byte[]`.

### Operations Dependent on Thread Globalization Settings

The thread globalization settings are used by ODP.NET types whenever they are converted to and from .NET string types, where applicable. Specific thread globalization settings are used in most cases, depending on the ODP.NET type, by the following:

- The `ToString` method
- The `Parse` static method
- Constructors that accept .NET string data
- Conversion operators to and from .NET strings

For example, the `OracleDate` type uses the `DateFormat` property of the thread globalization settings when the `ToString` method is invoked on it. This returns a `DATE` as a string in the format specified by the thread's settings.

The thread globalization settings also affect data that is retrieved into the `DataSet` as a string using Safe Type Mapping. If the type is format-sensitive, the strings are always in the format specified by the thread globalization settings.

For example, `INTERVAL DAY TO SECOND` data is not affected by thread settings because no format is applicable for this type. However, the `DateFormat` and `NumericCharacters` properties can impact the string representation of `DATE` and `NUMBER` types, respectively, when they are retrieved as strings into the `DataSet` through Safe Type Mapping.

#### See Also:

- The remarks in [OracleGlobalization Class](#) for more details on the ODP.NET type methods that convert between ODP.NET types and .NET string types, and to identify which thread globalization settings are used for that particular method.
- [OracleDataAdapter Safe Type Mapping](#)
- [Oracle Data Provider for .NET Types Structures](#)

## Operations Sensitive to Session Globalization Parameters

Session globalization settings affect any data that is retrieved from or sent to the database as a string.

For example, if a `DATE` column is selected with the `TO_CHAR` function applied on it, the `DATE` column data will be a string in the date format specified by the `DateFormat` property of the session globalization settings. Transmitting data in the other direction, the string data that is to be inserted into the `DATE` column, must be in the format specified by the `DateFormat` property of the session globalization settings.

## ODP.NET Driver Globalization Differences

### Default Session Time Zone

ODP.NET drivers set the default session time zone differently. While the session time zone for unmanaged ODP.NET uses an hour offset, managed ODP.NET and ODP.NET Core use the region identifier for setting their respective session time zone. As a result, managed and Core ODP.NET is sensitive to daylight savings in scenarios where the timestamp LTZ values have to be converted from or to the session time zone.

There are two methods to resolve this difference if needed. For ODP.NET, Unmanaged Driver, the application explicitly sets the region identifier with the environment variable `ORA_SDTZ`. For example, set `ORA_SDTZ = <Region ID>`. If `ORA_SDTZ` variable is set, Oracle Client considers this value as the session time zone. The second method is to execute an alter session command to set the session time zone property to the region identifier.

### .NET Culture Info

As noted earlier, ODP.NET, Managed Driver and ODP.NET Core do not support thread-based globalization. ODP.NET, Unmanaged Driver does. As a result, managed ODP.NET and ODP.NET Core strings are insensitive to .NET culture information. As such, invoking the `ToString()` method on date/time related Oracle provider types (i.e. `OracleDate`, `OracleTimestamp`, etc.) will generate a string in the format of `MM/dd/yyyy HH:mm:ss[.fffffffff] [timezone]`. Whether the outputted string contains a fractional second and/or the timezone will depend on the Oracle provider type being used.

## Debug Tracing

All ODP.NET providers include debug tracing support, which allows logging of all the ODP.NET activities into a trace file. Different levels of tracing are available.

Tracing can record the following information and more:

- Entry and exit information for the ODP.NET public methods
- User-provided SQL statements as well as SQL statements modified by the provider
- Connection pooling statistics such as enlistment and delistment
- Thread ID (entry and exit)
- HA Events and Load Balancing information
- Distributed Transactions
- Self-tuning information

- User-mode dumps upon unmanaged exceptions

The following properties enable and configure tracing for all ODP.NET providers:

- `TraceLevel` – specifies which ODP.NET details to write to the trace file
- `TraceFileLocation` – specifies the directory to write the trace to
- `TraceFileMaxSize` – specifies the maximum file size of each trace file
- `TraceOption` – specifies whether to use a separate trace file for each thread

By default, tracing is turned off (`TraceLevel = 0`). To enable tracing, set `TraceLevel` to the trace level you wish.

Managed ODP.NET and ODP.NET Core have the following trace levels:

- 1 = public APIs
- 2 = private APIs
- 4 = network APIs/data
- 8 = disables writing SQL statements and network packet contents

These values can be bitwise ORed. To enable all traces, set `TraceLevel` to 7.

Unmanaged ODP.NET has the following trace levels:

- 1 = Entry, exit, and SQL statement information
- 2 = Connection pooling statistics
- 4 = Distributed transactions (enlistment and delistment)
- 8 = User-mode dump creation upon unmanaged exception
- 16 = HA Event Information
- 32 = Load Balancing Information
- 64 = Self Tuning Information

These values can be bitwise ORed. To enable all traces, set `TraceLevel` to 127.

`TraceFileLocation` writes to a temporary operating system folder if no value is set.

- ODP.NET Core
  - Windows: `<Windows user temporary folder>\ODP.NET\core\trace`
  - Linux: `<current user temporary folder>/ODP.NET/core/trace`
  - macOS: `<macOS temporary folder>\ODP.NET\core\trace`
- ODP.NET, Managed Driver: `<Windows user temporary folder>\ODP.NET\managed\trace`
- ODP.NET, Unmanaged Driver: `<Windows user temporary folder>\ODP.NET\unmanaged\trace`

The Windows user temporary folder is determined by your local Windows settings, such as your Windows `TMP` or `TEMP` environment variable. Typically, it can be `C:\temp` or `C:\Users\<user name>\AppData\Local\Temp`.

`TraceFileMaxSize` defaults to 100 MB if no value is set. Administrators can use this setting to keep trace files down to a manageable size.

`TraceOption` will write all threads to a single trace file at a time by default (`TraceOption=0`).

ODP.NET will create an entry in the Windows event log where the trace was created anytime it creates a new trace file. An event log entry will be added every time in cases when `TraceFileLocation` changes, trace file size exceeds `TraceFileMaxSize`, `TraceLevel` changes, and `TraceOption` changes. In each of these cases, ODP.NET creates a new file and starts writing traces in the newly created file. ODP.NET Core does not support writing to the Windows event log.

To enable ODP.NET tracing, these trace properties must be set appropriately either in the `OracleConfiguration` class (all providers), in the .NET configuration file (managed and unmanaged ODP.NET), or in the Windows Registry (unmanaged ODP.NET).

ODP.NET begins writing to the trace file only after the `OracleConnection.Open()` call occurs.

### Dynamic Tracing

Starting with ODAC 19c, applications can change ODP.NET `OracleConfiguration` class trace settings during runtime. Most commonly, this feature would permit enabling and disabling tracing dynamically while applications continue to run. Dynamic tracing is useful for errors that occur after applications are run for a considerable time. Customers can avoid collecting extremely large trace files and Oracle Support will find it easier to diagnose problems from more targeted trace files.

ODP.NET Core, managed, and unmanaged all support dynamic tracing.

To enable tracing at runtime, set `OracleConfiguration.TraceLevel` to the trace level desired. To disable tracing dynamically, set `OracleConfiguration.TraceLevel` to zero.

Only `OracleConfiguration` tracing properties can alter runtime tracing behavior. Windows Registry and .NET configuration file settings are only read when an application starts up.

As a general matter, tracing is not recommended for production use because writing to trace files affects performance. However, if a problem only occurs during production, use dynamic tracing to enable and disable tracing during the problem period to capture diagnostics for identifying the root cause.

#### See Also:

- ["Configuring Oracle Data Provider for .NET" for further details](#)
- [OracleConfiguration Debug Tracing Properties](#)
- [settings section](#)

## Database Application Migration: SQL Translation Framework

A key part of migrating non-Oracle database applications to an Oracle Database requires converting non-Oracle SQL statements to SQL statements that can be processed by an Oracle Database. SQL conversion is generally a manual and laborious process. To minimize the effort, Oracle Database 12c introduces SQL Translation Framework which takes non-Oracle SQL statements from client applications and then translates them at run-time for the Oracle Database to execute.

The SQL Translation Framework can be used to map non-Oracle stored procedure to Oracle stored procedures to ensure successful execution of those stored procedures when migrating to Oracle Database.

Currently, SQL Translation Framework is available for Sybase Adaptive Server Enterprise and Microsoft SQL Server. There is limited support for IBM DB2.

**Note:**

SQL Translation Framework is only supported by ODP.NET, Unmanaged Driver. ODP.NET, Managed Driver and ODP.NET Core do not support this feature.

## The SQL Translation Profile

The SQL Translation Profile is a database object that contains the set of captured non-Oracle SQL statements, and their translations or translation errors. The SQL Translation Profile is used to review, approve, and modify translations. A profile is associated to a single translator. However, a translator can be used in one or more SQL Translation Profiles. Typically, there is one SQL Translation Profile per application, otherwise applications can share translated queries. You can export profiles among various databases.

### 1. Configuring the SQL Translation Profile Name

The default translation profile name for SQL Translation Framework can be configured through the `app/web/machine` .NET configuration file. If configured, connections, by default will automatically be set to the specified profile when the connection is initially created.

### 2. Changing the SQL Translation Profile Name

ODP.NET supports setting the profile name through the .NET config file, logon trigger, or database service. ODP.NET does not support using `ALTER SESSION` from an application to set the profile name.

### 3. Forcing Translation

Applications are strictly prohibited to execute the following SQL which forces translation of all SQL's on the database:

```
ALTER SESSION SET events = '10601 trace name context forever, level 32'
```

### 4. Connection Related Error Mapping

Connection Related Error Mapping can be configured through the .NET configuration file. Please note that this error mapping strictly applies to errors which could be thrown before the connection is successfully established. Once the database connection is established successfully, then these error mapping will be completely ignored and further error translation will be provided through the error mapping configured in the database.

The rules to choose an error mapping section in the configuration file are as follows:

- a. ODP.NET uses the error mapping section which matches the configured `userId`, `dataSource`, and `profile`, where `userId` and `dataSource` matches the

corresponding values in the connection string and profile matches the `defaultProfile` configuration setting.

- b. If no error mapping section is found from 4.a.), then ODP.NET uses the error mapping section which matches the `userId`, `dataSource`, and profile similar to 4.a.), but with the profile that matches with the `defaultErrorMappingProfile` configuration setting.
  - c. If still no error mapping section is found, then ODP.NET uses the global mapping, that is, `<ErrorMapping profile="*">`, if configured.
5. Stored Procedure Mapping.

Application must map their native stored procedure names to the corresponding Oracle stored procedure names on the translation profile in the database. The following procedure can be used to setup the mapping in the database.

```
DBMS_SQL_TRANSLATOR.REGISTER_SQL_TRANSLATION (
  PROFILE_NAME    VARCHAR2    IN
  SQL_TEXT        CLOB          IN
  TRANSLATED_TEXT CLOB          IN    DEFAULT
  ENABLE          BOOLEAN      IN    DEFAULT)
```

Example of stored procedure mapping:

```
DBMS_SQL_TRANSLATOR.REGISTER_SQL_TRANSLATION('profile_name',
  'native_sp_name',
  'oracle_sp_name');
```

#### See Also:

Chapter 2, *SQL Translation Framework Overview and Architecture*, of the *Oracle Database Migration Guide* for more information.

# 4

## ADO.NET Entity Framework and LINQ to Entities

This section describes ADO.NET Entity Framework and LINQ to Entities. Entity Framework is a framework for providing object-relational mapping service on data models.

This section contains these topics:

- [Overview of Entity Framework](#)
- [Language Integrated Query and Entity SQL](#)
- [Mapping Oracle Data Types to EDM Types](#)
- [Oracle Number Default Data Type Mapping and Customization](#)
- [Migrating Existing Entity Framework 5 Applications to Entity Framework 6](#)
- [Code First](#)
- [Unsupported Entity Framework Features](#)



### Note:

ADO.NET Entity Framework and LINQ to Entities is not supported by ODP.NET Core.

## Overview of Entity Framework

ODP.NET includes support for the ADO.NET Entity Framework and LINQ to Entities. ODP.NET also supports Entity SQL.

Entity Framework is a framework for providing object-relational mapping service on data models. Entity Framework addresses the impedance mismatch between the relational database format and the client's preferred object format.

Entity Framework and LINQ provides productivity benefits for the .NET developer. It abstracts the database's data model from the application's data model. Working with object-relational data becomes easier with Entity Framework's tools. Oracle's integration with Entity Framework and LINQ enables Oracle .NET developers to take advantage of all these productivity benefits.

 **Note:**

- Entity Framework and LINQ to Entities support is included in ODP.NET for .NET Framework 4. ODP.NET for .NET Framework 2.0 does not support the ADO.NET Entity Framework and LINQ to Entities.
- Binding scalar parameters is supported with ODP.NET and Entity Framework. In Entity Framework, parameter binding by name is supported. Binding by position is not supported.

Entity data models can be generated from Oracle database schemas. Schemas can be generated from entity data models. These Oracle entity data models can be queried and manipulated using Visual Studio and ODP.NET. Oracle supports Code First, Database First, and Model First modeling approaches. Specifying filters on the Visual Studio Server Explorer data connection enables the Entity Data Model Wizard to also filter Oracle database objects that are fetched and displayed.

LINQ to Entities can perform queries on the Oracle Database using ODP.NET, including using LINQ to Entities built-in functions. `INSERTS`, `UPDATES`, and `DELETES` can be executed using Oracle stored procedures, or by using the `ObjectContext.SaveChanges` method.

ODP.NET supports function import of Oracle stored procedures that Entity Framework can then execute. These Oracle function imports can return a collection of scalar, complex, and entity types, including returning an Oracle implicit result set as an entity type. Implicit result set binding is supported using Oracle `REF CURSOR`.

 **See Also:**

- [Implicit REF CURSOR Binding](#).
- For a tutorial on how to use Entity Framework, Language Integrated Query (LINQ), and generate Data Definition Language (DDL) scripts using Model First, refer to:

[Entity Framework, LINQ and Model-First for the Oracle Database](#)

## Language Integrated Query and Entity SQL

Language Integrated Query (LINQ) defines a set of operators that can be used to query, project, and filter data in arrays, enumerable classes, XML, relational databases, and other data sources. One form of LINQ, LINQ to Entities, allows querying of Entity Framework data sources. ODP.NET supports Entity Framework such that the Oracle database can participate in object-relational modeling and LINQ to Entities queries.

Entity SQL is a language that enables querying of Entity Framework conceptual models. It allows querying Entity Framework entities and relationships in a format that is similar to SQL. ODP.NET supports querying Oracle databases through Entity SQL.

LINQ and Entity SQL syntax are generally data source neutral.

## Mapping Oracle Data Types to EDM Types

The ODP.NET manifest file describes the primitive types, such as `VARCHAR2` and `Number`, and the Entity Data Model (EDM) types, such as `string` and `Int32`, that they map to. It also includes the facets for each EDM type.

ODP.NET does not support Time literals and canonical functions related to the Time type.

Oracle considers both `NULL` and empty strings to be `NULL` strings and are considered to be equal. Operations, such as `Equals()`, `Length()`, and `Trim()` on such strings will result in a `NULL` string.

[Table 4-1](#) maps the Oracle data types to their corresponding EDM types. The table also includes details about provider type attributes and the EDM type facets associated with each Oracle data type.

**Table 4-1 Mapping of Oracle Data Types and EDM Types**

Oracle Data Types	EDM Types (Primitive-TypeKind)	Provider Type Attributes: Name and Value	EDM Type Facets
Bfile	Binary	<ul style="list-style-type: none"> <li>Equal Comparable: False</li> <li>Order Comparable: False</li> </ul>	<a href="#">EDM Type Facets for Bfile</a>
Binary_Double	Double	<ul style="list-style-type: none"> <li>Equal Comparable: True</li> <li>Order Comparable: True</li> </ul>	Not Applicable
Binary_Float	Single	<ul style="list-style-type: none"> <li>Equal Comparable: True</li> <li>Order Comparable: True</li> </ul>	Not Applicable
Binary_Integer	Int32	<ul style="list-style-type: none"> <li>Equal Comparable: True</li> <li>Order Comparable: True</li> </ul>	Not Applicable
Blob	Binary	<ul style="list-style-type: none"> <li>Equal Comparable: False</li> <li>Order Comparable: False</li> </ul>	<a href="#">EDM Type Facets for Blob</a>
Char	String	<ul style="list-style-type: none"> <li>Equal Comparable: True</li> <li>Order Comparable: True</li> </ul>	<a href="#">EDM Type Facets for Char</a>
Clob	String	<ul style="list-style-type: none"> <li>Equal Comparable: False</li> <li>Order Comparable: False</li> </ul>	<a href="#">EDM Type Facets for Clob</a>

**Table 4-1 (Cont.) Mapping of Oracle Data Types and EDM Types**

Oracle Data Types	EDM Types (Primitive-TypeKind)	Provider Type Attributes: Name and Value	EDM Type Facets
Date	DateTime	<ul style="list-style-type: none"> <li>• Equal Comparable: True</li> <li>• Order Comparable: True</li> </ul>	<a href="#">EDM Type Facets for Date</a>
Float	Decimal	<ul style="list-style-type: none"> <li>• Equal Comparable: True</li> <li>• Order Comparable: True</li> </ul>	<a href="#">EDM Type Facets for Float</a>
Int	Int32	<ul style="list-style-type: none"> <li>• Equal Comparable: True</li> <li>• Order Comparable: True</li> </ul>	Not Applicable
Interval Day To Second	Decimal	<ul style="list-style-type: none"> <li>• Equal Comparable: True</li> <li>• Order Comparable: True</li> </ul>	<a href="#">EDM Type Facets for Interval Day To Second</a>
Interval Year To Month	Decimal	<ul style="list-style-type: none"> <li>• Equal Comparable: True</li> <li>• Order Comparable: True</li> </ul>	<a href="#">EDM Type Facets for Interval Year To Month</a>
Long	String	<ul style="list-style-type: none"> <li>• Equal Comparable: False</li> <li>• Order Comparable: False</li> </ul>	<a href="#">EDM Type Facets for Long</a>
Json	String	<ul style="list-style-type: none"> <li>• Equal Comparable: True</li> <li>• Order Comparable: True</li> </ul>	<a href="#">EDM Types Facets for JSON</a>
Long Raw	Binary	<ul style="list-style-type: none"> <li>• Equal Comparable: False</li> <li>• Order Comparable: False</li> </ul>	<a href="#">EDM Type Facets for Long Raw</a>
NChar	String	<ul style="list-style-type: none"> <li>• Equal Comparable: True</li> <li>• Order Comparable: True</li> </ul>	<a href="#">EDM Type Facets for NChar</a>
NClob	String	<ul style="list-style-type: none"> <li>• Equal Comparable: False</li> <li>• Order Comparable: False</li> </ul>	<a href="#">EDM Type Facets for NClob</a>
Nested Table		Not Applicable	Not Applicable and Not Supported

**Table 4-1 (Cont.) Mapping of Oracle Data Types and EDM Types**

Oracle Data Types	EDM Types (Primitive-TypeKind)	Provider Type Attributes: Name and Value	EDM Type Facets
Number (1,0) Number (2,0) Number (3,0) Number (4,0) Number (5,0)	Int16	<ul style="list-style-type: none"> <li>Equal Comparable: True</li> <li>Order Comparable: True</li> </ul>	Not Applicable
Number (6,0) Number (7,0) Number (8,0) Number (9,0) Number (10,0)	Int32	<ul style="list-style-type: none"> <li>Equal Comparable: True</li> <li>Order Comparable: True</li> </ul>	Not Applicable
Number (11,0) Number (12,0) Number (13,0) Number (14,0) Number (15,0) Number (16,0) Number (17,0) Number (18,0) Number (19,0)	Int64	<ul style="list-style-type: none"> <li>Equal Comparable: True</li> <li>Order Comparable: True</li> </ul>	Not Applicable
Number (all other cases)	Decimal	<ul style="list-style-type: none"> <li>Equal Comparable: True</li> <li>Order Comparable: True</li> </ul>	<a href="#">EDM Type Facets for Number</a>
NVarchar2	String	<ul style="list-style-type: none"> <li>Equal Comparable: True</li> <li>Order Comparable: True</li> </ul>	<a href="#">EDM Type Facets for NVarchar2</a>
Object		Not Applicable	Not Applicable and Not Supported
Raw	Binary	<ul style="list-style-type: none"> <li>Equal Comparable: True</li> <li>Order Comparable: True</li> </ul>	<a href="#">EDM Type Facets for Raw</a>
Raw (16)	Guid	<ul style="list-style-type: none"> <li>Equal Comparable: True</li> <li>Order Comparable: True</li> </ul>	Not Applicable
Ref		Not Applicable	Not Applicable and Not Supported

**Table 4-1 (Cont.) Mapping of Oracle Data Types and EDM Types**

Oracle Data Types	EDM Types (Primitive-TypeKind)	Provider Type Attributes: Name and Value	EDM Type Facets
ROWID	String	<ul style="list-style-type: none"> <li>Equal Comparable: True</li> <li>Order Comparable: True</li> </ul>	<a href="#">EDM Type Facets for ROWID</a>
Smallint	Int16	<ul style="list-style-type: none"> <li>Equal Comparable: True</li> <li>Order Comparable: True</li> </ul>	Not Applicable
Timestamp	DateTime	<ul style="list-style-type: none"> <li>Equal Comparable: True</li> <li>Order Comparable: True</li> </ul>	<a href="#">EDM Type Facets for Timestamp</a>
Timestamp with Local Time Zone	DateTime	<ul style="list-style-type: none"> <li>Equal Comparable: True</li> <li>Order Comparable: True</li> </ul>	<a href="#">EDM Type Facets for Timestamp with Local Time Zone</a>
Timestamp with Time Zone	DateTimeOffset	<ul style="list-style-type: none"> <li>Equal Comparable: True</li> <li>Order Comparable: True</li> </ul>	<a href="#">EDM Type Facets for Timestamp with Time Zone</a>
UROWID (size)	Binary	<ul style="list-style-type: none"> <li>Equal Comparable: True</li> <li>Order Comparable: True</li> </ul>	<a href="#">EDM Type Facets for UROWID</a>
Varchar2	String	<ul style="list-style-type: none"> <li>Equal Comparable: True</li> <li>Order Comparable: True</li> </ul>	<a href="#">EDM Type Facets for Varchar2</a>
VArray		Not Applicable	Not Applicable and Not Supported
XMLType	String	<ul style="list-style-type: none"> <li>Equal Comparable: False</li> <li>Order Comparable: False</li> </ul>	<a href="#">EDM Type Facets for XMLType</a>

## EDM Type Facets

The following sections enumerate the EDM type facets for the preceding Oracle data types. The first column of each table displays the EDM type facet names for the Oracle data type. Subsequent columns list the facet attribute names and displays their respective values.

## EDM Type Facets for Bfile

**Table 4-2 EDM Type Facets for Bfile**

Facet name	Attributes Name and Value
MaxLength	DefaultValue: 2147483648 Constant: True
FixedLength	DefaultValue: False Constant: True

## EDM Type Facets for Blob

**Table 4-3 EDM Type Facets for Blob**

Facet name	Attributes Name and Value
MaxLength	DefaultValue: 2147483648 Constant: True
FixedLength	DefaultValue: False Constant: True

## EDM Type Facets for Char

**Table 4-4 EDM Type Facets for Char**

Facet Name	Attributes Name and Value
MaxLength	Minimum: 1 Maximum: 2000 DefaultValue: 2000 Constant: False
Unicode	DefaultValue: False Constant: True
FixedLength	DefaultValue: True Constant: True

## EDM Type Facets for Clob

**Table 4-5 EDM Type Facets for Clob**

Facet Name	Attributes Name and Value
MaxLength	DefaultValue: 2147483647 Constant: True

**Table 4-5 (Cont.) EDM Type Facets for Clob**

Facet Name	Attributes Name and Value
Unicode	DefaultValue: False Constant: True
FixedLength	DefaultValue: False Constant: True

**EDM Type Facets for Date**

**Table 4-6 EDM Type Facets for Date**

Facet Name	Attributes Name and Value
Precision	Constant: True DefaultValue: 0

**EDM Type Facets for Float**

**Table 4-7 EDM Type Facets for Float**

Facet name	Attributes Name and Value
Precision	Minimum: 0 Maximum: 126 DefaultValue: 0 Constant: False
Scale	Minimum: 0 Maximum: 38 DefaultValue: 0 Constant: False

**EDM Type Facets for Interval Day To Second**

**Table 4-8 EDM Type Facets for Interval Day To Second**

Facet name	Attributes Name and Value
Precision	Minimum: 1 Maximum: 251 DefaultValue: 251 Constant: False

**Table 4-8 (Cont.) EDM Type Facets for Interval Day To Second**

Facet name	Attributes Name and Value
Scale	Minimum: 0 Maximum: 9 DefaultValue: 0 Constant: False



**Note:**

EDM types do not support `TimeSpan`.

Use `Decimal` to represent the total number of seconds. An application can obtain a `TimeSpan` by using the `TimeSpan.FromSeconds` static method.

**EDM Type Facets for Interval Year To Month**

**Table 4-9 EDM Type Facets for Interval Year To Month**

Facet name	Attributes Name and Value
Precision	Minimum: 1 Maximum: 250 DefaultValue: 250 Constant: False
Scale	Minimum: 0 Maximum: 9 DefaultValue: 0 Constant: False

**EDM Type Facets for JSON**

**Table 4-10 EDM Type Facets for Json**

Facet name	Attributes Name and Value
MaxLength	DefaultValue: 33,554,432 (32M) Constant: True
Unicode	DefaultValue: True Constant: True
FixedLength	DefaultValue: False Constant: True

**EDM Type Facets for Long**

**Table 4-11 EDM Type Facets for Long**

Facet name	Attributes Name and Value
MaxLength	DefaultValue: 2147483647 Constant: True
Unicode	DefaultValue: False Constant: True
FixedLength	DefaultValue: False Constant: True

**EDM Type Facets for Long Raw****Table 4-12 EDM Type Facets for Long Raw**

Facet name	Attributes Name and Value
MaxLength	DefaultValue: 2147483647 Constant: True
FixedLength	DefaultValue: False Constant: True

**EDM Type Facets for NChar****Table 4-13 EDM Type Facets for NChar**

Facet name	Attributes Name and Value
MaxLength	Minimum: 1 Maximum: 1000 DefaultValue: 1000 Constant: False
Unicode	DefaultValue: True Constant: True
FixedLength	DefaultValue: True Constant: True

 **Note:**

For NChar, the actual data is subject to the maximum byte limit of 2000.

The value of 1000 for Maximum and DefaultValue allows the EDM wizard to display columns of NCHAR(1000), where 1000 is the maximum number of characters allowed in DDL.

**EDM Type Facets for NClob****Table 4-14 EDM Type Facets for NClob**

<b>Facet name</b>	<b>Attributes Name and Value</b>
MaxLength	DefaultValue: 2147483647 Constant: True
Unicode	DefaultValue: True Constant: True
FixedLength	DefaultValue: False Constant: True

**EDM Type Facets for Number****Table 4-15 EDM Type Facets for Number**

<b>Facet name</b>	<b>Attributes Name and Value</b>
Precision	Minimum: 1 Maximum: 38 DefaultValue: 38 Constant: False
Scale	Minimum: 0 Maximum: 38 DefaultValue: 0 Constant: False

**EDM Type Facets for NVarchar2****Table 4-16 EDM Type Facets for NVarchar2**

<b>Facet name</b>	<b>Attributes Name and Value</b>
MaxLength	Minimum: 1 Maximum: 2000 DefaultValue: 2000 Constant: False
Unicode	DefaultValue: True Constant: True
FixedLength	DefaultValue: False Constant: True

 **Note:**

For NVARCHAR2, the actual data is subject to the maximum byte limit of 4000.

The value of 2000 for Maximum and DefaultValue allows the EDM wizard to display columns of NVARCHAR2 (2000), where 2000 is the maximum number of characters allowed in DDL.

### EDM Type Facets for Raw

**Table 4-17 EDM Type Facets for Raw**

Facet name	Attributes Name and Value
MaxLength	Minimum: 1 Maximum: 2000 Constant: False
FixedLength	DefaultValue: False Constant: True

### EDM Type Facets for ROWID

**Table 4-18 EDM Type Facets for ROWID**

Facet name	Attributes Name and Value
MaxLength	DefaultValue: 18 Constant: True
Unicode	DefaultValue: False Constant: True
FixedLength	DefaultValue: True Constant: True

### EDM Type Facets for Timestamp

**Table 4-19 EDM Type Facets for Timestamp**

Facet name	Attributes Name and Value
Precision	Minimum: 0 Maximum: 9 DefaultValue: 6 Constant: False

### EDM Type Facets for Timestamp with Local Time Zone

**Table 4-20 EDM Type Facets for Timestamp with Local Time Zone**

Facet name	Attributes Name and Value
Precision	Minimum: 0 Maximum: 9 DefaultValue: 6 Constant: False

**EDM Type Facets for Timestamp with Time Zone****Table 4-21 EDM Type Facets for Timestamp with Time Zone**

Facet name	Attributes Name and Value
Precision	Minimum: 0 Maximum: 9 DefaultValue: 6 Constant: False

**EDM Type Facets for UROWID****Table 4-22 EDM Type Facets for UROWID**

Facet name	Attributes Name and Value
MaxLength	DefaultValue: 4000 Constant: True
FixedLength	DefaultValue: True Constant: True

**EDM Type Facets for Varchar2****Table 4-23 EDM Type Facets for Varchar2**

Facet name	Attributes Name and Value
MaxLength	Minimum: 1 Maximum: 4000 DefaultValue: 4000 Constant: False
Unicode	DefaultValue: False Constant: True
FixedLength	DefaultValue: False Constant: True

## EDM Type Facets for XMLType

**Table 4-24 EDM Type Facets for XMLType**

Facet name	Attributes Name and Value
MaxLength	DefaultValue: 2147483647 Constant: True
Unicode	DefaultValue: True Constant: True
FixedLength	DefaultValue: False Constant: True

# Oracle Number Default Data Type Mapping and Customization

This section describes the default number mapping behavior and how to customize it for your application. You can configure a custom mapping in the .NET configuration file to override the default mapping for each Oracle `NUMBER(p, 0)`, which represents integer values.

Oracle `NUMBER` data types that represent integers do not have a matching .NET integer data type with exactly the same range of acceptable values. ODP.NET uses a default mapping that ensures any .NET integer type values can be stored within the Oracle database without requiring custom data type mapping. However, it is possible that Oracle `NUMBER(p, 0)` column data can be larger than what a .NET data type can hold when retrieving values from the database.

For example, in Entity Framework 6, Oracle `NUMBER(3, 0)` has a default mapping to .NET `Byte`. Oracle `NUMBER(3, 0)` can store a value up to 999, while a .NET `Byte` can store up to the value of 255. If you expect the Oracle data to exceed 255, modify the mapping to a larger numeric data type, such as a .NET `Int16`. Setting up this custom mapping allows you to consume the data in .NET without encountering an error. When such a custom mapping is used, be cautious not to insert a .NET `Int16.MaxValue` (i.e. 32,767) into a `NUMBER(3, 0)` column will cause an Oracle Database error.

## Entity Framework 6 Mapping and Customization

Managed and unmanaged ODP.NET Entity Framework 6 applications can set up custom data type mapping using a .NET configuration file. The mapping works with Code First, Database First, and Model First use cases. This format improves on the older version as it unifies how managed and unmanaged ODP.NET set their configuration values and supports auto-completion.

The following is an example of an `edmMappings` section for ODP.NET, Managed Driver:

```
<oracle.manageddataaccess.client>
  <version number="*">
    <edmMappings>
```

```

    <edmNumberMapping>
      <add NETType="bool" MinPrecision="1" MaxPrecision="1" DBType="Number" />
      <add NETType="byte" MinPrecision="2" MaxPrecision="3" DBType="Number" />
      <add NETType="int16" MinPrecision="4" MaxPrecision="5" DBType="Number" />
      <add NETType="int32" MinPrecision="6" MaxPrecision="10" DBType="Number" />
      <add NETType="int64" MinPrecision="11" MaxPrecision="19" DBType="Number" />
    </edmNumberMapping>
  </edmMappings>
</version>
</oracle.manageddataaccess.client>

```

Where:

- `DBType` is the Oracle Database data type
- `NETType` is the .NET data type that the Oracle data type maps to
- `MinPrecision` is the minimum range the Oracle data type will map to the .NET type
- `MaxPrecision` is the maximum range the Oracle data type will map to the .NET type

The following is an example of an `edmmappings` section for ODP.NET, Unmanaged Driver. It is exactly same format as the managed driver with the exception of the opening and closing tags.

```

<oracle.unmanageddataaccess.client>
  <version number="*">
    <edmMappings>
      <edmNumberMapping>
        <add NETType="bool" MinPrecision="1" MaxPrecision="1" DBType="Number" />
        <add NETType="byte" MinPrecision="2" MaxPrecision="3" DBType="Number" />
        <add NETType="int16" MinPrecision="4" MaxPrecision="5" DBType="Number" />
        <add NETType="int32" MinPrecision="6" MaxPrecision="10" DBType="Number" />
        <add NETType="int64" MinPrecision="11" MaxPrecision="19" DBType="Number" />
      </edmNumberMapping>
    </edmMappings>
  </version>
</oracle.unmanageddataaccess.client>

```

## New Default Mappings

For Entity Framework 6, ODP.NET 12.1.0.2 introduces new default mappings that apply to Code First, Database First, and Model First scenarios. These changes were necessary to support Code First interoperability.

- .NET Booleans map to Oracle `Number(1,0)` and vice-versa by default
- .NET Bytes map to Oracle `Number(2,0)` and `Number(3,0)` and vice-versa by default

This default behavior can be changed by providing an alternative data type mapping by configuring the section of the .NET config file.

## Data Type Mapping and Customization Process

To enable custom mapping, add the mapping information to the .NET config file *prior* to EDM creation.

If the EDM was created already before providing the mapping information, then you can *modify* the mappings either through the Visual Studio tools or manually. Using Visual Studio, go to the EDM Model Browser page. Right-click on the table(s) requiring new data type

mapping and select **Table Mapping** from the pop-up menu. The **Mapping Details** window will appear usually at the bottom of your screen. Update **Column Mappings** as desired.

If you need to *add* or *delete* mappings, find the **Type** values in the CSDL mapping section of your project's existing EDMX file. Add or delete those **Type** values to the .NET data types you want the application to use. In the example below, the property name types for `BOOLCOL` and `BYTECOL` are added to the CSDL and mapped to Boolean and Byte, respectively.

Example Mapping Before CSDL Customization:

```
<Property Name="INT16COL" Type="Int16" Nullable="false" />
```

Example Mapping After CSDL Customization:

```
<Property Name="BOOLCOL" Type="Boolean" Nullable="false" />
<Property Name="BYTECOL" Type="Byte" Nullable="false" />
<Property Name="INT16COL" Type="Int16" Nullable="false" />
```

You can employ combinations of these customization possibilities depending on your planned mapping changes. If *many* tables and *many* columns require mapping changes, it is most efficient to delete the EDMX file and regenerate the data model. If a *few* tables and *many* columns require changes, then delete the affected tables, save the EDMX file, and select **Update Model from Database...** to include those tables again. If only a *single* table and *one or two* columns require changes, then modify the EDMX either manually or by using the **Mapping Details** window.



#### Note:

When using the EDM wizard to create a complex type from a function import, any custom EDM type mappings specified will not be applied automatically. The EDM wizard uses the default type mappings. Developers must then manually edit the resulting complex type. Developers begin this process after the complex type is generated. Any type declaration (field, property, constructor parameter, etc.) in the complex object which has an undesired type mapping, such as Decimal rather than Boolean, should be manually edited to the desired type.

## StoreGeneratedPattern Enumeration

The following sections describe the Identity attribute and the Virtual column.

### Identity Attribute

Oracle Database 12c (12.1) and later versions support table or view Identity attribute columns. Oracle has three Identity attribute types. When the EDM wizard generates a data model from an Oracle Identity attribute-containing table or view, ODP.NET will set the value of `StoreGeneratedPattern` to `Identity` in the .edmx file for any of three Oracle Identity types. The Identity attribute-associated column will use the server-generated value during `INSERT`; hence, application developers no longer need to create a sequence nor trigger. If the .NET application attempts to set the Identity attribute itself, this value will be ignored.

For Oracle Database 11g Release 2 (11.2) and earlier versions that do not support Identity columns, application developers can manually set `StoreGeneratedPattern` to `Identity` in columns through the entity model designer Properties after model generation, then create an `INSERT` trigger. Depending on the data type, a sequence may not be necessary if a server function, such as `sys_guid()`, can generate the value for the column.

## Virtual Column

Oracle Database versions can store expressions directly in base tables as Virtual columns, also known as Generated columns. Virtual columns cannot be inserted into or updated. ODP.NET will not automatically set `StoreGeneratedPattern` to `Computed` in the EF model for Virtual columns. To avoid errors, application developers need to add or change the value of `StoreGeneratedPattern` to `Computed` for Virtual columns after the model generation. Once done, Virtual columns are excluded from `INSERTS` and `UPDATES` upon calling `SaveChanges()`.

## Resolving Compilation Errors When Using Custom Mapping

If the custom mapping in a .NET configuration file has changed, then regenerate the data model to solve compilation errors introduced by the changes.

Under certain scenarios, custom mapping may cause compilation errors when a project that uses custom mapping is loaded by Visual Studio. One specific scenario is when Visual Studio opens a project with an existing custom mapping that now generates errors when those errors did not exist before. You may use the following workaround for such scenarios:

1. Open Visual Studio Help, About Microsoft Visual Studio. Click **OK** to exit the dialog box. Alternatively, open the to-be-used connection in Server Explorer.
2. Compile the project again to eliminate the compilation errors.

## Mapping Boolean and Guid Parameters in Custom INSERT, UPDATE, and DELETE Stored Procedures

When using your custom `INSERT`, `UPDATE`, or `DELETE` stored procedure in Stored Procedure Mapping, the following error might occur:

```
Error 2042: Parameter Mapping specified is not valid.
```

This can happen if a `Number` parameter has been mapped to a `Boolean` attribute, or if a `RAW` parameter has been mapped to a `Guid` attribute.

The solution is to manually add `Precision="1"` for the `Number` parameter, and `MaxLength="16"` for the `RAW` parameter of your stored procedure in the `SSDL`.

# Migrating Existing Entity Framework 5 Applications to Entity Framework 6

To migrate existing Database First Entity Framework 5 applications to Entity Framework 6, use the following instructions. The first four steps are generic to all Entity Framework applications. The last four steps are specific to Oracle deployments.

1. Uninstall Entity Framework 5 in Visual Studio Package Manager Console. For example,

```
Uninstall-Package EntityFramework
```

2. Install Entity Framework 6 in Package Manager Console. For example,

```
Install-Package EntityFramework -Version 6.0.2
```

This step adds Entity Framework 6 to the `configSections` entry and adds a new section called `entityFramework`.

3. Delete the following namespaces from your application:

```
// C#  
using System.Data.EntityClient;  
using System.Data.Objects;
```

4. Add the following namespaces to your application:

```
// C#  
using System.Data.Entity.Core.EntityClient;  
using System.Data.Entity.Core.Objects;
```

5. Add the Oracle Entity Framework 6 provider configuration information to the .NET config file in the `providers` section. Modify the ODP.NET version if using a version besides 6.121.2.0. If you installed the ODP.NET NuGet package, you can skip this step as the NuGet install has already added made this change.

```
<provider invariantName="Oracle.DataAccess.Client"  
type="Oracle.DataAccess.EntityFramework.EFOracleProviderServices,Oracle.DataA  
ccess.EntityFramework, Version=6.121.2.0, Culture=neutral,  
PublicKeyToken=89b483f429c47342" />
```

```
<provider invariantName="Oracle.ManagedDataAccess.Client"  
type="Oracle.ManagedDataAccess.EntityFramework.EFOracleProviderServices,Oracl  
e.ManagedDataAccess.EntityFramework, Version=6.121.2.0, Culture=neutral,  
PublicKeyToken=89b483f429c47342" />
```

6. Add the `Oracle.ManagedDataAccess.EntityFramework` or `Oracle.DataAccess.EntityFramework` assembly as a reference to the project.
7. Modify the Oracle data type to .NET data type mappings as required by your application. See ["Entity Framework 6 Mapping and Customization"](#) for more details.
8. Rebuild the application.

## Code First

Using the Entity Framework Code First modeling path, developers define the application domain model using source code rather than working directly with a designer or an XML-based configuration file. The classes defined within the source code become the model. The Code First model path offers an alternative to the existing Entity Framework Database First and Model First paths. Within Code First, the classes defined in code that comprise the model are known as Plain Old CLR Objects (POCOs). This name derives from the fact that these classes have no dependency upon Entity Framework itself and are independent of it.

Oracle's support for the Code First modeling path enables .NET developers to take advantage of Oracle Database benefits.

**See Also:**[Configuring for Entity Framework Code First](#)

## Mapping of .NET Types to Oracle Types

When using the Code First path, the model is defined by the application's classes and properties. The property data types need to be mapped to the Oracle Database table data types. The following table lists the default mapping of supported .NET types to Oracle types as well as how to map a String property to non-default Oracle types:

**Table 4-25 Mapping of .NET Data Types to Oracle Data Types**

.NET Data Type	Oracle Data Type	Mapping Method
Boolean	number(1, 0)	Use EDM Mapping Note: Requires use of EDM Mapping configuration. Reference the EDM Mapping sections in the documentation for additional information.
Byte	number(3, 0)	Use EDM Mapping Note: Requires use of EDM Mapping configuration. Reference the EDM Mapping sections in the documentation for additional information.
Byte[]	blob	Default
Int16	number(5, 0)	Default Note: The default mapping of integer types may be specified in the EDM Mapping configuration. Reference the EDM Mapping sections in the documentation for additional information.
Int32	number(10, 0)	Default Note: The default mapping of integer types may be specified in the EDM Mapping configuration. Reference the EDM Mapping sections in the documentation for additional information.
Int64	number(19, 0)	Default Note: The default mapping of integer types may be specified in the EDM Mapping configuration. Reference the EDM Mapping sections in the documentation for additional information.
Decimal	number(18, 2)	Default
Single	binary_float	Default

**Table 4-25 (Cont.) Mapping of .NET Data Types to Oracle Data Types**

<b>.NET Data Type</b>	<b>Oracle Data Type</b>	<b>Mapping Method</b>
Double	binary_double	Default
Guid	raw(16)	Default
DateTime	date	Default
DateTimeOffset	timestamp with time zone	Default
String	nclob	Default
String	clob	Set Unicode to false using IsUnicode() fluent API
String	nvarchar2	Set Max Length to <= 2000 using HasMaxLength() fluent API or MaxLength data annotation
String	varchar2	Set Max Length to <= 4000 using HasMaxLength() fluent API or MaxLength data annotation and set Unicode to false using IsUnicode() fluent API
String	nchar	Set Max Length to <= 1000 using HasMaxLength() fluent API or MaxLength annotation and Set Column Type to NCHAR using HasColumnType() fluent API or Column data annotation
String	char	Set Max Length to <= 2000 using HasMaxLength() fluent API or MaxLength annotation and Set Column Type to CHAR using HasColumnType() fluent API or Column data annotation
String	Long	Set Column Type to LONG using HasColumnType() fluent API or Column data annotation  Note: The long data type is deprecated and not recommended.
String	rowid	Set Column Type to ROWID using HasColumnType() fluent API or Column data annotation
String	urowid	Set Column Type to UROWID using HasColumnType() fluent API or Column data annotation

 **Note:**

The character based columns, namely, `CHAR`, `NCHAR`, `VARCHAR2`, `NVARCHAR2` will be created using character semantics to be able to store the specified `Max Length` amount of characters. However, due to the Oracle database limit, these columns can store only up to 4000 bytes. As such, these columns may not be able to store 4000 characters even if `Max Length` is set to 4000 characters since one character may require multiple number of bytes of storage, depending on the data and the database character set. If the character data can be longer than 4000 bytes, it may be more appropriate to use `CLOB` or `NCLOB` column.

**Influencing the Oracle Data Type Characteristics**

The type mappings listed in the previous table represent the mappings that occur by default or what is known as convention in Entity Framework. As illustrated with the `String` type, you can influence the resulting Oracle Data Type for a property as well as characteristics of that data type. There are two Entity Framework methods to influence the resulting Oracle Data Type: Data Annotations and the Code First Fluent API. Data Annotations permit you to explicitly mark a class property with one or more attributes, whereas the Code First Fluent API permits you to use code rather than attributes to achieve the same goal. For additional information regarding the use of Data Annotations and the Code First Fluent API refer to the MSDN Entity Framework documentation.

The following table illustrates the available functionality:

**Table 4-26 Mapping of Data Annotations and the Code First Fluent APIs**

Data Annotation	Fluent API	Purpose	Applies To
Key	HasKey	Set a property as the Primary Key.	All Scalar Types
Required	IsRequired	Set the database column as <code>NOT NULL</code> .	All
MaxLength	HasMaxLength	Specifies the maximum length of the property.	String
NotMapped	Ignore	Indicates the property is not mapped to a database column.	All

**Table 4-26 (Cont.) Mapping of Data Annotations and the Code First Fluent APIs**

Data Annotation	Fluent API	Purpose	Applies To
ConcurrencyCheck	IsConcurrencyToken	Indicates the column should be used for optimistic concurrency checking.  Note: Do not use with an unbounded (no maximum length specified) string property as this will create a LOB column. Use of a LOB column in the concurrency check will result in an <code>ORA-00932: inconsistent datatypes error</code> .	All
TimeStamp	IsRowVersion	Indicates to create the column as a <code>rowversion</code> column.	Not Supported
Column	HasColumnType	Indicates the provider-specific type to use for the database column.  Note: Must be a legal compatible type. For example a <code>Date</code> property is not legal to map to a number column. Use the <code>TypeName</code> property with the <code>Column Data Annotation</code> to specify the type.	All
N/A	IsUnicode	Indicates to create the column as an N-type, that is, <code>nvarchar2</code> or <code>nclob</code> . Default is <code>true</code> .  Note: There is no Data Annotation equivalent for <code>IsUnicode</code> .	String
N/A	HasPrecision	Indicates the precision and scale for a decimal property.  Note: There is no Data Annotation equivalent for <code>HasPrecision</code> .	Decimal

## Code First Migrations

The Oracle Data Provider for .NET supports Code First Migrations functionality. The use of Code First Migrations with Oracle Database is supported through the Package

Manager Console window migrations commands. For information on these commands, refer to the MSDN Code First Migrations documentation:

<https://docs.microsoft.com/en-us/ef/ef6/modeling/code-first/migrations/>

Code First Migrations utilizes a table known as the Migration History table for tracking migration operations as well as model changes. ODP.NET creates this table, by default, in the user schema specified in the context connection string. This table is named **\_\_MigrationHistory**.

This table can be created in another user schema besides the user specified in the context connection string. This is accomplished through a process known as Migration History Table Customization, which is described in the following MSDN documentation.

<https://docs.microsoft.com/en-us/ef/ef6/modeling/code-first/migrations/history-customization>

 **Note:**

- Changing the user schema for the table is the only supported customization.
- Code First Automatic Migrations is limited to working with the `dbo` schema only. Due to this limitation it is recommended to use code-based migrations, that is, add explicit migrations through the Add-Migration command.

## Code First Migrations With No Supporting Code Migration File

When using Code First Migrations with ODP.NET, the migration history table may be dropped if no supporting code migration file existed prior to updating the database. Developers should ensure the supporting code migration file has been added prior to updating the database.

The following steps can remove the migration history table:

1. Execute application to create database objects
2. **Enable-Migrations** in the Package Manager Console
3. Make code change to POCO
4. **Update-Database** in the Package Manager Console

The following steps ensure the code migration file is created:

1. Execute application to create database objects
2. **Enable-Migrations** in the Package Manager Console
3. Make code change to POCO
4. **Add-Migration** in the Package Manager Console. This step will create the necessary code migration file.
5. **Update-Database** in the Package Manager Console

## Code First Database Initialization

ODP.NET supports the following Code First Database Initializer methods:

- `CreateDatabaseIfNotExists` (default if none specified)
- `DropCreateDatabaseAlways`
- `DropCreateDatabaseIfModelChanges`
- `NullDatabaseInitializer`
- `MigrateDatabaseToLatestVersion`

These methods are documented on MSDN.

Due to differences in how Oracle and SQL Server define a database, database initialization actions work on all of the Oracle objects in the model. An Oracle Database is not created or dropped, rather the objects that compose the model are considered to be the database for these operations.

## Oracle Database Object Creation

In order to support the client application, ODP.NET will create and maintain the required database objects. The following are the database objects created and maintained by the provider:

- Table
- Table Column
- Primary Key
- Foreign Key
- Index
- Sequence
- Trigger



### Note:

Sequences and triggers may be created in Oracle Database 11g Release 2 and earlier databases to support identity columns.

For objects which directly relate to a client application object, namely, a table which represents an application class and a table column which represents a class property, the object names used are those provided by the client. These object names must conform to the object identifier length limits for Oracle Database. For example, if a class name length exceeds the valid object identifier length in Oracle Database then the `ORA-00972: identifier is too long` exception will be raised at object creation time.

For the remaining objects, ODP.NET utilizes a name generation algorithm if the supplied name length exceeds the database identifier length limit. If the supplied name length does not exceed the database limit the name is used as-is. In all cases, the object name is created as a quoted identifier in order to preserve case and any special characters which may be part of the identifier.

In cases where the provider generates a name to comply with database identifier length limits, the name is composed of the following underscore separated elements:

- A substring of the original name (from the first character)
- A numeric suffix value calculated from the original name

The following example illustrates the results of the name generation algorithm using a simple POCO in the client application:

```
public class LongSamplePocoTestClassNames
{
    [Key]
    public int Id { get; set; }

    [MaxLength(64)]
    public string Name { get; set; }
}
```

The default name for the Primary Key for the resulting table will be:

```
PK_LongSamplePocoTestClassNames
```

As this name contains 31 characters (single byte per character), it violates the database identifier restrictions. The rewritten Primary Key name will resemble the following value:

```
PK_LongSamplePocoTes_730795129
```

The algorithm is designed to utilize as many characters as possible from the original name such that the new name does not violate the identifier length restrictions.

### Controlling Table Name and Owner

Through the use of Data Annotations or the Entity Framework Fluent API you may control the table name, as well as the table owner. For example, you may choose to explicitly set the table name to conform to your organization's naming standards or if you do not wish to, use the name Entity Framework provides. The `Table` Data Annotation is used to control both the table name and the owner. When using the Fluent API, the `.ToTable` method is used to control the table name and the owner within the `OnModelCreating` override in your class which derives from `DbContext`.

The following examples use an incomplete class definition to illustrate these actions.

Setting the table name using a Data Annotation:

```
[Table("Employee")]
public class Employee
```

Setting the table name using the Fluent API:

```
protected override void OnModelCreating(DbModelBuilder modelBuilder)
{
    modelBuilder.Entity<Employee>().ToTable("Employee");
}
```

Setting the table name and the owner using a Data Annotation:

```
[Table("Employee ", Schema="TESTUSER")]
public class Employee
```

Setting the table name and the owner using the Fluent API:

```
protected override void OnModelCreating(DbModelBuilder modelBuilder)
{
```

```
modelBuilder.Entity<Employee>().ToTable("Employee", "TESTUSER");  
}
```

 **Note:**

When using Data Annotations or the Fluent API as above to set the owner, it is required to also set the name.

### Setting the Default Table Owner

Rather than set the table owner for each user table, Entity Framework 6 and higher allows you to set the default owner to be used. This is done by invoking the `HasDefaultSchema` method within the `OnModelCreating` override in your class, which derives from `DbContext`.

For example, the following code will cause all user tables to be created within the `TESTUSER` schema by default:

```
protected override void OnModelCreating(DbModelBuilder modelBuilder)  
{  
    modelBuilder.HasDefaultSchema("TESTUSER");  
}
```

 **Note:**

The owner name is case-sensitive.

 **See Also:**

*Oracle Database Administrator's Guide.*

## Using the Default Connection Factory

The default connection factory allows ODP.NET connections to be created by providing an Oracle connection string to the `DbContext` constructor. For example, the following entry could be used to configure the ODP.NET, Managed Driver default connection factory:

```
<defaultConnectionFactory  
type="Oracle.ManagedDataAccess.EntityFramework.OracleConnectionFactory,  
Oracle.ManagedDataAccess.EntityFramework,  
Version=6.121.2.0,  
Culture=neutral,  
PublicKeyToken=89b483f429c47342" />
```

When using the default connection factory, the application supplies an Oracle connection string to the `DbContext` base constructor as follows:

```
public class TestContext : DbContext  
{
```

```
public TestContext()  
    : base("<connection string>")  
{  
}  
}
```

Where <connection string> is the ODP.NET connection string. This allows the application to connect to the database using code similar to the following:

```
using (var ctx = new TestContext())  
{  
    ...  
}
```

For additional information please see the MSDN documentation for the `IDbConnectionFactory` interface:

<https://docs.microsoft.com/en-us/dotnet/api/system.data.entity.infrastructure.idbconnectionfactory>

## Unsupported Entity Framework Features

The following items are not supported by the current release of the provider:

- Mapping Code First Insert, Update, Delete operations to Stored Procedures
- TimeStamp/RowVersion properties
- Custom Configuration
- Spatial Types
- Table-valued functions
- Asynchronous Query and Save
- Connection Resiliency
- Oracle synonyms

# 5

## Oracle Data Provider for .NET Entity Framework Core

Oracle Data Provider for .NET (ODP.NET) Entity Framework (EF) Core is a database provider that allows Entity Framework Core to be used with Oracle databases.

Entity Framework Core is a cross-platform Microsoft object-relational mapper that enables .NET developers to work with relational databases using .NET objects.

ODP.NET EF Core consists of a single 100% managed code dynamic-link library, `Oracle.EntityFrameworkCore.dll`, available via a NuGet package.



### Note:

ODP.NET EF Core does not support Oracle UDTs, REFs, and Object Tables.

This section contains these topics:

- [Oracle Entity Framework Core 7 Features](#)
- [Application Programming Interface](#)
- [Sample Code](#)
- [Using ODP.NET Core Classes](#)
- [Logging](#)
- [Migrations](#)
- [Scaffolding Or Reverse Engineering](#)
- [Identifier Name Length and Uniqueness](#)
- [Using Large Character or Binary Data Types](#)
- [Performance Considerations](#)
- [Breaking Changes](#)

## Oracle Entity Framework Core 7 Features

Oracle Entity Framework Core 7 supports .NET 6 and 7 runtimes. It supports connecting to Oracle Database 12.2 and higher.

Oracle supports the EF Core 7 features described on this page. This page notes the differences from standard EF Core 7 functionality and Oracle's support. More details about each of these features standard functionality are described on the [What's New in EF Core 7.0 web page](#).

## Stored Procedure Mapping

Using Oracle PL/SQL stored procedures to perform entity insert, update, and delete operations are supported. [Table 5-2](#) lists the supported parameter data types. Oracle PL/SQL packages and functions are not currently supported.



### Note:

The `HasRowsAffectedReturnValue()` API is not supported.

## Query Enhancements

Oracle EF Core improves the following LINQ query translations:

- `GroupBy` as final operator
- `GroupJoin` as final operator
- `GroupBy` entity type
- Subqueries don't reference ungrouped columns from outer query
- Read-only collections can be used for `Contains`
- Translations of string aggregate functions, `string.Join` and `string.Concat`
- Translation of `string.IndexOf`
- Translation of `GetType` for entity types
- Filtered Include on hidden navigations

## Model Building Conventions

Oracle EF Core now supports model building that allow applications to remove or replace any model building conventions and to add new conventions.

## Model Building Enhancements

New enhancements in model building are supported with the following features and limitations:

- Mapping attribute for composite keys
- `DeleteBehavior` mapping attribute
- Properties mapped to different column names
- Unidirectional many-to-many relationships
- Entity splitting
- Descending Indexes are only supported for code first, and not for scaffolding.
- `ITableIndex.IsDescending` property, which returns a Boolean indicating whether the index is descending or not, is not supported.

## Custom Reverse Engineering Templates

Oracle EF Core 7 provider supports scaffolding customization of a generated EF model.

## New and Improved Interceptors and Events

Enhancements to interceptors which enable interception, modification, and/or suppression of EF Core operations are supported. These new improvements include interception for:

- New entity instance creation and population
- LINQ expression tree modification before query compilation
- Handling optimistic concurrency
- Connections before checking the connection string is populated
- After the result set has been consumed, but before the result set is closed
- `DbConnection` creation
- `DbCommand` after initialization

The new events include:

- Right before an entity is tracked or changes state
- Before and after changes are detected to entities and properties

## DbContext API and Behavior Enhancements

Improvements to `DbContext` and related classes are supported.

- Suppressor for uninitialized `DbSet` properties
- Distinguish cancellation from failure in logs
- New `IProperty` and `INavigation` overloads for `EntityEntry` methods
- `EntityEntry` for shared-type entity types
- `ContextInitialized` is now logged as `Debug`
- `IEntityEntryGraphIterator` is publicly usable

## Improved Value Generation

Improvements to the automatic generation of values for key properties are supported.

- Value generation for domain-driven design guarded types
- Sequence-based key generation

For sequence-based key generation, Oracle EF Core 7 provider introduces a new fluent API, `UseSequence()`, which can configure the default values of a key property to be generated using a database sequence.

## Migrations Tooling Improvements

Improvements when using the EF Core Migrations command-line tools are supported.

This includes the `UseOracle()` method which now accepts a null connection string so that the connection string can be assigned at a later time without encountering an exception. It also includes being able to detect when migration tools are running.

### First-Class Windows Forms Data Binding

The new data binding experiences introduced in Windows Forms which integrates well with EF Core are supported by the Oracle EF Core 7 provider.

### Not Supported Features

The following features are not supported by the Oracle EF Core 7 provider.

- Mapping to and from JSON columns
- Bulk updates
- Faster SaveChanges
- TPC inheritance mapping
- Performance enhancements for proxies

## Oracle Entity Framework Core 8 Features

Oracle supports the EF Core 8 features described on this page. This page notes the differences from standard EF Core 8 functionality and Oracle's support.

More details about each of these features standard functionality are described on the [What's New in EF Core 8.0 web page](#).

### JSON Columns

Oracle database includes comprehensive JSON document and column support, including binary JSON storage and JSON Relational Duality.

EF Core provides support for JSON columns that allows the mapping and modifying of aggregates built from .NET types to JSON documents. LINQ queries can act upon the aggregates, which will translate to the necessary query constructs to perform operations on the JSON.

Oracle EF Core 8 JSON column support includes:

- JSON column mapping
- Queries into JSON columns
- JSON column data updates
- Translate element access into JSON arrays

Oracle Database 21c and higher support JSON columns. Oracle EF Core 8 will map aggregate types to NCLOB columns instead of JSON columns when connected to earlier Oracle database versions.

### Math Translations

Concrete .NET types, such as double and float, recently introduced generic math interfaces. They mirrored existing functionality in .NET `Math` and `MathF` classes.

Oracle EF Core 8 translates calls to these generic math APIs in LINQ using existing Oracle SQL translations for `Math` and `MathF`. Developers can choose between math APIs, such as either `Math.Sin` or `double.Sin`.

Oracle EF Core support all math translations except for `DegreesToRadians` and `RadiansToDegrees`.

### Value Objects Using Complex Types

Oracle EF Core 8 support complex types, also known as object types. They are structured to hold multiple values, such as an address.

Complex types must be configured in the model using either mapping attributes "[ComplexType]" or by calling the "ComplexProperty" API in `OnModelCreating`.

Complex types do not map to their own tables. Instead, they are saved inline to the table columns. This matches the table sharing behavior of owned types.

### Model Building - Discriminator Columns Maximum Length

In Oracle EF Core 8, string discriminator columns in table-per-hierarchy inheritance mapping are now configured with a maximum length. This length is calculated as the smallest Fibonacci number covering all defined discriminator values.

### Raw SQL Queries for Unmapped Types

Oracle EF Core 8 has added raw SQL queries returning any mappable CLR type, without including that type in the EF model. Queries using unmapped types are executed using `SqlQuery` or `SqlQueryRaw`.

### Lazy-Loading Enhancements

Oracle EF Core 8 adds the following lazy-loading features:

- Lazy-loading for no-tracking queries
- Explicit loading from untracked entities
- Opt-out of lazy-loading for specific navigations

### Access to Tracked Entities

Oracle EF Core 8 supports new APIs for applications to lookup tracked entities by their primary, alternate, or foreign key. These APIs are accessed through the `LocalView<TEntity>` of the entity type.

### Not Supported Features

The following feature is not supported by the Oracle EF Core 8 provider:

- Primitive Collections

## Application Programming Interface

ODP.NET EF Core supports standard EF Core application programming interfaces. The provider contains additional extension methods specific to the provider.

- [DatabaseFacade Class](#)
- [DbContextOptionsBuilder Class](#)
- [IQueryingEnumerable Interface](#)
- [MigrationBuilder Class](#)

- [ModelBuilder Class](#)
- [OracleSQLCompatibility Enumeration](#)

## DatabaseFacade Class

ODP.NET EF Core contains additional extension methods and changes to method default behavior for the `DatabaseFacade` class.

- [DatabaseFacade.IsOracle](#)
- [DatabaseFacade.EnsureCreated](#)
- [DatabaseFacade.EnsureCreated\(string\[\]\)](#)
- [DatabaseFacade.EnsureDeleted](#)
- [DatabaseFacade.EnsureDeleted\(string\[\]\)](#)

## DatabaseFacade.IsOracle

This method returns true if ODP.NET is the currently used database provider.

```
// C#  
public static bool IsOracle()
```

Returns a bool value.



### Note:

The provider is only known after the provider is set in the `DbContext`.

## DatabaseFacade.EnsureCreated

This property ensures that the tables for the schema defined in the current context exists.

### Declaration

```
// C#  
public static bool EnsureCreated()
```

### Return Value

A bool

### Remarks

If any of the tables in the schema exist, then no action is taken. Pre-existing tables are not checked for compatibility with the EF Core context model.

If none of the tables in the schema exist, then all the defined context model objects are created.

If the user/schema specified in the connection string does not exist, then an error is thrown and no action is taken to create the user/schema. The administrator must create the user/schema and assign the appropriate privileges prior to using this method.

The return value is `true` if all the objects defined in the context are created. It is `false` if any of the tables for the schema already exist.

### Exception

`NotSupportedException()` is thrown when a non-existent user/schema is specified in the connection string.

*Type:* `NotSupportedException()`

*Message:* Required user does not exist or invalid user name/password provided

## DatabaseFacade.EnsureCreated(string[])

This property ensures that the tables for the specified schemas in the string array exist.

### Declaration

```
// C#  
public static bool EnsureCreated (string[] schemas)
```

### Parameters

- `schemas` – List of schemas to check for the EF Core context's pre-existing tables. Schema names are case-sensitive.

### Return Value

A `bool`

### Remarks

If any of the tables in the string array schema list exists, then no action is taken. Pre-existing tables are not checked for compatibility with the EF Core context model.

If none of the tables in the string array schema list exist, then all the defined context model objects are created.

If the user/schema specified in the connection string does not exist, then an error is thrown and no action is taken to create the user/schema. The administrator must create the user/schema and assign the appropriate privileges prior to using this method.

If the schemas passed to this method does not include the user/schema specified in the connection string, then that schema is implicitly added to the array of schemas.

If the array of schemas is null or length zero, then the `DatabaseFacade.EnsureCreated()` API is called.

The return value is `true` if all the objects defined in the context are created. It is `false` if any of the tables for the schema already exist.

### Exception

`NotSupportedException()` is thrown when a non-existent user/schema is specified in the connection string.

*Type:* `NotSupportedException()`

*Message:* Required user does not exist or invalid user name/password provided

### Sample Code

```
using (var db = DbContext())
{
    db.Database.EnsureCreated(new string[]{"SCOTT", "HR", "EFUser"});
}
```

## DatabaseFacade.EnsureDeleted

This property ensures that all the schema user's created objects are deleted.

### Declaration

```
// C#
public static bool EnsureDeleted()
```

### Return Value

A bool

### Remarks

If none of the EF Core context model objects exist, no action is taken. If any of the objects exist, then all the user/schema objects are dropped, except for Oracle data dictionary objects.

**Warning:** The dropped objects include schema objects outside of the EF Core context model, as long as the user/schema has privileges to drop those objects.

If the schema defined in the current context does not exist, then no action is taken.

The return value is `true` if an attempt is made to drop all user created objects related to the schema in the current context. It is `false` if the schema specified in the connection string does not exist.

## DatabaseFacade.EnsureDeleted(string[])

This property ensures that the user/schema objects for the specified schemas in the string array are deleted.

### Declaration

```
// C#
public static bool EnsureCreated (string[] schemas)
```

### Parameters

- `schemas` – List of schemas to drop user generated objects. Schema names are case-sensitive.

### Return Value

A bool

### Remarks

If any of the objects exist, then all the user/schema objects are dropped, except for Oracle data dictionary objects. If none of the EF Core context model objects exist, no

action is taken. If the schemas passed to this method does not include the user/schema specified in the connection string, then that schema is implicitly added to the array of schemas.

**Warning:** The dropped objects include schema objects outside of the EF Core context model, as long as the user/schema has privileges to drop those objects.

If the specified schemas do not exist, then no action is taken.

The return value is `true` if an attempt is made to drop all user created objects that the user has privilege to in the specified schemas. It is `false` if the schema specified in the connection string does not exist.

### Sample Code

```
using (var db = DbContext())
{
    db.Database.EnsureDeleted(new string[]{"SCOTT", "HR", "EFUser"});
}
```

## DbContextOptionsBuilder Class

ODP.NET EF Core contains additional extension methods and changes to method default behavior for the `DbContextOptionsBuilder` class.

- [DbContextOptionsBuilder.UseOracle](#)
- [UseOracle\(string connectionString\)](#)
- [UseOracle\(DbContextOptionsBuilder, Action<OracleDbContextOptionsBuilder> oracleOptionsAction = null\)](#)
- [UseOracleSQLCompatibility\(string version\)](#)
- [UseOracleSQLCompatibility\(enum version\)](#)

## DbContextOptionsBuilder.UseOracle

This extension method sets the provider and database connection configuration to connect to Oracle Database. Developers can set any connection string attributes that are available in ODP.NET Core. The available method overloads that can be called are as follows:

- `UseOracle(string connectionString)`
- `UseOracle(string connectionString, Action<OracleDbContextOptionsBuilder> oracleOptionsAction = null)`
- `UseOracle(DbConnection connection, Action<OracleDbContextOptionsBuilder> oracleOptionsAction = null)`
- `DbContextOptionsBuilder<TContext> UseOracle<TContext>(string connectionString, Action<OracleDbContextOptionsBuilder> oracleOptionsAction = null)`
- `DbContextOptionsBuilder<TContext> UseOracle<TContext>(DbConnection connection, Action<OracleDbContextOptionsBuilder> oracleOptionsAction = null)`
- `UseOracle(DbContextOptionsBuilder, Action<OracleDbContextOptionsBuilder> oracleOptionsAction = null)`

## UseOracle(string connectionString)

This extension method sets the provider and database connection configuration. Developers can set any connection string attributes that are available in ODP.NET Core.

### Declaration

```
// C#
optionsBuilder.UseOracle(@"User Id=blog;Password=<password>;Data
Source=pdborcl;");
```

## UseOracle(DbContextOptionsBuilder, Action<OracleDbContextOptionsBuilder> oracleOptionsAction = null)

The following extension configures the EF Core context to connect to an Oracle database without initially setting any `DbConnection` nor connection string. The `DbConnection` or connection string must be set before the `DbContext` attempts to connect to a database. To set the connection using, use `RelationalDatabaseFacadeExtensions.SetDbConnection` or `RelationalDatabaseFacadeExtensions.SetConnectionString`.

### Declaration

```
// C#
public static DbContextOptionsBuilder UseOracle(this DbContextOptionsBuilder,
Action<OracleDbContextOptionsBuilder>)
```

### Parameters

- `DbContextOptionsBuilder` - The builder being used to configure the context
- `Action<OracleDbContextOptionsBuilder>` - An optional action to allow additional Oracle specific configuration

### Return Value

The options builder so that further configuration can be chained.

### Sample Code

```
// C# - Setting up the DB context
protected override void OnConfiguring(DbContextOptionsBuilder optionsBuilder) =>
optionsBuilder.UseOracle();
// Using the DB context
using (var context = new DbContext())
{
context.Database.SetDbConnection(new OracleConnection(<connection string>));
}
```

 **Note:**

- `optionsBuilder` is of type `DbContextOptionsBuilder`.
- Do not use Oracle built-in accounts to store Entity Framework Migrations.

## UseOracleSQLCompatibility(string version)

This extension method specifies the database version generated SQL should be compatible with.

 **Note:**

- This method is deprecated. Oracle EF Core 8 and ODP.NET 23c will use the method `UseOracleSQLCompatibility(enum version)` to set the Oracle database compatibility version.
- This extension method exists for EF Core 6 and 7 only.

This method uses the value "12" as the default. The generated SQL is compatible with database version 12 and higher. No other value changes the method's behavior.

```
// C#
optionsBuilder.UseOracle("User Id=hr;Password=<password>;Data Source = inst1", b =>
b.UseOracleSQLCompatibility("12"));
```

 **Note:**

`optionsBuilder` is of type `DbContextOptionsBuilder`.

## UseOracleSQLCompatibility(enum version)

This extension method specifies the database version generated SQL and functionality to be compatible with.

With Oracle EF Core 21.12.1 and higher, `UseOracleSQLCompatibility` extension method now takes an enumeration type as an argument rather than a string value.

The valid enum values that can be used are:

- `OracleSQLCompatibility.DatabaseVersion19`
- `OracleSQLCompatibility.DatabaseVersion21`
- `OracleSQLCompatibility.DatabaseVersion23`

By default, the SQL compatibility value will be `OracleSQLCompatibility.DatabaseVersion21`. So generated SQL will be compatible with database version 21. If using Oracle EF Core 8

with `OracleSQLCompatibility.DatabaseVersion21`, JSON database columns are supported. Otherwise, aggregate types will map to `NCLOB` columns in the database instead of JSON.

Using `OracleSQLCompatibility.DatabaseVersion23`, the `.NET` `bool` type will map to Oracle `BOOLEAN` column type rather than `NUMBER(1)` by default. To map `.NET` booleans to `NUMBER(1)` by default, use `OracleSQLCompatibility.DatabaseVersion21` or lower.

The default enumeration value matches the ODP.NET version. For ODP.NET 21c, the default is `OracleSQLCompatibility.DatabaseVersion21`.

The following example shows how to set `UseOracleSQLCompatibility`.

```
// C#
optionsBuilder.UseOracle("User Id=hr;Password=<password>;Data Source = inst1", b
=>
b.UseOracleSQLCompatibility(OracleSQLCompatibility.DatabaseVersion19));
```

#### Note:

- `optionsBuilder` is of type `DbContextOptionsBuilder`.
- This extension method exists for EF Core 8 only.

## IQueryingEnumerable Interface

This section includes:

- [IQueryingEnumerable.ToQueryString Extension Method](#)

## IQueryingEnumerable.ToQueryString Extension Method

A string representation of the Oracle SQL query used. This extension method will generate SQL that can be run in Oracle Database and Oracle Autonomous Database.

To execute the generated SQL programmatically, developers can adapt the following C# pseudo-code for their specific requirements. The pseudo-code demonstrates how to generate the script using `ToQueryString()` on a sample LINQ query, and then how to execute the script with an `OracleCommand`, depending on the database version backing the application.

```
using System.Data;
using Microsoft.EntityFrameworkCore;
using Oracle.ManagedDataAccess.Client;

class ToQueryStringPseudoCode
{
    static void Main(string[] args)
    {
        using (ModelContext db = new ModelContext())
        {
            //sample LINQ to convert query string from
            string name = "Name";
```

```

var query = db.Set<Instructor>().Where(c => c.Name == name);
string sqltext = query.ToQueryString();

//'sqltext' can be used directly with OracleCommand
OracleConnection con = new OracleConnection("<Connection String>");
con.Open();
OracleCommand cmd = con.CreateCommand();
cmd.CommandText = sqltext;
OracleDataReader reader;
reader = cmd.ExecuteReader();

//verifying the result set
while (reader.Read())
{
    Console.WriteLine($"{reader[0]}, {reader[1]}, {reader[2]},
{reader[3]}");
}
con.Close();
}
}
}

```

## MigrationBuilder Class

### MigrationBuilder.IsOracle Extension Method

Returns true if the MigrationBuilder object uses ODP.NET as its database provider.

### Declaration

```
public static bool IsOracle(this MigrationBuilder)
```

### Parameters

- MigrationBuilder object

### Return Value

A bool.

### Sample Code

```
var migrationBuilder = new MigrationBuilder("Oracle.EntityFrameworkCore");
bool b_oracle = migrationBuilder.IsOracle(); //returns true for ODP.NET
```

## ModelBuilder Class

ODP.NET EF Core contains additional extension methods and changes to method default behavior for the ModelBuilder class.

- [ModelBuilder UseIdentityColumn\(\) and UseOracleIdentityColumn\(\)](#)

## ModelBuilder UseIdentityColumn() and UseOracleIdentityColumn()

This extension method specifies whether the column is an identity column or have it associated with a sequence and a trigger to have a server generated column value,

depending on the value passed to `UseOracleSQLCompatibility()`. By default, columns do not have this extension method enabled.

```
// C #
protected override void OnModelCreating(ModelBuilder modelBuilder)
{
    modelBuilder.Entity<Blog>().Property(p => p.Id).UseIdentityColumn();
}
```

For EF Core 3.1 and higher versions, use `UseIdentityColumn`. For EF Core 3.1 Core and lower versions, you can use `UseOracleIdentityColumn`. Starting with EF Core 5, `UseOracleIdentityColumn` is no longer available to use with Oracle EF Core. These two methods have identical functionality. For the remainder of this section, the term `UseIdentityColumn` is synonymous with `UseOracleIdentityColumn`.

## OracleSQLCompatibility Enumeration

The `OracleSQLCompatibility` enum is used to specify database version the generated SQL should be compatible with. It is also used to determine the type mappings for .NET types.

There are currently 3 possible values of `SQLCompatibility` that can be set in the application using `UseOracleSQLCompatibility()` API.

- `OracleSQLCompatibility.DatabaseVersion19`
- `OracleSQLCompatibility.DatabaseVersion21`
- `OracleSQLCompatibility.DatabaseVersion23`

If using Oracle EF Core 8 with `OracleSQLCompatibility.DatabaseVersion21`, JSON database columns are supported. Otherwise, aggregate types will map to NCLOB columns in the database instead of JSON.

Using `OracleSQLCompatibility.DatabaseVersion23`, the .NET `bool` type will map to Oracle `BOOLEAN` column type rather than `NUMBER(1)` by default. To map .NET booleans to `NUMBER(1)` by default, use `OracleSQLCompatibility.DatabaseVersion21` or lower.

The default enumeration value matches the ODP.NET version. For ODP.NET 21c, the default is `OracleSQLCompatibility.DatabaseVersion21`.

## Sample Code

This code sample demonstrates code necessary to create a blogging context of `Blogs` and `Posts` objects.

EF Core will create database schema tables mapping to these two objects. When the application is run, it will add a new blog entry to the `Blogs` table, then retrieve that entry back to the application.

```
// C#
using Oracle.EntityFrameworkCore;
using System.Collections.Generic;
using Microsoft.EntityFrameworkCore;

namespace OracleBlog
{
    class Program
```

```
{
    public class BloggingContext : DbContext
    {
        public DbSet<Blog> Blogs { get; set; }
        public DbSet<Post> Posts { get; set; }
        protected override void OnConfiguring(DbContextOptionsBuilder
optionsBuilder)
        {
            optionsBuilder.UseOracle(@"User Id=blog;Password=<password>;Data
Source=pdborcl;");
        }
    }
    public class Blog
    {
        public int BlogId { get; set; }
        public string Url { get; set; }
        public List<Post> Posts { get; set; }
    }
    public class Post
    {
        public int PostId { get; set; }
        public string Title { get; set; }
        public string Content { get; set; }
        public int BlogId { get; set; }
        public Blog Blog { get; set; }
    }
    static void Main(string[] args)
    {
        {
            using (var db = new BloggingContext())
            {
                var blog = new Blog { Url = "https://blogs.example.com" };
                db.Blogs.Add(blog);
                db.SaveChanges();
            }
            using (var db = new BloggingContext())
            {
                var blogs = db.Blogs;
            }
        }
    }
}
```

Additional ODP.NET EF Core sample code is available on GitHub, including stored procedure and dependency injection examples.

<https://github.com/oracle/dotnet-db-samples/tree/master/samples/dotnet-core/ef-core>

## Using ODP.NET Core Classes

Developers can use the `OracleConfiguration` class and other ODP.NET Core classes in Entity Framework Core to access ODP.NET Core-specific functionality, such as the TNS ADMIN location or tracing settings.

The ODP.NET Core assembly will already be part of any Oracle EF Core project since it is a dependency of `Oracle.EntityFrameworkCore`. Most commonly, developers will add the ODP.NET Core namespace to the project:

```
// C#
using Oracle.ManagedDataAccess.Client;
```

Then, add the desired `OracleConfiguration` property settings. These properties should be set prior to any EF Core code as `OracleConfiguration` settings must be made prior to opening an ODP.NET connection. The below example turns on tracing and sets a TNS ADMIN location which should contain the application's `tnsnames.ora` and `sqlnet.ora` files:

```
// C#
static void Main(string[] args)
{
    OracleConfiguration.TraceFileLocation = @"D:\traces";
    OracleConfiguration.TraceLevel = 7;
    OracleConfiguration.TnsAdmin = @"D:\tnsadmin";

    <Start Entity Framework Core code>
}
```

Oracle EF Core applications can use all the properties and behavior available in ODP.NET Core.

## Logging

Oracle EF Core integrates directly with EF Core logging mechanisms. Oracle EF Core logs are filtered using `DbLoggerCategory` class and `LogLevel` enumeration.

The following `DbLoggerCategory` properties can be used to filter the logs:

- Database
- Database.Command
- Database.Connection
- DbLoggerCategory.Infrastructure
- Migrations
- Model
- Model.Validation
- Query
- Scaffolding
- Update

The following `LogLevel` properties are available:

- **Debug:** Displays entry and exit traces. Also displays key Oracle EF Core activities and metadata, such as SQL executed, table and column metadata, and mappings.
- **Error:** Displays error related information, including the stack trace.
- **None**

To setup logging using `DebugLoggerProvider`, include the `Microsoft.Extensions.Logging.Debug.dll` assembly in your project. Similarly to setup logging using `ConsoleLoggerProvider`, include the `Microsoft.Extensions.Logging.Console.dll` assembly in your project. Next, add the following namespace in your project:

```
using Microsoft.Extensions.Logging;
```

Next, configure the `DbContext` to use the logger factory.

```
protected override void OnConfiguring(DbContextOptionsBuilder optionsBuilder)
{
    optionsBuilder.UseOracle(@<connection string>)
        .UseLoggerFactory(_myLoggerFactory);
}
```

Finally, set the `DbLoggerCategory` and `LogLevel` properties that you would like to be written to the log. In an `EnsureCreated` scenario, you can create the following `LoggerFactory`:

```
public static readonly ILoggerFactory _myLoggerFactory
    = LoggerFactory.Create(builder =>
    {
        builder
            .AddFilter((category, level) =>
                category == DbLoggerCategory.Database.Name &&
                // Filter the logs based on DbLoggerCategory. Comment this line above if you do not
                // want to filter logs based on DbLoggerCategory.
                level >= LogLevel.Trace
            )
            // Filter the logs based on LogLevel. All levels greater than or equal to "Trace" will
            // be enabled. Comment this line above if you do not want to filter logs based on
            // LogLevel.
            .AddDebug();
    });
```

In a migrations scenario, you can create the following `LoggerFactory`:

```
public static readonly ILoggerFactory _myLoggerFactory
    = LoggerFactory.Create(builder =>
    {
        builder
            .AddFilter((category, level) =>
                category == DbLoggerCategory.Database.Command.Name &&
                // Filter the logs based on DbLoggerCategory. Comment this line above if you do not
                // want to filter logs based on DbLoggerCategory.
                level >= LogLevel.Trace
            )
            // Filter the logs based on LogLevel. All levels greater than or equal to "Trace" will
            // be enabled. Comment this line above if you do not want to filter logs based on
            // LogLevel.
            .AddConsole();
    });
```

In Scaffolding scenario, use the `-verbose` option to generate traces.

```
Scaffold-DbContext .. -verbose
```

## Migrations

By convention, ODP.NET EF Core maps an appropriate database data type based on the .NET data type and its characteristics. This table shows the default mappings. Fluent APIs/Annotations can be used to map the .NET types to any valid Oracle data type.

This table shows the default mappings. Fluent APIs and Data Annotations can be used to map the .NET types to any valid Oracle data type.

**Table 5-1 ODP.NET Entity Framework Core Migrations Data Type Default Mappings**

.NET Type Alias	.NET Data Type	Required Fluent API(s)*	Oracle Database Data Type
bool	System.Boolean	None	BOOLEAN or NUMBER (1)
sbyte	System.Sbyte	None	NUMBER (3)
byte	System.Byte	None	NUMBER (3)
short/int16	System.Int16	None	NUMBER (5)
ushort/uint16	System.UInt16	None	NUMBER (5)
int/int32	System.Int32	None	NUMBER (10)
uint32	System.UInt32	None	NUMBER (10)
decimal	System.Decimal	None	NUMBER (18, 2)
long/int64	System.Int64	None	NUMBER (19)
uint64	System.UInt64	None	NUMBER (20)
float	System.Float	None	BINARY_FLOAT
double	System.Double	None	BINARY_DOUBLE
DateTime	System.DateTime	None	TIMESTAMP (7)
DateTimeOffset	System.DateTimeOffset	None	TIMESTAMP (7) WITH TIME_ZONE
TimeSpan	System.TimeSpan	None	INTERVAL DAY (8) TO SECOND (7)
char	System.Char	None	NVARCHAR2 (1)
byte[]	System.Byte[]	None	RAW (2000)
byte[]	System.Byte[]	HasMaxLength (x <= 2000)	RAW (x)
byte[]	System.Byte[]	HasMaxLength (x > 2000)	BLOB
string	System.String	None	NVARCHAR2 (2000)
string	System.String	IsUnicode (false) && IsFixedLength (false) && HasMaxLength (x > 4000)	CLOB
string	System.String	IsUnicode (true) && IsFixedLength (false) && HasMaxLength (x > 2000)	NCLOB

**Table 5-1 (Cont.) ODP.NET Entity Framework Core Migrations Data Type Default Mappings**

.NET Type Alias	.NET Data Type	Required Fluent API(s)*	Oracle Database Data Type
string	System.String	IsUnicode(false) && IsFixedLength(false) && HasMaxLength(x <= 4000)	VARCHAR2(size)
string	System.String	IsUnicode(true) && IsFixedLength(false) && HasMaxLength(x <= 2000)	NVARCHAR2(size)
string	System.String	IsUnicode(false) && IsFixedLength(true) && HasMaxLength(x < 2000)	CHAR(size)
string	System.String	IsUnicode(true) && IsFixedLength(true) && HasMaxLength(x < 1000)	NCHAR(size)
guid	System.Guid	None	RAW(16)

\* Corresponding data annotations can also be used instead of the specified fluent APIs.

NCHAR and NVARCHAR2 use character length semantics. The number of characters for columns with one of these data types depend on the character set, NLS\_NCHAR\_CHARACTERSET. ODP.NET Entity Framework Core defaults to a 2-byte character set, which allows a maximum of 2000 characters for NCHAR and NVARCHAR2 columns. If a [MaxLength(4000)] data annotation or fluent API equivalent is used for a string entity property, ODP.NET will map the property to an NCLOB type because the specified length is greater than 2000 characters.

For example, if a NVARCHAR2(4000) column on the database NLS\_NCHAR\_CHARACTERSET or if the NVARCHAR2 column has a maximum 32 KB length (i.e. MAX\_STRING\_SIZE = EXTENDED), the string entity property can use the [Column] data annotation or a fluent API equivalent to map to an N-character data type, rather than mapping to the default NCLOB. Here's an example of using such an annotation:

```
[Column("Name", TypeName = "NVARCHAR2(4000)")]
string EmployeeName
```

Applications may prefer N-character data types over NCLOBs as they require no additional server roundtrips to fetch and update data.

## Synonyms

EF Core migrations can generate arbitrary Oracle schema objects using the `RelationalDatabaseFacadeExtensions` class, such as using the `ExecuteSqlRaw` method to perform DDL on those objects. For example, to create a synonym for the `Blogs` table sample, the following code snippet can be used:

```
private static void SetupDatabase()
{
    using (var db = new BloggingContext())
    {
        db.Database.EnsureDeleted();
        if (db.Database.EnsureCreated())
        {

            //other code

            #region Synonym
            db.Database.ExecuteSqlRaw(
                " create synonym s for \"Blogs\";");
            #endregion

            db.SaveChanges();
        }
    }
}
```

# Scaffolding Or Reverse Engineering

ODP.NET EF Core supports scaffolding the following tables and views:

- Relational tables and views
- Materialized views

By convention, ODP.NET EF Core maps an appropriate .NET data type based on the Oracle Database data type and its characteristics.

When scaffolding, developers may wish to change the default data type mappings between Oracle Database and .NET. When modifying .NET CLR types of the generated entity's property, remove the auto-generated `HasColumnType()` Fluent API in the model. For example, an Oracle `NUMBER(4)` is scaffolded to a .NET `Byte` data type by default. If the .NET CLR data type is changed to .NET `Short` or `Int16` data type, then an invalid cast exception at runtime may occur until the `HasColumnType("NUMBER(4)")` has been removed.

### Data Type Mapping

This table shows the default mappings.

**Table 5-2 ODP.NET Entity Framework Core Reverse Engineering Data Type Default Mappings**

Oracle Database Data Type	.NET Type Alias	.NET Data Type
NUMBER(1)	bool	System.Boolean

**Table 5-2 (Cont.) ODP.NET Entity Framework Core Reverse Engineering Data Type Default Mappings**

Oracle Database Data Type	.NET Type Alias	.NET Data Type
NUMBER (2) to NUMBER (4)	byte	System.Byte
NUMBER (5)	short/int16	System.Int16
NUMBER (6) to NUMBER (10)	int/int32	System.Int32
NUMBER (11) to NUMBER (19)	long/int64	System.Int64
NUMBER (>19)	decimal	System.Decimal
NUMBER (p, s)	decimal	System.Decimal
NUMBER	decimal	System.Decimal
BINARY_FLOAT	float	System.Float
BINARY_DOUBLE	double	System.Double
BOOLEAN	bool	System.Boolean
TIMESTAMP	DateTime	System.DateTime
TIMESTAMP WITH TIMEZONE	DateTimeOffset	System.DateTimeOffset
TIMESTAMP WITH LOCAL TIMEZONE	DateTimeOffset	System.DateTimeOffset
DATE	DateTime	System.DateTime
INTERVAL DAY TO SECOND	TimeSpan	System.TimeSpan
INTERVAL YEAR TO MONTH	string	System.String
VARCHAR2	string	System.String
JSON	string	System.String
NVARCHAR2	string	System.String
CHAR	string	System.String
NCHAR	string	System.String
CLOB	string	System.String
NCLOB	string	System.String
RAW	byte[]	System.Byte[]
BLOB	byte[]	System.Byte[]
XMLTYPE	string	System.String
ROWID	string	System.String
UROWID	string	System.String
LONG	string	System.String
BFILE	byte[]	System.Byte[]
LONG RAW	byte[]	System.Byte[]

### Scaffolding Tables from Another Schema

Developers can scaffold tables from other schemas other than the user/schema they are connected with. The connected user requires privileges to access the other schema's objects. Once these privileges are granted, developers can use the Package Manager Console (PMC) tools for Entity Framework Core to perform the scaffolding operation. For example:

```
Scaffold-DbContext "User Id=scott;Password=<password>;Data Source=myhost:1521/mydb;"
Oracle.EntityFrameworkCore -Schemas HR -Tables EMPLOYEES
```

Developers can use the `-Schemas` and `-Tables` parameters to specify which schemas and tables/views to scaffold for an Entity Framework Core model. If connecting with one user/schema to create tables from a second schema, the user must have at least `SELECT` privileges for that second schema.

The following table displays the ODP.NET Entity Framework Core behavior when the `-Schemas` and/or `-Tables` parameter is specified or left as default while scaffolding a pre-existing model using the Package Manager Console command, `Scaffold-DbContext`. All sample command excerpts below use `Scaffold-DbContext` syntax. Similar functionality is available using the EF Core tools command, `dotnet ef dbcontext scaffold`.

**Table 5-3 Schema and Table Filter Mapping**

Mapping of Schema and Table Filters	No Schema Filter	Schema Filter
<b>No Table Filter</b>	Generates all tables/views within current user/schema <i>Box 1</i>	Generates all tables/views in specified user(s)/schema(s) <i>Box 2</i>
<b>Table Filter</b>	Generates specified tables/views within current user/schema <i>Box 3</i>	Generates specified tables/views within current schema <i>and</i> all tables/views in specified user(s)/schema(s) Filtered results include combined <i>Box 2</i> and <i>Box 3</i> results.

It is possible to scaffold tables/views in other schemas by appending the schema name in front: `-Tables <schema>.<table/view>`

For example, the following snippet would scaffold three tables in three different schemas:

```
-Tables SCHEMA1.TABLEA, SCHEMA2.TABLEB, SCHEMA3.TABLEC
```

If the schema or table name contains any special characters, such as a period, then use brackets to delimit the schema and table names when using the `-Tables` option.

```
-Tables [SCHEMA1].[TABLEA]
```

## Scaffolding Views

Oracle supports scaffolding database relational and materialized views only. These views can be either read-only or updatable. Use the `-Tables` parameter to specify the views to scaffold. If the parameter is left blank (default), all the user tables, relational views, and materialized views will be scaffolded.

# Identifier Name Length and Uniqueness

Oracle Database prior to version 12.2 limit identifier names, such as table names, column names, and primary key names, to 30 characters. Oracle Database 12.2 and higher have a default limit of 128 characters.

In Entity Framework Core Migrations, these identifier lengths should be constrained to prevent creating identifier names longer than what the Oracle Database version supports. Attempting to create an identifier longer than the database can support generally results in an "ORA-00972: IDENTIFIER IS TOO LONG" error.

Use `RelationalModelAnnotations MaxIdentifierLength` property (EF Core 2.x) or `ModelBuilder HasAnnotation` method (EF Core 3.x) to set the maximum identifier length the target database version can handle. For example, if Oracle Database 12.1.0.2 is used, it needs to be set to 30 (or less). Once set, Entity Framework Core will automatically truncate identifier names that are too long to the specified length. This prevents both the user and Entity Framework Core from creating identifiers beyond the maximum character limit of the Oracle Database version you are connecting to.

```
// C# Sample Code: Setting maximum identifier length to 30 characters; By default,
it's set to 128.
modelBuilder.Model.Relational().MaxIdentifierLength = 30;
```

Entity Framework Core 2.x has a known issue in which identifier names longer than the maximum identifier length are merely truncated, but not made unique. Also, the `MaxIdentifierLength` has no impact on controlling the length of table names that are created based on the entity class names. These issues have been resolved in Entity Framework Core 3.x.

In the meantime, either rename the class names, property names, etc. to work around this issue or use the `ToTable()/HasColumnName()` fluent APIs or their equivalent data annotations to specify a shorter and/or unique names for the tables/columns that are to be created in the Oracle database.

If the identifiers use multi-byte characters, the `MaxIdentifierLength` may need to be set with character expansion ratio in mind to assure that all identifiers can be created in the Oracle database. For example, if the Oracle database character set is UTF8, a single character may require up to 4 bytes. Thus, to guarantee that all identifiers can be created in an Oracle database that does not support long identifiers, the `MaxIdentifierLength` should be set to 7 characters (i.e. 30 characters divided by 4).

If your EF Core model does not use identifier names longer than what your database version supports, you should still set `MaxIdentifierLength`. ODP.NET and Entity Framework Core auto-generate schema object names from models. They may, on occasion, append additional characters to the names, which could exceed the maximum number of characters the database version permits. By setting the `MaxIdentifierLength`, you prevent EF Core from causing the ORA-00972 inadvertently.

## Using Large Character or Binary Data Types

By default, .NET `byte[]` maps to `RAW(2000)` and .NET string maps to `NVARCHAR(2000)`. But if your application deals with data that larger than 2000 bytes, you can use the `Column` or the `MaxLength` data annotations or the associated fluent API to create `BLOB` and `CLOB` columns in the database, respectively.

```
// This annotation will force a BLOB column to be created.
[Column("BLOB_COLUMN", TypeName = "BLOB")]
public byte[] BYTE_TYPE { get; set; }

// This annotations will force a NCLOB column to be created.
[MaxLength(65536)]
public string NCLOB_TYPE { get; set; }
```

Without these annotations, you may hit errors, such as “ORA-01460: unimplemented or unreasonable conversion requested” or “ORA-12899: value too large for column” when modifying the data.

## Performance Considerations

EF Core application performance is most optimal for binding character-based data when the .NET String entity property bind data type and the database column data type Unicode support match. If the mapping is done properly, then the application will bind the string entity property value properly as `NVARCHAR2` for a `NVARCHAR2` column or bind it as `VARCHAR2` for a `VARCHAR2` column. If the types are mismatched, then additional processing is incurred on the server side, slowing down performance.

To avoid performance related issues due to this mismatch, one of the following can be done:

- If the table already exists, use scaffolding to generate the entity classes corresponding to the relational database tables. Doing so generates the correct fluent API for each table column.
- If the entity classes exist without the corresponding database tables, use migrations to generate the corresponding database columns for the string entity properties, which will honor the `IsUnicode()` or `HasColumnType()` fluent APIs that are invoked.
- If manually creating the entity classes corresponding to the database tables, correctly map each string entity property to the `NVARCHAR2` or `VARCHAR2` column type using the appropriate `IsUnicode()` or `HasColumnType()` fluent API to avoid mismatches.

Other considerations:

- If both `IsUnicode()` and `HasColumnType()` fluent APIs are used, then the `HasColumnType()` fluent API takes precedence.
- For migrations, the .NET String entity property maps to `NVARCHAR2` by default. For scaffolding, both `VARCHAR2` and `NVARCHAR2` columns map to .NET string.
- If the database column type is `VARCHAR2`, then the `IsUnicode(false)` or `HasColumnType("VARCHAR2(<length>")` fluent API should be used to correctly

map the string entity property to the VARCHAR2 column. This avoids the performance degradation problem.

- If a string entity property is associated with a NVARCHAR2 column, no invocations of `IsUnicode()` nor `HasColumnType()` fluent APIs are needed. Alternatively, `IsUnicode(true)` or `HasColumnType("NVARCHAR2(<length>")` fluent APIs can be invoked to bind the data as NVARCHAR2.
- In Oracle.EntityFrameworkCore 2.19.70 and earlier versions, string entity property values were always bound as VARCHAR2 while executing LINQ queries. The behavior changed starting with Oracle EF Core 2.19.80. The string entity property values are now bound based on the mapping specified for entity string property. An application that performed optimally with Oracle EF Core 2.19.70 can degrade in performance when upgrading to a later Oracle EF Core version.
- If you encounter a new performance problem after an Oracle EF Core upgrade, verify the string entity properties associated with VARCHAR2 columns have not set either `IsUnicode(false)` nor `HasColumnType("VARCHAR2(<length>")` fluent APIs nor equivalent data annotations. If so, add one of these fluent API so that the character-based data are bound using the correct type.

## Breaking Changes

### Application Programming Interface Changes

- Oracle EF Core `UseOracleSQLCompatibility` extension method

In EF Core 6 and higher versions with Oracle EF Core 21.12.1, `UseOracleSQLCompatibility` extension method now takes an enumeration type as an argument rather than a string value.

#### See Also:

[UseOracleSQLCompatibility\(enum version\)](#)

### Desupported APIs

The desupported APIs are as follows:

- `ModelBuilder.UseOracleIdentityColumn` Extension Method

Starting with EF Core 5, ODP.NET EF Core desupports `UseOracleIdentityColumn`. Developers should call the `ModelBuilder.UseIdentityColumn` extension method instead, which provides identical functionality. `UseOracleIdentityColumn` remains supported for EF Core 3.1 and earlier releases.

- `ModelBuilder` and `PropertyBuilder` `ForOracleUseSequenceHiLo` Extension Method

Starting with EF Core 5, ODP.NET EF Core desupports `ForOracleUseSequenceHiLo`. Developers should call the `ModelBuilder.UseHiLo` extension method instead, which provides identical functionality. `ForOracleUseSequenceHiLo` remains supported for EF Core 3.1 and earlier releases.

- `Oracle.EntityFrameworkCore.Migrations.Operations.OracleCreateUserOperation` Class

Starting with Oracle EF Core 21c, the `OracleCreateUserOperation` class is desupported. Developers should call the `MigrationBuilder.Sql` method instead with a `CREATE USER` SQL statement to create a user if they are using the desupported API directly.

- `Oracle.EntityFrameworkCore.Migrations.Operations.OracleDropUserOperation` Class

Starting with Oracle EF Core 21c, the `OracleDropUserOperation` class is desupported. Developers should call the `MigrationBuilder.Sql` method instead with a `DROP USER` SQL statement to drop a user if they are using the desupported API directly.

# 6

## Oracle Data Provider for .NET Stored Procedures

This section discusses server-side features provided by Oracle Data Provider for .NET.

With the support for .NET stored procedures in Oracle Databases for Windows that Oracle Database Extensions for .NET provides, ODP.NET can be used to access Oracle data through the [implicit database connection](#) that is available from the context of the .NET stored procedure execution. Explicit user connections can also be created to establish connections to the database that hosts the .NET stored procedure or to other Oracle Databases.

### See Also:

*Oracle Database Extensions for .NET Developer's Guide for Microsoft Windows*

This section contains these topics:

- [Introducing .NET Stored Procedure Execution Using ODP.NET](#)
- [Limitations and Restrictions on ODP.NET Within .NET Stored Procedure](#)
- [Porting Client Application to .NET Stored Procedure](#)

## Introducing .NET Stored Procedure Execution Using ODP.NET

Oracle Data Provider for .NET classes and APIs provide data access to the Oracle Database from a .NET client application and from .NET stored procedures and functions.

However, some limitations and restrictions exist when Oracle Data Provider for .NET is used within a .NET stored procedure. These are discussed in the next section.

The following is a simple .NET stored procedure example.

```
using System;
using Oracle.DataAccess.Client;
using Oracle.DataAccess.Types;

public class CLRLibrary1
{
    // .NET Stored Function returning the DEPTNO of the employee whose
    // EMPNO is 'empno'
    public static uint GetDeptNo(uint empno)
    {
        uint deptno = 0;

        // Create and open a context connection
        OracleConnection conn = new OracleConnection();
        if( OracleConnection.IsAvailable == true )
        {
```

```

        conn.ConnectionString = "context connection=true";
    }
    else
    {
        //set connection string for a normal client connection
        conn.ConnectionString = "user id=scott;password=tiger;" +
            "data source=oracle";
    }
    conn.Open();

    // Create and execute a command
    OracleCommand cmd = conn.CreateCommand();
    cmd.CommandText = "SELECT DEPTNO FROM EMP WHERE EMPNO = :1";
    cmd.Parameters.Add(":1", OracleDbType.Int32, empno,
        System.Data.ParameterDirection.Input);
    OracleDataReader rdr = cmd.ExecuteReader();
    if (rdr.Read())
        deptno = (uint)rdr.GetInt32(0);
    rdr.Close();
    cmd.Dispose();
    conn.Close();
    return deptno;
} // GetDeptNo
} // CLRLibrary1

```

#### See Also:

- *Oracle Database Extensions for .NET Developer's Guide for Microsoft Windows* for more information about how to create .NET Stored procedures
- [Table 6-1](#)

## Limitations and Restrictions on ODP.NET Within .NET Stored Procedure

This section covers important concepts that apply when Oracle Data Provider for .NET is used within a .NET stored procedure.

#### Note:

ODP.NET, Managed Driver and ODP.NET Core do not support .NET stored procedures.

## Implicit Database Connection

Within a .NET stored procedure, an implicit database connection is available for use to access Oracle data. This implicit database connection should be used rather than establishing a user connection because the [implicit database connection](#) is already

established by the caller of the .NET stored procedure, thereby minimizing resource usage.

To obtain an `OracleConnection` object in a .NET stored procedure that represents the implicit database connection, set the `ConnectionString` property of the `OracleConnection` object to `"context connection=true"` and invoke the `Open` method. No connection string attributes can be used with `"context connection=true"`, except the `Statement Cache Size` attribute.

The availability of the implicit database connection can be checked at run time through the static `OracleConnection.IsAvailable` property. This property always returns `true` when Oracle Data Provider for .NET is used within a .NET stored procedure. Otherwise, `false` is returned.

**Note:**

DBLinks are not supported in .NET stored procedures.

Only one implicit database connection is available within a .NET stored procedure invocation. To establish more connections in addition to the implicit database connection, an explicit connection must be created. When the `Close` method is invoked on the `OracleConnection` that represents the implicit database connection, the connection is not actually closed. Therefore, the `Open` method of the same or another `OracleConnection` object can be invoked to obtain the connection that represents the implicit database connection.

The implicit database connection can only be acquired by the `Open` method invocation by a native Oracle thread that initially invokes the .NET stored procedure. However, threads spawned from the native Oracle thread can use implicit database connections that are obtained by the native Oracle thread.

**See Also:**

["IsAvailable"](#)

## Transaction Support

The .NET stored procedure execution automatically inherits the current transaction on the implicit database connection. No explicit transaction can be started, committed, or rolled back inside a .NET stored procedure on a Context connection. However, explicit transaction can be started, committed, or rolled back inside a .NET stored procedure on a Client connection.

For example, `OracleConnection.BeginTransaction` is not allowed inside a .NET stored procedure for a context connection, but is allowed for a client connection. .NET stored procedures do not support distributed transactions. If you have enlisted a client connection in a distributed transaction and call a .NET stored procedure or function, an error occurs.

If a .NET stored procedure or function performs operations on the database that are required to be part of a transaction, the transaction must be started prior to calling the .NET stored procedure. Any desired commit or rollback must be performed after returning from the .NET stored procedure or function.

The following example consists of a client application and a .NET stored procedure, `InsertRecordSP`, that inserts an employee record into an `EMP` table.

**Example (.NET Stored Procedure)**

```

using System;
using System.Data;
using Oracle.DataAccess.Client;
// This class represents an Oracle .NET stored procedure that inserts
// an employee record into an EMP table of SCOTT schema.
public class InsertRecordSP
{
    // This procedure will insert a row into the emp database
    // For simplicity we are using only two parameters, the rest are hard coded
    public static void InsertRecord( int EmpNo, string EmpName )
    {
        if(OracleConnection.IsAvailable == true )
        {
            OracleConnection conn = new OracleConnection(
                "context connection=true");
            conn.Open();
            // Create new command object from connection context
            OracleCommand Cmd = conn.CreateCommand();
            Cmd.CommandText = "INSERT INTO EMP( EMPNO, ENAME, JOB," +
                "MGR, HIREDATE, SAL, COMM, DEPTNO ) " +
                "VALUES ( :1, :2, 'ANALYST', 7566, " +
                "'06-DEC-04', 5000, 0, 20 )";
            Cmd.Parameters.Add( ":1", OracleDbType.Int32,
                EmpNo, ParameterDirection.Input );
            Cmd.Parameters.Add( ":2", OracleDbType.Varchar2,
                EmpName, ParameterDirection.Input );
            Cmd.ExecuteNonQuery();
        }
    }
}

```

**Example (Client Application)**

The example enters new employee, Bernstein, employee number 7950, into the EMP table.

```

// C#
// This sample demonstrates how to start the transaction with ODP.NET client
// application and execute an Oracle .NET stored procedure that performs
// a DML operation. Since .NET stored procedure inherits the current
// transaction from the implicit database connection, DML operation
// in .NET stored procedure will not be in auto-committed mode.
// Therefore, it is up to the client application to do a COMMIT or ROLLBACK
// after returning from .NET stored procedure
using System;
using System.Data;
using Oracle.DataAccess.Client;
// In this class we are starting a transaction on the client side and
// executing a .NET stored procedure, which inserts a record into EMP
// table and then verifies record count before and after COMMIT statement
class TransactionSample
{
    static void Main(string[] args)
    {
        OracleConnection Conn = null;
        OracleTransaction Txn = null;
        OracleCommand Cmd = null;
        try

```

```

{
    Console.WriteLine( "Sample: Open DB connection in non auto-committed "
        + "mode," +
        "DML operation performed by .NET stored " +
        "procedure doesn't have an effect before COMMIT " +
        "is called." );
    // Create and Open oracle connection
    Conn = new OracleConnection();
    Conn.ConnectionString = "User Id=scott;Password=tiger;" +
        "Data Source=oracle;";
    Conn.Open();
    // Start transaction
    Txn = Conn.BeginTransaction( IsolationLevel.ReadCommitted );
    // Create command object
    Cmd = new OracleCommand();
    Cmd.Connection = Conn;
    Cmd.CommandType = CommandType.StoredProcedure;
    Cmd.CommandText = "InsertRecord"; // .NET Stored procedure
    // Parameter settings
    OracleParameter EmpNoPrm = Cmd.Parameters.Add(
        "empno", OracleDbType.Int32 );
    EmpNoPrm.Direction = ParameterDirection.Input;
    EmpNoPrm.Value = 7950;
    OracleParameter EmpNamePrm = Cmd.Parameters.Add(
        "ename", OracleDbType.Varchar2, 10 );
    EmpNamePrm.Direction = ParameterDirection.Input;
    EmpNamePrm.Value = "Bernstein";
    // Execute .NET stored procedure
    Cmd.ExecuteNonQuery();
    Console.WriteLine( "Number of record(s) before COMMIT {0}",
        RecordCount() );
    Txn.Commit();
    Console.WriteLine( "Number of record(s) after COMMIT {0}",
        RecordCount() );
}
catch( OracleException OE )
{
    Console.WriteLine( OE.Message );
}
finally
{
    // Cleanup objects
    if( null != Txn )
        Txn.Dispose();
    if( null != Cmd )
        Cmd.Dispose();
    if( null != Conn && Conn.State == ConnectionState.Open )
        Conn.Close();
}
}
static int RecordCount()
{
    int EmpCount = 0;
    OracleConnection Conn = null;
    OracleCommand Cmd = null;
    try
    {
        Conn = new OracleConnection( "User Id=scott;Password=tiger;" +
            "Data Source=oracle;" );
        Conn.Open();
        Cmd = new OracleCommand( "SELECT COUNT(*) FROM EMP", Conn );
    }
}

```

```

        Object o = Cmd.ExecuteScalar();
        EmpCount = Convert.ToInt32(o.ToString());
    }
    catch( OracleException OE )
    {
        Console.WriteLine( OE.Message );
    }
    finally
    {
        if( null != Cmd )
            Cmd.Dispose();
    }
    return EmpCount;
}
}

```

## Unsupported SQL Commands

Transaction controls commands such as `COMMIT`, `ROLLBACK`, and `SAVEPOINT` are not supported in a .NET stored procedure.

Data definition commands such as `CREATE` and `ALTER` are not supported with an implicit database connection, but they are supported with an explicit user connection in a .NET stored procedure.

## Oracle User-Defined Type (UDT) Support

UDTs are not supported within a context connection but they are supported with a client connection. UDTs are not supported as parameters to .NET stored procedures.

## Porting Client Application to .NET Stored Procedure

All classes and class members provide the same functionality for both client applications and .NET stored procedures, unless it is otherwise stated.

[Table 6-1](#) lists those classes or class members that have different behavior depending on whether or not they are used in a client application or in a .NET stored procedure.

### Column Headings

The column headings for this table are:

Client application: The client application.

Implicit connection: The implicit database connections in a .NET stored procedure.

Explicit connection: The explicit user connections in a .NET stored procedure.

**Table 6-1 API Support Comparison Between Client Application and .NET Stored Procedure**

Class or Class Members	Client Application	Implicit Connection/Explicit Connection
<a href="#">OnChangeEventHandler Delegate</a>	Yes	No/No
-all members		

**Table 6-1 (Cont.) API Support Comparison Between Client Application and .NET Stored Procedure**

Class or Class Members	Client Application	Implicit Connection/Explicit Connection
OracleDependency Class -all members	Yes	No/No
OracleNotificationEventArgs Class -all members	Yes	No/No
OracleNotificationRequest Class -all members	Yes	No/No
OracleFailoverEventArgs Class -all members	Yes	No/No
OracleFailoverEventHandler Delegate -all members	Yes	No/No
OracleTransaction Class -all members	Yes	No/No
OracleCommand Class -Transaction Property	Yes	No: Always returns null /No: Always returns null.
OracleConnection Class -ConnectionTimeout Property	Yes	Yes: Implicit database connection always returns 0/Yes
-DataSource Property	Yes	
-BeginTransaction Method	No	Yes: Implicit database connection always returns an empty string/Yes
-ChangeDatabase Method	Yes	
-Clone Method	Yes	No/Yes
-EnlistDistributedTransaction Method	Yes	No/No
-	Yes	No/Yes
OpenWithNewPassword(String) Method	Yes	No/No
-Failover Event		No/Yes
-OracleFailoverEventHandler Delegate		No/No
ODP.NET Enumerations	Yes	No/No
-FailoverEvent Enumeration	Yes	No/No
-FailoverReturnCode Enumeration	Yes	No/No
-FailoverType Enumeration	Yes	No/No
-OracleNotificationInfo Enumeration	Yes	No/No
-OracleNotificationSource Enumeration	Yes	No/No
-OracleNotificationType Enumeration	Yes	No/No

# 7

## Oracle Data Provider for .NET Classes

This chapter describes the following Oracle Data Provider for .NET classes.

- [OracleAccessToken Class](#)
- [OracleClientFactory Class](#)
- [OracleCommand Class](#)
- [OracleCommandBuilder Class](#)
- [OracleConnection Class](#)
- [OracleConfiguration Class](#)
- [OracleConnectionOpenEventArgs Class](#)
- [OracleConnectionOpenEventHandler Delegate](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleCredential Class](#)
- [OracleDataAdapter Class](#)
- [OracleDatabase Class](#)
- [OracleDataReader Class](#)
- [OracleDataSourceCollection Class](#)
- [OracleDataSourceEnumerator Class](#)
- [OracleError Class](#)
- [OracleErrorCollection Class](#)
- [OracleException Class](#)
- [OracleInfoMessageEventArgs Class](#)
- [OracleInfoMessageEventHandler Delegate](#)
- [OracleLogicalTransaction Class](#)
- [OracleOnsServerCollection Class](#)
- [OracleParameter Class](#)
- [OracleParameterCollection Class](#)
- [OraclePermission Class](#)
- [OracleRefreshAccessTokenEventArgs Class](#)
- [OraclePermissionAttribute Class](#)
- [OracleRefreshAccessTokenEventArgs Class](#)
- [OracleRowUpdatedEventArgs Class](#)
- [OracleRowUpdatedEventHandler Delegate](#)
- [OracleRowUpdatingEventArgs Class](#)

- [OracleRowUpdatingEventHandler Delegate](#)
- [OracleShardingKey Class](#)
- [OracleTransaction Class](#)
- [OracleConnectionType Enumeration](#)
- [OracleCollectionType Enumeration](#)
- [OracleDBAPrivilege Enumeration](#)
- [OracleDBShutdownMode Enumeration](#)
- [OracleDBStartupMode Enumeration](#)
- [OracleDbType Enumeration](#)
- [OracleDRCPurity Enumeration](#)
- [OracleIdentityType Enumeration](#)
- [OracleParameterStatus Enumeration](#)
- [OraclePasswordAuth Enumeration](#)
- [OracleTokenAuth Enumeration](#)

## OracleAccessToken Class

An `OracleAccessToken` object stores Oracle Identity and Access Management information required for token authentication.

### Class Inheritance

`System.Object`

`Oracle.DataAccess.OracleAccessToken`

### Declaration

```
// C#
public sealed class OracleAccessToken
```

### Requirements

Provider	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	<code>Oracle.ManagedDataAccess.dll</code>	<code>Oracle.ManagedDataAccess.dll</code>
<b>Namespace</b>	<code>Oracle.ManagedDataAccess.Client</code>	<code>Oracle.ManagedDataAccess.Client</code>
<b>.NET Framework</b>	4.8	-
<b>.NET (Core)</b>	-	See <a href="#">System Requirements</a>

### Example

```
// C#
public class OracleAccessToken
{
    // Constructor
    public OracleAccessToken(char[] dbToken, char[] privateKey);
}
```

```
// Event to get refreshed token before expiry
public event OracleRefreshAccessTokenEventHandler RefreshAccessToken;
}
```

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAccessToken Members](#)
- [OracleAccessToken\(char, char\)](#)
- [RefreshAccessToken Event](#)

## OracleAccessToken Members

OracleAccessToken members are listed in the following tables.

### OracleAccessToken Constructor

OracleAccessToken constructors are listed in [OracleAccessToken Constructors](#).

**Table 7-1 OracleAccessToken Constructor**

Constructor	Description
<a href="#">OracleAccessToken Constructors</a>	OracleAccessToken constructors instantiate new instances of OracleAccessToken class.

### RefreshAccessToken Event

OracleAccessToken event is listed in [RefreshAccessToken Event](#).

**Table 7-2 RefreshAccessToken Event**

Event	Description
<a href="#">RefreshAccessToken Event</a>	Triggered 60 seconds before the signature token expiration time so that application can provide a refreshed token

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAccessToken Class](#)

## OracleAccessToken Constructors

`OracleAccessToken` constructors instantiate new instances of `OracleAccessToken` class.

### Overload List:

- [OracleAccessToken\(char\)](#)

This constructor creates an `OracleAccessToken` object with the access token provided by the application.

- [OracleAccessToken\(char, char\)](#)

This constructor creates an `OracleAccessToken` object with the signature token and private key provided by the application. Only Signature token type will be supported through this class.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAccessToken Class](#)
- [OracleAccessToken Members](#)

## OracleAccessToken(char)

This constructor creates an `OracleAccessToken` object with the access token provided by the application.

### Declaration

```
// C#  
public OracleAccessToken(char[] token);
```

### Exceptions

`ArgumentNullException` is raised if token is passed in as null.

### Description

The `char[]` passed by the application for the access token will be cleared by ODP.NET. Applications should not depend on this `char[]` once this constructor is called.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAccessToken Class](#)
- [OracleAccessToken Members](#)

## OracleAccessToken(char, char)

This constructor creates an `OracleAccessToken` object with the signature token and private key provided by the application. Only Signature token type will be supported through this class.

### Declaration

```
// C#  
public OracleAccessToken(char[] dbToken, char[] privateKey);
```

### Exceptions

- `ArgumentNullException` is raised if any parameters are passed in as null.
- `Argument` exception is thrown if the provided token is invalid.

### Description

The `char[]` passed by the application for the signature token and private key will be cleared by ODP.NET. Applications should not depend on these `char[]` once this constructor is called.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAccessToken Class](#)
- [OracleAccessToken Members](#)

## RefreshAccessToken Event

This event is triggered 60 seconds before the database token expiration time so that application can provide a refreshed token.

### Declaration

```
// C#  
public event OracleRefreshAccessTokenEventHandler RefreshAccessToken;
```

## Description

The event handler receives an `OracleRefreshAccessTokenEventArgs` object in which the application should set the refreshed database token and private key, or access token. The event handler is not called unless a connection has been made with the token, and the token has been found to be valid.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAccessToken Class](#)
- [OracleAccessToken Members](#)

# OracleClientFactory Class

An `OracleClientFactory` object allows applications to instantiate ODP.NET classes in a generic way.

## Class Inheritance

`System.Object`

`System.Data.Common.DbProviderFactory`

`Oracle.DataAccess.Client.OracleClientFactory`

## Declaration

```
// C#
public sealed class OracleClientFactory : DbProviderFactory
```

## Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver
<b>Assembly</b>	<code>Oracle.DataAccess.dll</code>	<code>Oracle.ManagedDataAccess.dll</code>
<b>Namespace</b>	<code>Oracle.DataAccess.Client</code>	<code>Oracle.ManagedDataAccess.Client</code>
<b>.NET Framework</b>	4.8	4.8

## Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

## Example

```
// C#
using System;
```

```
using System.Data;
using System.Data.Common;
using Oracle.DataAccess.Client;

class FactorySample
{
    static void Main()
    {
        string constr = "user id=scott;password=tiger;data source=oracle";

        DbProviderFactory factory =
            DbProviderFactories.GetFactory("Oracle.DataAccess.Client");

        DbConnection conn = factory.CreateConnection();

        try
        {
            conn.ConnectionString = constr;
            conn.Open();

            DbCommand cmd = factory.CreateCommand();
            cmd.Connection = conn;
            cmd.CommandText = "select * from emp";

            DbDataReader reader = cmd.ExecuteReader();
            while (reader.Read())
                Console.WriteLine(reader["EMPNO"] + " : " + reader["ENAME"]);
        }
        catch (Exception ex)
        {
            Console.WriteLine(ex.Message);
            Console.WriteLine(ex.StackTrace);
        }
    }
}
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleClientFactory Members](#)
- [OracleClientFactory Field](#)
- [OracleClientFactory Constructor](#)
- [OracleClientFactory Public Properties](#)
- [OracleClientFactory Public Methods](#)

## OracleClientFactory Members

OracleClientFactory members are listed in the following tables.

### OracleClientFactory Field

The OracleClientFactory field is listed in [Table 7-3](#)

**Table 7-3 OracleClientFactory Field**

Property	Description
<a href="#">Instance</a>	Gets an instance of the <code>OracleClientFactory</code> class

**OracleClientFactory Constructor**

The `OracleClientFactory` constructor is listed in [Table 7-4](#)

**Table 7-4 OracleClientFactory Constructor**

Property	Description
<a href="#">OracleClientFactory Constructor</a>	Instantiates a new instance of <code>OracleClientFactory</code> class

**OracleClientFactory Public Properties**

The `OracleClientFactory` public properties are listed in [Table 7-5](#).

**Table 7-5 OracleClientFactory Public Properties**

Property	Description
<a href="#">CanCreateDataSourceEnumerator</a>	Indicates whether or not the <code>CreateDataSourceEnumerator</code> method is supported

**OracleClientFactory Public Methods**

`OracleClientFactory` Public Methods are listed in [Table 7-6](#).

**Table 7-6 OracleClientFactory Public Method**

Method	Description
<a href="#">CreateCommand</a>	Returns a <code>DbCommand</code> object that represents an <code>OracleCommand</code> object
<a href="#">CreateCommandBuilder</a>	Returns a <code>DbCommandBuilder</code> object that represents an <code>OracleCommandBuilder</code> object
<a href="#">CreateConnection</a>	Returns a <code>DbConnection</code> object that represents an <code>OracleConnection</code> object
<a href="#">CreateConnectionStringBuilder</a>	Returns a <code>DbConnectionStringBuilder</code> object that represents an <code>OracleConnectionStringBuilder</code> object
<a href="#">CreateDataAdapter</a>	Returns a <code>DbDataAdapter</code> object that represents an <code>OracleDataAdapter</code> object
<a href="#">CreateDataSourceEnumerator</a>	Returns a <code>DbDataSourceEnumerator</code> object that represents an <code>OracleDataSourceEnumerator</code> object

**Table 7-6 (Cont.) OracleClientFactory Public Method**

Method	Description
<a href="#">CreateParameter</a>	Returns a <code>DbParameter</code> object that represents an <code>OracleParameter</code> object
<a href="#">CreatePermission</a>	Returns a <code>CodeAccessPermission</code> object that represents an <code>OraclePermission</code> object

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleClientFactory Class](#)

## OracleClientFactory Field

The `OracleClientFactory` field is listed in [Table 7-7](#)

**Table 7-7 OracleClientFactory Field**

Property	Description
<a href="#">Instance</a>	Gets an instance of the <code>OracleClientFactory</code> class

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleClientFactory Class](#)
- [OracleClientFactory Members](#)

## Instance

The `Instance` field gets an instance of the `OracleClientFactory` class. This can be used to retrieve strongly typed data objects.

**Declaration**

```
// C#
public static readonly OracleClientFactory Instance
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleClientFactory Class](#)
- [OracleClientFactory Members](#)

## OracleClientFactory Constructor

The `OracleClientFactory` constructor creates a new instances of the `OracleClientFactory` class.

### Declaration

```
// C#  
public OracleClientFactory();
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleClientFactory Class](#)
- [OracleClientFactory Members](#)

## OracleClientFactory Public Properties

The `OracleClientFactory` public properties are listed in [Table 7-8](#).

**Table 7-8 OracleClientFactory Public Properties**

Property	Description
<a href="#">CanCreateDataSourceEnumerator</a>	Indicates whether or not the <code>CreateDataSourceEnumerator</code> method is supported

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleClientFactory Class](#)
- [OracleClientFactory Members](#)

## CanCreateDataSourceEnumerator

This property indicates whether or not the `CreateDataSourceEnumerator` method is supported.

### Declaration

```
// C#
public override bool CanCreateDataSourceEnumerator { get; }
```

### Property Value

Returns `true`.

### Remarks

ODP.NET supports the `OracleDataSourceEnumerator` object.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleClientFactory Class](#)
- [OracleClientFactory Members](#)

## OracleClientFactory Public Methods

The `OracleClientFactory` public method is listed in [Table 7-9](#).

**Table 7-9 OracleClientFactory Public Method**

Method	Description
<a href="#">CreateCommand</a>	Returns a <code>DbCommand</code> object that represents an <code>OracleCommand</code> object
<a href="#">CreateCommandBuilder</a>	Returns a <code>DbCommandBuilder</code> object that represents an <code>OracleCommandBuilder</code> object
<a href="#">CreateConnection</a>	Returns a <code>DbConnection</code> object that represents an <code>OracleConnection</code> object
<a href="#">CreateConnectionStringBuilder</a>	Returns a <code>DbConnectionStringBuilder</code> object that represents an <code>OracleConnectionStringBuilder</code> object
<a href="#">CreateDataAdapter</a>	Returns a <code>DbDataAdapter</code> object that represents an <code>OracleDataAdapter</code> object
<a href="#">CreateDataSourceEnumerator</a>	Returns a <code>DbDataSourceEnumerator</code> object that represents an <code>OracleDataSourceEnumerator</code> object

Table 7-9 (Cont.) OracleClientFactory Public Method

Method	Description
<a href="#">CreateParameter</a>	Returns a <code>DbParameter</code> object that represents an <code>OracleParameter</code> object
<a href="#">CreatePermission</a>	Returns a <code>CodeAccessPermission</code> object that represents an <code>OraclePermission</code> object

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleClientFactory Class](#)
- [OracleClientFactory Members](#)

## CreateCommand

This method returns a `DbCommand` object that represents an `OracleCommand` object.

### Declaration

```
// C#  
public override DbCommand CreateCommand();
```

### Return Value

A `DbCommand` object that represents an `OracleCommand` object.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleClientFactory Class](#)
- [OracleClientFactory Members](#)

## CreateCommandBuilder

This method returns a `DbCommandBuilder` object that represents an `OracleCommandBuilder` object.

### Declaration

```
// C#  
public override DbCommandBuilder CreateCommandBuilder();
```

### Return Value

A `DbCommandBuilder` object that represents an `OracleCommandBuilder` object.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleClientFactory Class](#)
- [OracleClientFactory Members](#)

## CreateConnection

This method returns a `DbConnection` object that represents an `OracleConnection` object.

### Declaration

```
// C#  
public override DbConnection CreateConnection();
```

### Return Value

A `DbConnection` object that represents an `OracleConnection` object.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleClientFactory Class](#)
- [OracleClientFactory Members](#)

## CreateConnectionStringBuilder

This method returns a `DbConnectionStringBuilder` object that represents an `OracleConnectionStringBuilder` object.

### Declaration

```
// C#  
public override DbConnectionStringBuilder CreateConnectionStringBuilder();
```

### Return Value

A `DbConnectionStringBuilder` object that represents an `OracleConnectionStringBuilder` object.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleClientFactory Class](#)
- [OracleClientFactory Members](#)

## CreateDataAdapter

This method returns a `DbDataAdapter` object that represents an `OracleDataAdapter` object.

### Declaration

```
// C#  
public override DbDataAdapter CreateDataAdapter();
```

### Return Value

A `DbDataAdapter` object that represents an `OracleDataAdapter` object.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleClientFactory Class](#)
- [OracleClientFactory Members](#)

## CreateDataSourceEnumerator

This method returns a `DbDataSourceEnumerator` object that represents an `OracleDataSourceEnumerator` object.

### Declaration

```
// C#  
public override DbDataSourceEnumerator CreateDataSourceEnumerator();
```

### Return Value

A `DbDataSourceEnumerator` object that represents an `OracleDataSourceEnumerator` object.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleClientFactory Class](#)
- [OracleClientFactory Members](#)
- ["OracleDataSourceEnumerator Class"](#)

## CreateParameter

This method returns a `DbParameter` object that represents an `OracleParameter` object.

### Declaration

```
// C#  
public override DbParameter CreateParameter();
```

### Return Value

A `DbParameter` object that represents an `OracleParameter` object.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleClientFactory Class](#)
- [OracleClientFactory Members](#)

## CreatePermission

This method returns a `CodeAccessPermission` object that represents an `OraclePermission` object.

### Declaration

```
// C#  
public override System.Security.CodeAccessPermission CreatePermission(  
    System.Security.Permissions.PermissionState state);
```

### Parameter

- *state*  
A `PermissionState` object.

**Return Value**

A `CodeAccessPermission` object that represents an `OraclePermission` object.

**Remarks**

This method enables users, writing provider-independent code, to get a `CodeAccessPermission` instance that represents an `OraclePermission` object.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleClientFactory Class](#)
- [OracleClientFactory Members](#)

## OracleCommand Class

An `OracleCommand` object represents a SQL command, a stored procedure, or a table name. The `OracleCommand` object is responsible for formulating the request and passing it to the database. If results are returned, `OracleCommand` is responsible for returning results as an `OracleDataReader`, a `.NET XmlReader`, a `.NET Stream`, a scalar value, or as output parameters.

**Class Inheritance**

`System.Object`

`System.MarshalByRefObject`

`System.ComponentModel.Component`

`System.Data.Common.DbCommand`

`Oracle.DataAccess.Client.OracleCommand`

**Declaration**

```
// C#
public sealed class OracleCommand : DbCommand, ICloneable
```

**Requirements**

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
.NET (Core)	-	-	See <a href="#">System Requirements</a>

### Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

### Remarks

The execution of any transaction-related statements from an `OracleCommand` is not recommended because it is not reflected in the state of the `OracleTransaction` object represents the current local transaction, if one exists.

`ExecuteXmlReader`, `ExecuteStream`, and `ExecuteToStream` methods are only supported for XML operations.

`ExecuteReader` and `ExecuteScalar` methods are not supported for XML operations.

To minimize the number of open server cursors, `OracleCommand` objects should be explicitly disposed.

### Example

```
// C#

using System;
using System.Data;
using Oracle.DataAccess.Client;

class OracleCommandSample
{
    static void Main()
    {
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();

        string cmdQuery = "select ename, empno from emp";

        // Create the OracleCommand
        OracleCommand cmd = new OracleCommand(cmdQuery);

        cmd.Connection = con;
        cmd.CommandType = CommandType.Text;

        // Execute command, create OracleDataReader object
        OracleDataReader reader = cmd.ExecuteReader();

        while (reader.Read())
        {
            // output Employee Name and Number
            Console.WriteLine("Employee Name : " + reader.GetString(0) + " , " +
                "Employee Number : " + reader.GetDecimal(1));
        }
    }
}
```

```
// Clean up
reader.Dispose();
cmd.Dispose();
con.Dispose();
}
}
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Members](#)
- [OracleCommand Constructors](#)
- [OracleCommand Static Methods](#)
- [OracleCommand Properties](#)
- [OracleCommand Public Methods](#)

## OracleCommand Members

OracleCommand members are listed in the following tables.

### OracleCommand Constructors

OracleCommand constructors are listed in [Table 7-10](#).

**Table 7-10 OracleCommand Constructors**

Constructor	Description
<a href="#">OracleCommand Constructors</a>	Instantiates a new instance of OracleCommand class (Overloaded)

### OracleCommand Static Methods

The OracleCommand static method is listed in [Table 7-11](#).

**Table 7-11 OracleCommand Static Method**

Method	Description
Equals	Inherited from System.Object (Overloaded)

### OracleCommand Properties

OracleCommand properties are listed in [Table 7-12](#).

Table 7-12 OracleCommand Properties

Property	Description
<a href="#">AddRowid</a>	Adds the ROWID as part of the select list
<a href="#">AddToStatementCache</a>	Causes executed statements to be cached, when the property is set to <code>true</code> and statement caching is enabled
<a href="#">ArrayBindCount</a>	Specifies if the array binding feature is to be used and also specifies the maximum number of array elements to be bound in the <code>Value</code> property
<a href="#">ArrayBindRowsAffected</a>	Returns the number of affected rows for each iteration while executing a DML using array binding
<a href="#">BindByName</a>	Specifies the binding method in the collection
<a href="#">CommandText</a>	Specifies the SQL statement or stored procedure to run against the Oracle database or the XML data used to store changes to the Oracle database
<a href="#">CommandTimeout</a>	Specifies the number of seconds the command is allowed to execute before terminating the execution with an exception
<a href="#">CommandType</a>	Specifies the command type that indicates how the <code>CommandText</code> property is to be interpreted
<a href="#">Connection</a>	Specifies the <code>OracleConnection</code> object that is used to identify the connection to execute a command
<code>Container</code>	Inherited from <code>System.ComponentModel.Component</code>
<a href="#">DesignTimeVisible</a>	Specifies whether or not the <code>OracleCommand</code> object is visible on designer controls.
<a href="#">FetchSize</a>	Specifies the size of <code>OracleDataReader</code> 's internal cache to store result set data
<a href="#">ImplicitRefCursors</a>	Specifies an array of <code>OracleRefCursors</code> mapped to an implicit resultset returned by the stored procedure. <i>Not Available in the ODP.NET, Managed Driver and ODP.NET Core</i>
<a href="#">InitialLOBFetchSize</a>	Specifies the amount of data that the <code>OracleDataReader</code> initially fetches for LOB columns
<a href="#">InitialLONGFetchSize</a>	Specifies the amount of data that the <code>OracleDataReader</code> initially fetches for LONG and LONG RAW columns
<a href="#">Notification</a>	Indicates that there is a notification request for the command
<a href="#">NotificationAutoEnlist</a>	Indicates whether or not to register for a continuous query notification with the database automatically when the command is executed
<a href="#">Parameters</a>	Specifies the parameters for the SQL statement or stored procedure
<a href="#">RowSize</a>	Specifies the amount of memory needed by the <code>OracleDataReader</code> internal cache to store one row of data
<code>Site</code>	Inherited from <code>System.ComponentModel.Component</code>
<a href="#">Transaction</a>	Specifies the <code>OracleTransaction</code> object in which the <code>OracleCommand</code> executes <i>Not supported in a .NET stored procedure</i>

**Table 7-12 (Cont.) OracleCommand Properties**

Property	Description
<a href="#">UpdatedRowSource</a>	Specifies how query command results are applied to the row being updated <i>Not supported in a .NET stored procedure</i>
<a href="#">UseEdmMapping</a>	Indicates whether or not the command object utilizes the Entity Data Model mapping configuration values
<a href="#">XmlCommandType</a>	Specifies the type of XML operation on the <code>OracleCommand</code>
<a href="#">XmlQueryProperties</a>	Specifies the properties that are used when an XML document is created from the result set of a SQL query statement
<a href="#">XmlSaveProperties</a>	Specifies the properties that are used when an XML document is used to save changes to the database

**OracleCommand Public Methods**

`OracleCommand` public methods are listed in [Table 7-13](#).

**Table 7-13 OracleCommand Public Methods**

Public Method	Description
<a href="#">Cancel</a>	Attempts to cancel a command that is currently executing on a particular connection
<a href="#">Clone</a>	Creates a copy of <code>OracleCommand</code> object
<code>CreateObjRef</code>	Inherited from <code>System.MarshalByRefObject</code>
<a href="#">CreateParameter</a>	Creates a new instance of <code>OracleParameter</code> class
<a href="#">Dispose</a>	Releases any resources or memory allocated by the object
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)
<a href="#">ExecuteNonQuery</a>	Executes a SQL statement or a command using the <code>XmlCommandType</code> and <code>CommandText</code> properties and returns the number of rows affected
<a href="#">ExecuteReader</a>	Executes a command (Overloaded)
<a href="#">ExecuteScalar</a>	Returns the first column of the first row in the result set returned by the query
<a href="#">ExecuteStream</a>	Executes a command using the <code>XmlCommandType</code> and <code>CommandText</code> properties and returns the results in a new <code>Stream</code> object
<a href="#">ExecuteToStream</a>	Executes a command using the <code>XmlCommandType</code> and <code>CommandText</code> properties and appends the results as an XML document to the existing <code>Stream</code>
<a href="#">ExecuteXmlReader</a>	Executes a command using the <code>XmlCommandType</code> and <code>CommandText</code> properties and returns the result as an XML document in a .NET <code>XmlTextReader</code> object
<code>GetHashCode</code>	Inherited from <code>System.Object</code>

Table 7-13 (Cont.) OracleCommand Public Methods

Public Method	Description
<code>GetLifetimeService</code>	Inherited from <code>System.MarshalByRefObject</code>
<code>GetType</code>	Inherited from <code>System.Object</code>
<code>InitializeLifetimeService</code>	Inherited from <code>System.MarshalByRefObject</code>
<a href="#">Prepare</a>	<i>This method is a no-op</i>
<code>ToString</code>	Inherited from <code>System.Object</code>

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)

## OracleCommand Constructors

`OracleCommand` constructors instantiate new instances of `OracleCommand` class.

**Overload List:**

- [OracleCommand\(\)](#)  
This constructor instantiates a new instance of `OracleCommand` class.
- [OracleCommand\(string\)](#)  
This constructor instantiates a new instance of `OracleCommand` class using the supplied SQL command or stored procedure, and connection to the Oracle database.
- [OracleCommand\(string, OracleConnection\)](#)  
This constructor instantiates a new instance of `OracleCommand` class using the supplied SQL command or stored procedure, and connection to the Oracle database.

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)

## OracleCommand()

This constructor instantiates a new instance of `OracleCommand` class.

**Declaration**

```
// C#  
public OracleCommand();
```

**Remarks**

Default constructor.

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)

## OracleCommand(string)

This constructor instantiates a new instance of `OracleCommand` class using the supplied SQL command or stored procedure, and connection to the Oracle database.

**Declaration**

```
// C#  
public OracleCommand(string cmdText);
```

**Parameters**

- *cmdText*  
The SQL command or stored procedure to be executed.

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)

## OracleCommand(string, OracleConnection)

This constructor instantiates a new instance of `OracleCommand` class using the supplied SQL command or stored procedure, and connection to the Oracle database.

**Declaration**

```
// C#  
public OracleCommand(string cmdText, OracleConnection OracleConnection);
```

**Parameters**

- *cmdText*  
The SQL command or stored procedure to be executed.
- *OracleConnection*  
The connection to the Oracle database.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)

## OracleCommand Static Methods

The `OracleCommand` static method is listed in [Table 7-14](#).

**Table 7-14 OracleCommand Static Method**

Method	Description
<a href="#">Equals</a>	Inherited from <code>System.Object</code> (Overloaded)

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)

## OracleCommand Properties

`OracleCommand` properties are listed in [Table 7-15](#).

**Table 7-15 OracleCommand Properties**

Property	Description
<a href="#">AddRowid</a>	Adds the <code>ROWID</code> as part of the select list
<a href="#">AddToStatementCache</a>	Causes executed statements to be cached, when the property is set to <code>true</code> and statement caching is enabled

Table 7-15 (Cont.) OracleCommand Properties

Property	Description
<a href="#">ArrayBindCount</a>	Specifies if the array binding feature is to be used and also specifies the maximum number of array elements to be bound in the <code>Value</code> property
<a href="#">ArrayBindRowsAffected</a>	Returns the number of affected rows for each iteration while executing a DML using array binding
<a href="#">BindByName</a>	Specifies the binding method in the collection
<a href="#">CommandText</a>	Specifies the SQL statement or stored procedure to run against the Oracle database or the XML data used to store changes to the Oracle database
<a href="#">CommandTimeout</a>	Specifies the number of seconds the command is allowed to execute before terminating the execution with an exception
<a href="#">CommandType</a>	Specifies the command type that indicates how the <code>CommandText</code> property is to be interpreted
<a href="#">Connection</a>	Specifies the <code>OracleConnection</code> object that is used to identify the connection to execute a command
<a href="#">Container</a>	Inherited from <code>System.ComponentModel.Component</code>
<a href="#">DesignTimeVisible</a>	Specifies whether or not the <code>OracleCommand</code> object is visible on designer controls.
<a href="#">FetchSize</a>	Specifies the size of <code>OracleDataReader</code> 's internal cache to store result set data
<a href="#">ImplicitRefCursors</a>	Specifies an array of <code>OracleRefCursors</code> mapped to an implicit resultset returned by the stored procedure. <i>Not Available in the ODP.NET, Managed Driver and ODP.NET Core</i>
<a href="#">InitialLOBFetchSize</a>	Specifies the amount of data that the <code>OracleDataReader</code> initially fetches for LOB columns
<a href="#">InitialLONGFetchSize</a>	Specifies the amount that of data the <code>OracleDataReader</code> initially fetches for LONG and LONG RAW columns
<a href="#">Notification</a>	Indicates that there is a notification request for the command
<a href="#">NotificationAutoEnlist</a>	Indicates whether or not to register for a continuous query notification with the database automatically when the command is executed
<a href="#">Parameters</a>	Specifies the parameters for the SQL statement or stored procedure
<a href="#">RowSize</a>	Specifies the amount of memory needed by the <code>OracleDataReader</code> internal cache to store one row of data
<a href="#">Site</a>	Inherited from <code>System.ComponentModel.Component</code>
<a href="#">Transaction</a>	Specifies the <code>OracleTransaction</code> object in which the <code>OracleCommand</code> executes <i>Not supported in a .NET stored procedure</i>
<a href="#">UpdatedRowSource</a>	Specifies how query command results are applied to the row being updated <i>Not supported in a .NET stored procedure</i>

**Table 7-15 (Cont.) OracleCommand Properties**

Property	Description
<a href="#">UseEdmMapping</a>	Indicates whether or not the command object utilizes the Entity Data Model mapping configuration values
<a href="#">XmlCommandType</a>	Specifies the type of XML operation on the <code>OracleCommand</code>
<a href="#">XmlQueryProperties</a>	Specifies the properties that are used when an XML document is created from the result set of a SQL query statement
<a href="#">XmlSaveProperties</a>	Specifies the properties that are used when an XML document is used to save changes to the database

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)

## AddRowid

This property adds the `ROWID` as part of the select list.

### Declaration

```
// C#  
public bool AddRowid {get; set;}
```

### Property Value

bool

### Remarks

Default is `false`.

This `ROWID` column is hidden and is not accessible by the application. To gain access to the `ROWIDs` of a table, the `ROWID` must explicitly be added to the select list without the use of this property.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)
- ["LOB Support"](#) for further information on how this property used with LOBs

## AddToStatementCache

This property causes executed statements to be cached when the property is set to `true` and statement caching is enabled. If statement caching is disabled or if this property is set to `false`, the executed statement is not cached.

### Declaration

```
// C#  
public bool AddToStatementCache{get; set;}
```

### Return Value

Returns `bool` value. A value of `true` indicates that statements are being added to the cache, `false` indicates otherwise.

### Property Value

A `bool` value that indicates that the statements will be cached when they are executed, if statement caching is enabled.

### Remarks

Default is `true`.

`AddToStatementCache` is ignored if statement caching is disabled. Statement caching is enabled by setting the `Statement Cache Size` connection string attribute to a value greater than 0.

When statement caching is enabled, however, this property provides a way to selectively add statements to the cache.

### Example

```
// C#  
  
using System;  
using System.Data;  
using Oracle.DataAccess.Client;  
  
class AddToStatementCacheSample  
{  
    static void Main()  
    {
```

```
string constr = "User Id=scott;Password=tiger;Data Source=oracle;" +
    "statement cache size=10";
OracleConnection con = new OracleConnection(constr);
con.Open();

OracleCommand cmd = new OracleCommand("select * from emp", con);

if (cmd.AddToStatementCache)
    Console.WriteLine("Added to the statement cache:" + cmd.CommandText);
else
    Console.WriteLine("Not added to the statement cache:" + cmd.CommandText);

// The execution of "select * from emp" will be added to the statement cache
// because statement cache size is greater than 0 and OracleCommand's
// AddToStatementCache is true by default.
OracleDataReader readerEmp = cmd.ExecuteReader();

// Do not add "select * from dept" to the statement cache
cmd.CommandText = "select * from dept";
cmd.AddToStatementCache = false;

if (cmd.AddToStatementCache)
    Console.WriteLine("Added to the statement cache:" + cmd.CommandText);
else
    Console.WriteLine("Not added to the statement cache:" + cmd.CommandText);

// The execution of "select * from dept" will not be added to the
// statement cache because AddToStatementCache is set to false.
OracleDataReader readerDept = cmd.ExecuteReader();

// Clean up
con.Dispose();
}
}
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)
- ["Statement Caching"](#)
- [ConnectionString](#)

## ArrayBindCount

This property specifies if the array binding feature is to be used and also specifies the number of array elements to be bound in the `OracleParameter.Value` property.

### Declaration

```
// C#
public int ArrayBindCount {get; set;}
```

### Property Value

An `int` value that specifies number of array elements to be bound in the `OracleParameter.Value` property.

### Exceptions

`ArgumentException` - The `ArrayBindCount` value specified is invalid.

### Remarks

Default = 0.

If `ArrayBindCount` is equal to 0, array binding is not used; otherwise, array binding is used and `OracleParameter.Value` property is interpreted as an array of values. The value of `ArrayBindCount` must be specified to use the array binding feature.

If neither `DbType` nor `OracleDbType` is set, it is strongly recommended that you set `ArrayBindCount` before setting the `OracleParameter.Value` property so that inference of `DbType` and `OracleDbType` from `Value` can be correctly done.

Array binding is not used by default.

If the `XmlCommandType` property is set to any value other than `None`, this property is ignored.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)
- ["Array Binding"](#)
- ["Value "](#)

## ArrayBindRowsAffected

This property returns the number of affected rows for each iteration while executing a DML using array binding.

### Declaration

```
// C#  
public long[] ArrayBindRowsAffected ;
```

### Property Value

A long type

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)
- ["Array Binding"](#)
- ["Value "](#)

## BindByName

This property specifies the binding method in the collection.

### Declaration

```
// C#  
public bool BindByName {get; set;}
```

### Property Value

Returns `true` if the parameters are bound by name; returns `false` if the parameters are bound by position.

### Remarks

Default = `false`.

`BindByName` is ignored under the following conditions:

- The value of the `XmlCommandType` property is `Insert`, `Update`, or `Delete`.
- The value of the `XmlCommandType` property is `Query`, but there are no parameters set on the `OracleCommand`.

If the `XmlCommandType` property is `OracleXmlCommandType.Query` and any parameters are set on the `OracleCommand`, the `BindByName` property must be set to `true`. Otherwise, the following `OracleCommand` methods throw an `InvalidOperationException`.

- `ExecuteNonQuery`
- `ExecuteXmlReader`
- `ExecuteStream`
- `ExecuteToStream`

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)
- ["Array Binding"](#)
- ["Value "](#)

## CommandText

This property specifies the SQL statement or stored procedure to run against the Oracle database or the XML data used to store changes to the Oracle database.

### Declaration

```
// C#  
public override string CommandText {get; set;}
```

### Property Value

A string.

### Implements

IDbCommand

### Remarks

The default is an empty string.

When the `CommandType` property is set to `StoredProcedure`, the `CommandText` property is set to the name of the stored procedure. The command calls this stored procedure when an `Execute` method is called.

The effects of `XmlCommandType` values on `CommandText` are:

- `XmlCommandType = None`.  
`CommandType` property determines the contents of `CommandText`.
- `XmlCommandType = Query`.  
`CommandText` must be a SQL query. The SQL query should be a select statement. `CommandType` property is ignored.
- `XmlCommandType` property is `Insert`, `Update`, or `Delete`.  
`CommandText` must be an XML document. `CommandType` property is ignored.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)

## CommandTimeout

This property specifies the minimum number of seconds that the command is allowed to execute before terminating with an exception.

### Declaration

```
// C#  
public override int CommandTimeout {get; set;}
```

### Property Value

int

### Implements

IDbCommand.CommandTimeout

### Exceptions

InvalidArgument - The specified value is less than 0.

### Remarks

Default is 0 seconds, which enforces no time limit.

When the specified timeout value expires before a command execution finishes, ODP.NET will begin the process of canceling the command. If cancellation is successful, then an exception is thrown with the message `ORA-01013: user requested cancel of current operation`. Other possible exceptions thrown after a command timeout expiration occurs include `ORA-00936` and `ORA-00604`. If the command is executed in time without any errors, then no exceptions are thrown.

ODP.NET does not guarantee a command will be cancelled at the exact moment the timeout value is reached. The timeout value is the minimum time to allow a command to complete before the cancellation process begins. It is possible for commands to complete after the timeout value expires.

In a situation where multiple `OracleCommand` objects use the same connection, the timeout expiration on one of the `OracleCommand` objects may terminate any of the executions on the single connection. To make the timeout expiration of a `OracleCommand` cancel only its own command execution, simply use one `OracleCommand` for each connection if that `OracleCommand` sets the `CommandTimeout` property to a value greater than 0.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)
- <http://msdn.microsoft.com/library> for detailed information about this Microsoft .NET Framework feature

## CommandType

This property specifies the command type that indicates how the `CommandText` property is to be interpreted.

### Declaration

```
// C#  
public override CommandType CommandType {get; set;}
```

### Property Value

A `CommandType`.

### Exceptions

`ArgumentException` - The value is not a valid `CommandType` such as: `CommandType.Text`, `CommandType.StoredProcedure`, `CommandType.TableDirect`.

### Remarks

Default = `CommandType.Text`

If the value of the `XmlCommandType` property is not `None`, then the `CommandType` property is ignored.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)

## Connection

This property specifies the `OracleConnection` object that is used to identify the connection to execute a command.

**Declaration**

```
// C#  
public OracleConnection Connection {get; set;}
```

**Property Value**

An `OracleConnection` object.

**Implements**

`IDbCommand`

**Remarks**

Default = `null`

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)

## DesignTimeVisible

This property specifies whether or not the `OracleCommand` object is visible on designer controls.

**Declaration**

```
// C#  
public override bool DesignTimeVisible { get; set; }
```

**Property Value**

A value that indicate whether or not `OracleCommand` object is visible in a control. The default is `true`.

**Remarks**

This property is used by developers to indicate whether or not `OracleCommand` object is visible in a control.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)

## FetchSize

This property specifies the size of `OracleDataReader`'s internal cache to store result set data.

### Declaration

```
// C#  
public long FetchSize {get; set;}
```

### Property Value

A long that specifies the size (in bytes) of the `OracleDataReader`'s internal cache.

### Exceptions

`ArgumentException` - The `FetchSize` value specified is invalid.

### Remarks

Default = 131072.

The `FetchSize` property is inherited by the `OracleDataReader` that is created by a command execution returning a result set. The `FetchSize` property on the `OracleDataReader` object determines the amount of data the `OracleDataReader` fetches into its internal cache for each database round-trip.

If the `XmlCommandType` property is set to any value other than `None`, this property is ignored.

The `RowSize` and `FetchSize` properties handle UDT and `XMLType` data differently than other scalar data types. Because only a reference to the UDT and `XMLType` data is stored in the ODP.NET's internal cache, the `RowSize` property accounts for only the memory needed for the reference (which is very small) and not the actual size of the UDT and `XMLType` data. Thus, applications can inadvertently fetch a large number of UDT or `XMLType` instances from the database in a single database round-trip. This is because the actual size of UDT and `XMLType` data do not count against the `FetchSize`, and it would require numerous UDT and `XMLType` references to fill up the default cache size of 131072 bytes. Therefore, when fetching UDT or `XMLType` data, the `FetchSize` property must be appropriately configured to control the number of UDT and `XMLType` instances that are to be fetched, rather than the amount of the actual UDT and `XMLType` data to be fetched.

NOTE: For LOB and `LONG` data types, only the sizes specified in the `InitialLOBFetchSize` and `InitialLONGFetchSize` properties are accounted for by the

`RowSize` property in addition to the metadata and reference information that is maintained by the cache for each LOB in the select list.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)
- `OracleDataReader` ["FetchSize "](#)

## ImplicitRefCursors

This property returns an array of `OracleRefCursors`, where each `OracleRefCursor` maps to an implicit resultset returned by the stored procedure.

### Declaration

```
// C#  
public OracleRefCursor[] ImplicitRefCursors {get; set;}
```

### Property Value

An array of `OracleRefCursors`.

### Remarks

This property is populated only when the stored procedure is executed through `ExecuteNonQuery` and it does not get populated in any other scenarios.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)

## InitialLOBFetchSize

This property specifies the amount of data that the `OracleDataReader` initially fetches for LOB columns.

### Declaration

```
// C#  
public int InitialLOBFetchSize {get; set;}
```

### Property Value

An `int` specifying the number of characters or bytes to fetch initially.

### Exceptions

`ArgumentException` - The `InitialLOBFetchSize` value specified is invalid.

### Remarks

The value of `InitialLOBFetchSize` specifies the initial amount of LOB data that is immediately fetched by the `OracleDataReader`. The property value specifies the number of characters for `CLOB` and `NCLOB` data, and the number of bytes for `BLOB` data.

The `InitialLOBFetchSize` value is used to determine the length of the LOB column data to fetch, if the LOB column is in the select list. If the select list does not contain a LOB column, the `InitialLOBFetchSize` value is ignored.

When `InitialLOBFetchSize` is set to `-1`, the entire LOB data is prefetched and stored in the fetch array.

Default = 0.

The maximum value supported for `InitialLOBFetchSize` is 2 GB.

`GetOracleBlob` and `GetOracleClob` methods can be used to retrieve any LOBs no matter the `InitialLOBFetchSize` value.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)
- ["Obtaining LOB Data"](#) for more information on setting `InitialLOBFetchSize` values

## InitialLONGFetchSize

This property specifies the amount of data that the `OracleDataReader` initially fetches for `LONG` and `LONG RAW` columns.

### Declaration

```
// C#  
public int InitialLONGFetchSize {get; set;}
```

### Property Value

An `int` specifying the amount.

## Exceptions

`ArgumentException` - The `InitialLONGFetchSize` value specified is invalid.

## Remarks

The maximum value supported for `InitialLONGFetchSize` is 32767. If this property is set to a higher value, the provider resets it to 32767.

The value of `InitialLONGFetchSize` specifies the initial amount of `LONG` or `LONG RAW` data that is immediately fetched by the `OracleDataReader`. The property value specifies the number of characters for `LONG` data and the number of bytes for `LONG RAW`. To fetch more than the specified `InitialLONGFetchSize` amount, one of the following must be in the select list:

- Primary key
- ROWID
- Unique columns - (defined as a set of columns on which a unique constraint has been defined or a unique index has been created, where at least one of the columns in the set has a `NOT NULL` constraint defined on it)

The `InitialLONGFetchSize` value is used to determine the length of the `LONG` and `LONG RAW` column data to fetch if one of the two is in the select list. If the select list does not contain a `LONG` or a `LONG RAW` column, the `InitialLONGFetchSize` value is ignored.

When `InitialLONGFetchSize` is set to -1, the entire `LONG` or `LONG RAW` data is prefetched and stored in the fetch array. Calls to `GetString`, `GetChars`, or `GetBytes` in `OracleDataReader` allow retrieving the entire data.

Default = 0.

Setting this property to 0 defers the `LONG` and `LONG RAW` data retrieval entirely until the application specifically requests it.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)
- ["Obtaining LONG and LONG RAW Data"](#) for further information

## Notification

This instance property indicates that there is a notification request for the command.

### Declaration

```
// C#  
public OracleNotificationRequest Notification {set; get;}
```

### Property Value

A notification request for the command.

### Remarks

When a changed notification is first registered, the client listener is started in order to receive any database notification. The listener uses the port number defined in the `OracleDependency.Port` static field. Subsequent change notification registrations use the same listener in the same client process and do not start another listener.

When `Notification` is set to an `OracleNotificationRequest` instance, a notification registration is created (if it has not already been created) when the command is executed. Once the registration is created, the properties of the `OracleNotificationRequest` instance cannot be modified. If the notification registration has already been created, the result set that is associated with the command is added to the existing registration.

When `Notification` is set to `null`, subsequent command executions do not require a notification request. If a notification request is not required, set the `Notification` property to `null`, or set the `NotificationAutoEnlist` property to `false`.

For Continuous Query Notification, a notification request can be used for multiple command executions. In that case, any query result set associated with different commands can be invalidated within the same registration.

When the `OracleDependency.OnChange` event is fired, if the `ROWID` column is explicitly included in the query (or `AddRowid` property is set to `true`), then the `Rowid` column contains `ROWID` values in the `DataTable` referenced by the `OracleNotificationEventArgs.Details` property. This behavior can be overridden by explicitly requesting for an inclusion and exclusion of `ROWID` values in the `OracleNotificationEventArgs` by setting the `OracleDependency.RowidInfo` to `OracleRowidInfo.Include` or `OracleRowidInfo.Exclude`, respectively.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)
- ["Continuous Query Notification Support "](#)
- [Continuous Query Notification Classes](#)

## NotificationAutoEnlist

This instance property indicates whether or not to register for a continuous query notification with the database automatically when the command is executed.

### Declaration

```
// C#  
public bool NotificationAutoEnlist {set; get;}
```

### Property Value

A `bool` value indicating whether or not to make a continuous query notification request automatically, when the command is executed. If `NotificationAutoEnlist` is set to `true`, and the `Notification` property is set appropriately, a continuous query notification request is registered automatically; otherwise, no continuous query notification registration is made.

Default value: `true`

### Remarks

A notification request can be used for multiple command executions using the same `OracleCommand` instance. In that case, set the `NotificationAutoEnlist` property to `true`.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)
- ["Continuous Query Notification Support "](#)
- [Continuous Query Notification Classes](#)

## Parameters

This property specifies the parameters for the SQL statement or stored procedure.

### Declaration

```
// C#  
public OracleParameterCollection Parameters {get;}
```

### Property Value

`OracleParameterCollection`

### Implements

`IDbCommand`

### Remarks

Default value = an empty collection

The number of the parameters in the collection must be equal to the number of parameter placeholders within the command text, or an error is raised.

If the command text does not contain any parameter tokens (such as `:1`, `:2`), the values in the `Parameters` property are ignored.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)

## RowSize

This property specifies the amount of memory needed by the `OracleDataReader` internal cache to store one row of data.

### Declaration

```
// C#  
public long RowSize {get;}
```

### Property Value

A `long` that indicates the amount of memory (in bytes) that an `OracleDataReader` needs to store one row of data for the executed query.

### Remarks

Default value = 0

The `RowSize` property is set to a nonzero value after the execution of a command that returns a result set. This property can be used at design time or dynamically during runtime, to set the `FetchSize`, based on number of rows. For example, to enable the `OracleDataReader` to fetch `N` rows for each database round-trip, the `OracleDataReader` `FetchSize` property can be set dynamically to `RowSize * N`. Note that for the `FetchSize` to take effect appropriately, it must be set after `OracleCommand.ExecuteReader()` but before `OracleDataReader.Read()`.

ODP.NET now supports values up to 32K for `VARCHAR2`, `NVARCHAR2` or `RAW` type columns in its calculation of `RowSize` value.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)
- `OracleDataReader` ["FetchSize"](#)

## Transaction

This property specifies the `OracleTransaction` object in which the `OracleCommand` executes.

### Declaration

```
// C#  
public OracleTransaction Transaction {set; get;}
```

### Property Value

`OracleTransaction`

### Implements

`IDbCommand`

### Remarks

Default value = `null`

`Transaction` returns a reference to the transaction object associated with the `OracleCommand` connection object. Thus the command is executed in whatever transaction context its connection is currently in.



#### Note:

When this property is accessed through an `IDbCommand` reference, its set accessor method is not operational.

### Remarks (.NET Stored Procedure)

Always returns `null`.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)

## UpdatedRowSource

This property specifies how query command results are applied to the row to be updated.

### Declaration

```
// C#  
public override UpdateRowSource UpdatedRowSource {get; set;}
```

### Property Value

An `UpdateRowSource`.

### Implements

`IDbCommand`

### Exceptions

`ArgumentException` - The `UpdateRowSource` value specified is invalid.

### Remarks

Always returns `UpdateRowSource`,

Set accessor throws an `ArgumentException` if the value is other than `UpdateRowSource.None`.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)

## UseEdmMapping

This property Indicates whether or not the `OracleCommand` object utilizes the Entity Data Model mapping configuration values.

### Declaration

```
// C#  
public bool UseEdmMapping
```

### Property Value

A `bool`.

### Remarks

Default is `false`.

The `UseEdmMapping` property allows user to explicitly specify that the `OracleCommand` object should use the Entity Data Model mapping configuration values. This enables use of Entity Framework Multiple Result Sets feature.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)

## XmlCommandType

This property specifies the type of XML operation on the `OracleCommand`.

### Declaration

```
// C#  
public OracleXmlCommandType XmlCommandType {get; set;}
```

### Property Value

An `OracleXmlCommandType`.

### Remarks

Default value is `None`.

`XmlCommandType` values and usage:

- `None` - The `CommandType` property specifies the type of operation.
- `Query` - `CommandText` property must be set to a SQL select statement. The query is executed, and the results are returned as an XML document. The SQL select statement in the `CommandText` and the properties specified by the `XmlQueryProperties` property are used to perform the operation. The `CommandType` property is ignored.
- `Insert, Update, or Delete` - `CommandText` property is an XML document containing the changes to be made. The XML document in the `CommandText` and the properties specified by the `XmlSaveProperties` property are used to perform the operation. The `CommandType` property is ignored.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)

## XmlQueryProperties

This property specifies the properties that are used when an XML document is created from the result set of a SQL query statement.

### Declaration

```
// C#  
public OracleXmlQueryProperties XmlQueryProperties {get; set;}
```

### Property Value

OracleXmlQueryProperties.

### Remarks

When a new instance of `OracleCommand` is created, an instance of `OracleXmlQueryProperties` is automatically available on the `OracleCommand` instance through the `OracleCommand.XmlQueryProperties` property.

A new instance of `OracleXmlQueryProperties` can be assigned to an `OracleCommand` instance. Assigning an instance of `OracleXmlQueryProperties` to the `XmlQueryProperties` of an `OracleCommand` instance creates a new instance of the given `OracleXmlQueryProperties` instance for the `OracleCommand`. This way each `OracleCommand` instance has its own `OracleXmlQueryProperties` instance.

Use the default constructor to get a new instance of `OracleXmlQueryProperties`.

Use the `OracleXmlQueryProperties.Clone()` method to get a copy of an `OracleXmlQueryProperties` instance.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)

## XmlSaveProperties

This property specifies the properties that are used when an XML document is used to save changes to the database.

### Declaration

```
// C#  
public OracleXmlSaveProperties XmlSaveProperties {get; set;}
```

### Property Value

OracleXmlSaveProperties.

### Remarks

When a new instance of `OracleCommand` is created, an instance of `OracleXmlSaveProperties` is automatically available on the `OracleCommand` instance through the `OracleCommand.XmlSaveProperties` property.

A new instance of `OracleXmlSaveProperties` can be assigned to an `OracleCommand` instance. Assigning an instance of `OracleXmlSaveProperties` to the `XmlSaveProperties` of an `OracleCommand` instance creates a new instance of the given `OracleXmlSaveProperties` instance for the `OracleCommand`. This way each `OracleCommand` instance has its own `OracleXmlSaveProperties` instance.

Use the default constructor to get a new instance of `OracleXmlSaveProperties`.

Use the `OracleXmlSaveProperties.Clone()` method to get a copy of an `OracleXmlSaveProperties` instance.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)

## OracleCommand Public Methods

`OracleCommand` public methods are listed in [Table 7-16](#).

**Table 7-16 OracleCommand Public Methods**

Public Method	Description
<a href="#">Cancel</a>	Attempts to cancel a command that is currently executing on a particular connection
<a href="#">Clone</a>	Creates a copy of <code>OracleCommand</code> object
<code>CreateObjRef</code>	Inherited from <code>System.MarshalByRefObject</code>
<a href="#">CreateParameter</a>	Creates a new instance of <code>OracleParameter</code> class
<a href="#">Dispose</a>	Releases any resources or memory allocated by the object
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)
<a href="#">ExecuteNonQuery</a>	Executes a SQL statement or a command using the <code>XmlCommandType</code> and <code>CommandText</code> properties and returns the number of rows affected
<a href="#">ExecuteReader</a>	Executes a command (Overloaded)
<a href="#">ExecuteScalar</a>	Returns the first column of the first row in the result set returned by the query
<a href="#">ExecuteStream</a>	Executes a command using the <code>XmlCommandType</code> and <code>CommandText</code> properties and returns the results in a new <code>Stream</code> object
<a href="#">ExecuteToStream</a>	Executes a command using the <code>XmlCommandType</code> and <code>CommandText</code> properties and appends the results as an XML document to the existing <code>Stream</code>

Table 7-16 (Cont.) OracleCommand Public Methods

Public Method	Description
<a href="#">ExecuteXmlReader</a>	Executes a command using the <code>XmlCommandType</code> and <code>CommandText</code> properties and returns the result as an XML document in a .NET <code>XmlTextReader</code> object
<code>GetHashCode</code>	Inherited from <code>System.Object</code>
<code>GetLifetimeService</code>	Inherited from <code>System.MarshalByRefObject</code>
<code>GetType</code>	Inherited from <code>System.Object</code>
<code>InitializeLifetimeService</code>	Inherited from <code>System.MarshalByRefObject</code>
<a href="#">Prepare</a>	<i>This method is a no-op</i>
<code>ToString</code>	Inherited from <code>System.Object</code>

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)

## Cancel

This method attempts to cancel a command that is currently executing on a particular connection.

### Declaration

```
// C#  
public override void Cancel();
```

### Implements

```
IDbCommand.Cancel
```

### Remarks

If cancellation of the command succeeds, an exception is thrown. If cancellation is not successful, no exception is thrown. If there is no command being executed at the time of the `Cancel` invocation, `Cancel` does nothing. Invoking the `Cancel` method does not guarantee that the command executing at the time will always be cancelled. The execution may complete before it can be terminated. In such cases, no exception is thrown.

Commands cancellation will stop the command execution stage or results fetching stage if it is a query. If these stages have completed, `Cancel` does nothing.

ODP.NET sends a cancellation message to the database server when the `Cancel` method is invoked. There may be a delay when cancelling a running PL/SQL program. This delay is specific to PL/SQL's design in how it handles command cancellations.

When managed ODP.NET or ODP.NET Core invokes `Cancel`, it is deterministic. That means the command executed by the `OracleCommand` object is the only command that could be canceled. Unmanaged ODP.NET `Cancel` is non-deterministic.

Non-determinism in unmanaged ODP.NET means that when multiple `OracleCommand` objects share the same connection, only one command can be executed on that connection at any one time. When it is invoked, the `Cancel` method attempts to cancel the statement currently running on the connection that the `OracleCommand` object is using to execute the command. However, when multiple `OracleCommand` objects execute statements on the same connection simultaneously, issuing a `Cancel` method invocation may cancel any of the issued commands. This is because the command designated for cancellation may complete before the `Cancel` invocation is effective. If this happens, a command executed by a different `OracleCommand` could be cancelled instead.

There are several ways to avoid this non-deterministic situation that the `Cancel` method can cause:

- The application can create just one `OracleCommand` object for each connection. Doing so assures that the `Cancel` invocation only cancels commands executed by the `OracleCommand` object using a particular connection.
- Command executions in the application are synchronized between `OracleCommand` objects that use the same connection.

These suggestions do not apply if `Cancel` is not used in the application.

Because the termination on the currently running execution is non-deterministic, it is recommended that any *non-atomic* SQL or PL/SQL execution be started within a transaction. When the command execution successfully terminates with an exception of `ORA-01013: user requested cancel of current operation`, the transaction can be rolled back for data integrity. Other possible exceptions thrown after a command cancellation occurs include `ORA-00936` and `ORA-00604`. Examples of non-atomic execution are collections of DML command executions that are executed one-by-one and multiple DML commands that are part of a PL/SQL stored procedure or function.

### Example

```
// C#

// This example shows how command executions can be cancelled in a
// deterministic way even if multiple commands are executed on a single
// connection. This is accomplished by synchronizing threads through events.
// Since the Cancel method terminates the currently running operation on the
// connection, threads must be serialized if multiple threads are using the
// same connection to execute server round-trip incurring operations.
// Furthermore, the example shows how the execution and cancel threads should
// be synchronized so that nth iteration of the command execution does not
// inappropriately cancel the (n+1)th command executed by the same thread.

using System;
using System.Data;
using Oracle.DataAccess.Client;
using System.Threading;

class CancelSample
```

```
{
    private OracleCommand cmd;
    Thread t1, t2;
    // threads signal following events when assigned operations are completed

    private AutoResetEvent ExecuteEvent = new AutoResetEvent(false);
    private AutoResetEvent CancelEvent = new AutoResetEvent(false);
    private AutoResetEvent FinishedEvent = new AutoResetEvent(false);
    AutoResetEvent[] ExecuteAndCancel = new AutoResetEvent[2];

    // Default constructor
    CancelSample()
    {
        cmd = new OracleCommand("select * from all_objects",
            new OracleConnection("user id=scott;password=tiger;data source=oracle"));
        ExecuteAndCancel[0] = ExecuteEvent;
        ExecuteAndCancel[1] = CancelEvent;
    }

    // Constructor that takes a particular command and connection
    CancelSample(string command, OracleConnection con)
    {
        cmd = new OracleCommand(command, con);
        ExecuteAndCancel[0] = ExecuteEvent;
        ExecuteAndCancel[1] = CancelEvent;
    }

    // Execution of the command
    public void Execute()
    {
        OracleDataReader reader = null;
        try
        {
            Console.WriteLine("Execute.");
            reader = cmd.ExecuteReader();
            Console.WriteLine("Execute Done.");
            reader.Close();
        }
        catch (Exception e)
        {
            Console.WriteLine("The command has been cancelled.", e.Message);
        }
        Console.WriteLine("ExecuteEvent.Set()");
        ExecuteEvent.Set();
    }

    // Canceling of the command
    public void Cancel()
    {
        try
        {
            // cancel query if it takes longer than 100 ms to finish execution
            System.Threading.Thread.Sleep(100);
            Console.WriteLine("Cancel.");
            cmd.Cancel();
        }
        catch (Exception e)
        {
            Console.WriteLine(e.ToString());
        }
        Console.WriteLine("Cancel done.");
    }
}
```

```
        Console.WriteLine("CancelEvent.Set()");
        CancelEvent.Set();
    }

    // Execution of the command with a potential of cancelling
    public void ExecuteWithinLimitedTime()
    {
        for (int i = 0; i < 5; i++)
        {
            Monitor.Enter(typeof(CancelSample));
            try
            {
                Console.WriteLine("Executing " + this.cmd.CommandText);
                ExecuteEvent.Reset();
                CancelEvent.Reset();
                t1 = new Thread(new ThreadStart(this.Execute));
                t2 = new Thread(new ThreadStart(this.Cancel));
                t1.Start();
                t2.Start();
            }
            finally
            {
                WaitHandle.WaitAll(ExecuteAndCancel);
                Monitor.Exit(typeof(CancelSample));
            }
        }
        FinishedEvent.Set();
    }
    [MTAThread]
    static void Main()
    {
        try
        {
            AutoResetEvent[] ExecutionCompleteEvents = new AutoResetEvent[3];

            // Create the connection that is to be used by three commands
            OracleConnection con = new OracleConnection("user id=scott;" +
                "password=tiger;data source=oracle");
            con.Open();

            // Create instances of CancelSample class
            CancelSample test1 = new CancelSample("select * from all_objects", con);
            CancelSample test2 = new CancelSample("select * from all_objects, emp",
                con);
            CancelSample test3 = new CancelSample("select * from all_objects, dept",
                con);

            // Create threads for each CancelSample object instance
            Thread t1 = new Thread(new ThreadStart(test1.ExecuteWithinLimitedTime));
            Thread t2 = new Thread(new ThreadStart(test2.ExecuteWithinLimitedTime));
            Thread t3 = new Thread(new ThreadStart(test3.ExecuteWithinLimitedTime));

            // Obtain a handle to an event from each object
            ExecutionCompleteEvents[0] = test1.FinishedEvent;
            ExecutionCompleteEvents[1] = test2.FinishedEvent;
            ExecutionCompleteEvents[2] = test3.FinishedEvent;

            // Start all threads to execute three commands using a single connection
            t1.Start();
            t2.Start();
            t3.Start();
        }
    }
}
```

```
// Wait for all three commands to finish executing/canceling before
//closing the connection
WaitHandle.WaitAll(ExecutionCompleteEvents);
con.Close();
}
catch (Exception e)
{
    Console.WriteLine(e.ToString());
}
}
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)
- <http://msdn.microsoft.com/library> for detailed information about this Microsoft .NET Framework feature

## Clone

This method creates a copy of an `OracleCommand` object.

### Declaration

```
// C#
public object Clone();
```

### Return Value

An `OracleCommand` object.

### Implements

`ICloneable`

### Remarks

The cloned object has the same property values as that of the object being cloned.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)

## CreateParameter

This method creates a new instance of `OracleParameter` class.

### Declaration

```
// C#  
public OracleParameter CreateParameter();
```

### Return Value

A new `OracleParameter` with default values.

### Implements

`IDbCommand`



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)

## Dispose

This method releases any resources or memory allocated by the object.

### Declaration

```
// C#  
public void Dispose();
```

### Implements

`IDisposable`

### Remarks

The `Dispose` method also closes the `OracleCommand` object.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)

## ExecuteNonQuery

This method executes a SQL statement or a command using the `XmlCommandType` and `CommandText` properties and returns the number of rows affected.

### Declaration

```
// C#  
public override int ExecuteNonQuery();
```

### Return Value

The number of rows affected.

### Implements

IDbCommand

### Exceptions

`InvalidOperationException` - The command cannot be executed.

### Remarks

`ExecuteNonQuery` returns the number of rows affected, for the following:

- If the command is `UPDATE`, `INSERT`, or `DELETE` and the `XmlCommandType` property is set to `OracleXmlCommandType.None`.
- If the `XmlCommandType` property is set to `OracleXmlCommandType.Insert`, `OracleXmlCommandType.Update`, or `OracleXmlCommandType.Delete`.

For all other types of statements, the return value is `-1`.

`ExecuteNonQuery` is used for either of the following:

- Catalog operations (for example, querying the structure of a database or creating database objects such as tables).
- Changing the data in a database without using a `DataSet`, by executing `UPDATE`, `INSERT`, or `DELETE` statements.
- Changing the data in a database using an XML document.

Although `ExecuteNonQuery` does not return any rows, it populates any output parameters or return values mapped to parameters with data.

If the `XmlCommandType` property is set to `OracleXmlCommandType.Query` then `ExecuteNonQuery` executes the select statement in the `CommandText` property, and if successful, returns `-1`. The XML document that is generated is discarded. This is useful for determining if the operation completes successfully without getting the XML document back as a result.

If the `XmlCommandType` property is set to `OracleXmlCommandType.Insert`, `OracleXmlCommandType.Update`, or `OracleXmlCommandType.Delete`, then the value of the `CommandText` property is an XML document. `ExecuteNonQuery` saves the changes in that XML document to the table or view that is specified in the `XmlSaveProperties` property. The return value is the number of rows that are processed in the XML

document. Also, each row in the XML document could affect multiple rows in the database, but the return value is still the number of rows in the XML document.

### Example

```
// C#

using System;
using System.Data;
using Oracle.DataAccess.Client;

class ExecuteNonQuerySample
{
    static void Main()
    {
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();

        OracleCommand cmd = new OracleCommand(
            "select sal from emp where empno=7934", con);

        object sal = cmd.ExecuteScalar();
        Console.WriteLine("Employee sal before update: " + sal);

        cmd.CommandText = "update emp set sal = sal + .01 where empno=7934";

        // Auto-commit changes
        int rowsUpdated = cmd.ExecuteNonQuery();

        if (rowsUpdated > 0)
        {
            cmd.CommandText = "select sal from emp where empno=7934";
            sal = cmd.ExecuteScalar();
            Console.WriteLine("Employee sal after update: " + sal);
        }

        // Clean up
        cmd.Dispose();
        con.Dispose();
    }
}
```

### Requirements

For XML support, this method requires Oracle9i XML Developer's Kits (Oracle XDK) or later, to be installed in the database. Oracle XDK can be downloaded from Oracle Technology Network (OTN).

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)
- <http://www.oracle.com/technetwork/index.html>

## ExecuteReader

**Overload List:**

`ExecuteReader` executes a command specified in the `CommandText`.

- [ExecuteReader\(\)](#)

This method executes a command specified in the `CommandText` and returns an `OracleDataReader` object.

- [ExecuteReader\(CommandBehavior\)](#)

This method executes a command specified in the `CommandText` and returns an `OracleDataReader` object, using the specified `CommandBehavior` value.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)

## ExecuteReader()

This method executes a command specified in the `CommandText` and returns an `OracleDataReader` object.

**Declaration**

```
// C#  
public OracleDataReader ExecuteReader();
```

**Return Value**

An `OracleDataReader`.

**Implements**

`IDbCommand`

## Exceptions

`InvalidOperationException` - The command cannot be executed.

## Remarks

When the `CommandType` property is set to `CommandType.StoredProcedure`, the `CommandText` property should be set to the name of the stored procedure.

The specified command executes this stored procedure when `ExecuteReader` is called. If parameters for the stored procedure consist of `REF CURSOR` objects, behavior differs depending on whether `ExecuteReader()` or `ExecuteNonQuery()` is called. If `ExecuteReader()` is invoked, `REF CURSOR` objects can be accessed through the `OracleDataReader` that is returned. If more than one `REF CURSOR` is returned from a single execution, subsequent `REF CURSOR` objects can be accessed sequentially by the `NextResult` method on the `OracleDataReader`. If the `ExecuteNonQuery` method is invoked, the output parameter value can be cast to a `OracleRefCursor` type and the `OracleRefCursor` object then can be used to either populate a `DataSet` or create an `OracleDataReader` object from it. This approach provides random access to all the `REF CURSOR` objects returned as output parameters.

The value of 100 is used for the `FetchSize`. If 0 is specified, no rows are fetched. For further information, see "[Obtaining LONG and LONG RAW Data](#)".

If the value of the `XmlCommandType` property is set to `OracleXmlCommandType.Insert`, `OracleXmlCommandType.Update`, `OracleXmlCommandType.Delete`, or `OracleXmlCommandType.Query` then the `ExecuteReader` method throws an `InvalidOperationException`.

## Example

```
// C#

using System;
using System.Data;
using Oracle.DataAccess.Client;

class ExecuteReaderSample
{
    static void Main()
    {
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();

        OracleCommand cmd = new OracleCommand("select ename from emp", con);

        OracleDataReader reader = cmd.ExecuteReader();

        while (reader.Read())
        {
            Console.WriteLine("Employee Name : " + reader.GetString(0));
        }

        // Clean up
        reader.Dispose();
        cmd.Dispose();
        con.Dispose();
    }
}
```

```
}  
}
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)
- ["OracleRefCursor Class"](#)

## ExecuteReader(CommandBehavior)

This method executes a command specified in the `CommandText` and returns an `OracleDataReader` object, using the specified behavior.

### Declaration

```
// C#  
public OracleDataReader ExecuteReader(CommandBehavior behavior);
```

### Parameters

- `behavior`  
The expected behavior.

### Return Value

An `OracleDataReader`.

### Implements

`IDbCommand`

### Exceptions

`InvalidOperationException` - The command cannot be executed.

### Remarks

A description of the results and the effect on the database of the query command is indicated by the supplied `behavior` that specifies command behavior.

For valid `CommandBehavior` values and for the command behavior of each `CommandBehavior` enumerated type, read the .NET Framework documentation.

When the `CommandType` property is set to `CommandType.StoredProcedure`, the `CommandText` property should be set to the name of the stored procedure. The command executes this stored procedure when `ExecuteReader()` is called.

If the stored procedure returns stored `REF CURSORS`, read the section on `OracleRefCursors` for more details. See ["OracleRefCursor Class"](#).

The value of 100 is used for the `FetchSize`. If 0 is specified, no rows are fetched. For more information, see "[Obtaining LONG and LONG RAW Data](#)".

If the value of the `XmlCommandType` property is set to `OracleXmlCommandType.Insert`, `OracleXmlCommandType.Update`, `OracleXmlCommandType.Delete`, or `OracleXmlCommandType.Query` then the `ExecuteReader` method throws an `InvalidOperationException`.



#### See Also:

- "[Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces](#)"
- [OracleCommand Class](#)
- [OracleCommand Members](#)
- "[OracleRefCursor Class](#)"

## ExecuteScalar

This method executes the query using the connection, and returns the first column of the first row in the result set returned by the query.

### Declaration

```
// C#  
public override object ExecuteScalar();
```

### Return Value

An object which represents the value of the first row, first column.

### Implements

`IDbCommand`

### Exceptions

`InvalidOperationException` - The command cannot be executed.

### Remarks

Extra columns or rows are ignored. `ExecuteScalar` retrieves a single value (for example, an aggregate value) from a database. This requires less code than using the `ExecuteReader()` method, and then performing the operations necessary to generate the single value using the data returned by an `OracleDataReader`.

If the query does not return any row, it returns `null`.

The `ExecuteScalar` method throws an `InvalidOperationException`, if the value of the `XmlCommandType` property is set to one of the following `OracleXmlCommandType` values: `Insert`, `Update`, `Delete`, `Query`.

## Example

```
// C#

using System;
using System.Data;
using Oracle.DataAccess.Client;

class ExecuteScalarSample
{
    static void Main()
    {
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();

        OracleCommand cmd = new OracleCommand("select count(*) from emp", con);

        object count = cmd.ExecuteScalar();

        Console.WriteLine("There are {0} rows in table emp", count);

        // Clean up
        cmd.Dispose();
        con.Dispose();
    }
}
```

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)

## ExecuteStream

This method executes a command using the `XmlCommandType` and `CommandText` properties and returns the result as an XML document in a new `Stream` object.

### Declaration

```
// C#
public Stream ExecuteStream();
```

### Return Value

A `Stream`.

### Remarks

The behavior of `ExecuteStream` varies depending on the `XmlCommandType` property value:

- `XmlCommandType = OracleXmlCommandType.None`  
`ExecuteStream` throws an `InvalidOperationException`.
- `XmlCommandType = OracleXmlCommandType.Query`  
`ExecuteStream` executes the select statement in the `CommandText` property, and if successful, returns an `OracleClob` object containing the XML document that was generated. `OracleClob` contains Unicode characters.  
  
If the SQL query does not return any rows, then `ExecuteStream` returns an `OracleClob` object containing an empty XML document.
- `XmlCommandType = OracleXmlCommandType.Insert, OracleXmlCommandType.Update, or OracleXmlCommandType.Delete.`  
  
The value of the `CommandText` property is an XML document. `ExecuteStream` saves the data in that XML document to the table or view that is specified in the `XmlSaveProperties` property and an empty `OracleClob` is returned.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)
- [Oracle XML DB Developer's Guide](#)
- <http://www.oracle.com/technetwork/index.html>

## ExecuteToStream

This method executes a command using the `XmlCommandType` and `CommandText` properties and appends the result as an XML document to the existing `Stream` provided by the application.

### Declaration

```
// C#  
public void ExecuteToStream(Stream outputStream);
```

### Parameters

- `outputStream`  
A `Stream`.

### Remarks

The behavior of `ExecuteToStream` varies depending on the `XmlCommandType` property value:

- `XmlCommandType = OracleXmlCommandType.None`  
`ExecuteToStream` throws an `InvalidOperationException`.

- `XmlCommandType = OracleXmlCommandType.Query`  
`ExecuteToStream` executes the select statement in the `CommandText` property, and if successful, appends the XML document that was generated to the given `Stream`.  
If the SQL query does not return any rows, then nothing is appended to the given `Stream`. The character set of the appended data is Unicode.
- `XmlCommandType = OracleXmlCommandType.Insert, OracleXmlCommandType.Update, or OracleXmlCommandType.Delete`  
The value of the `CommandText` property is an XML document. `ExecuteToStream` saves the changes in that XML document to the table or view that is specified in the `XmlSaveProperties` property. Nothing is appended to the given `Stream`.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)
- *Oracle XML DB Developer's Guide*
- <http://www.oracle.com/technetwork/index.html>

## ExecuteXmlReader

This method executes the command using the `XmlCommandType` and `CommandText` properties and returns the result as an XML document in a .NET `XmlTextReader` object.

### Declaration

```
// C#  
public XmlReader ExecuteXmlReader();
```

### Return Value

An `XmlReader`.

### Remarks

The behavior of `ExecuteXmlReader` varies depending on the `XmlCommandType` property value:

- `XmlCommandType = OracleXmlCommandType.None`  
`ExecuteStream` throws an `InvalidOperationException`.
- `XmlCommandType = OracleXmlCommandType.Query`  
`ExecuteXmlReader` executes the select statement in the `CommandText` property, and if successful, returns a .NET `XmlTextReader` object containing the XML document that was generated.

If the XML document is empty, which can happen if the SQL query does not return any rows, then an empty .NET `XmlTextReader` object is returned.

- `XmlCommandType = OracleXmlCommandType.Insert, OracleXmlCommandType.Update, or OracleXmlCommandType.Delete.`

The value of the `CommandText` property is an XML document, and `ExecuteXmlReader` saves the changes in that XML document to the table or view that is specified in the `XmlSaveProperties` property. An empty .NET `XmlTextReader` object is returned.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)
- *Oracle XML DB Developer's Guide*
- <http://www.oracle.com/technetwork/index.html>

## Prepare

This method is not supported.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommand Class](#)
- [OracleCommand Members](#)

## OracleCommandBuilder Class

An `OracleCommandBuilder` object provides automatic SQL generation for the `OracleDataAdapter` when updates are made to the database.

### Class Inheritance

`System.Object`

`System.MarshalByRefObject`

`System.ComponentModel.Component`

`System.Data.Common.DbCommandBuilder`

`Oracle.DataAccess.Client.OracleCommandBuilder`

## Declaration

```
// C#
public sealed class OracleCommandBuilder : DbCommandBuilder
```

## Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

## Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

## Remarks

`OracleCommandBuilder` automatically generates SQL statements for single-table updates when the `SelectCommand` property of the `OracleDataAdapter` is set. An exception is thrown if the `DataSet` contains multiple tables. The `OracleCommandBuilder` registers itself as a listener for `RowUpdating` events whenever its `DataAdapter` property is set. Only one `OracleDataAdapter` object and one `OracleCommandBuilder` object can be associated with each other at one time.

To generate `INSERT`, `UPDATE`, or `DELETE` statements, the `OracleCommandBuilder` uses `ExtendedProperties` within the `DataSet` to retrieve a required set of metadata. If the `SelectCommand` is changed after the metadata is retrieved (for example, after the first update), the `RefreshSchema` method should be called to update the metadata.

`OracleCommandBuilder` first looks for the metadata from the `ExtendedProperties` of the `DataSet`; if the metadata is not available, `OracleCommandBuilder` uses the `SelectCommand` property of the `OracleDataAdapter` to retrieve the metadata.

## Example

The following example performs an update on the `EMP` table. It uses the `OracleCommandBuilder` object to create the `UpdateCommand` for the `OracleDataAdapter` object when `OracleDataAdapter.Update()` is called.

```
// C#

using System;
using System.Data;
using Oracle.DataAccess.Client;

class OracleCommandBuilderSample
{
    static void Main()
```

```
{
    string constr = "User Id=scott;Password=tiger;Data Source=oracle";
    string cmdstr = "SELECT empno, sal from emp";

    // Create the adapter with the selectCommand txt and the
    // connection string
    OracleDataAdapter adapter = new OracleDataAdapter(cmdstr, constr);

    // Create the builder for the adapter to automatically generate
    // the Command when needed
    OracleCommandBuilder builder = new OracleCommandBuilder(adapter);

    // Create and fill the DataSet using the EMP
    DataSet dataset = new DataSet();
    adapter.Fill(dataset, "EMP");

    // Get the EMP table from the dataset
    DataTable table = dataset.Tables["EMP"];

    // Indicate DataColumn EMPNO is unique
    // This is required by the OracleCommandBuilder to update the EMP table
    table.Columns["EMPNO"].Unique = true;

    // Get the first row from the EMP table
    DataRow row = table.Rows[0];

    // Update the salary
    double sal = double.Parse(row["SAL"].ToString());
    row["SAL"] = sal + .01;

    // Now update the EMP using the adapter
    // The OracleCommandBuilder will create the UpdateCommand for the
    // adapter to update the EMP table
    adapter.Update(dataset, "EMP");

    Console.WriteLine("Row updated successfully");
}
}
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommandBuilder Members](#)
- [OracleCommandBuilder Constructors](#)
- [OracleCommandBuilder Static Methods](#)
- [OracleCommandBuilder Properties](#)
- [OracleCommandBuilder Public Methods](#)
- [OracleCommandBuilder Events](#)

## OracleCommandBuilder Members

OracleCommandBuilder members are listed in the following tables.

### OracleCommandBuilder Constructors

OracleCommandBuilder constructors are listed in [Table 7-17](#).

**Table 7-17 OracleCommandBuilder Constructors**

Constructor	Description
<a href="#">OracleCommandBuilder Constructors</a>	Instantiates a new instance of OracleCommandBuilder class (Overloaded)

### OracleCommandBuilder Static Methods

OracleCommandBuilder static methods are listed in [Table 7-18](#).

**Table 7-18 OracleCommandBuilder Static Methods**

Method	Description
<a href="#">DeriveParameters</a>	Queries for the parameters of a stored procedure or function, represented by a specified OracleCommand, and populates the OracleParameterCollection of the command with the return values
Equals	Inherited from System.Object (Overloaded)

### OracleCommandBuilder Properties

OracleCommandBuilder properties are listed in [Table 7-19](#).

**Table 7-19 OracleCommandBuilder Properties**

Property	Description
Container	Inherited from System.ComponentModel.Component
<a href="#">CaseSensitive</a>	Indicates whether or not double quotes are used around Oracle object names when generating SQL statements
<a href="#">CatalogLocation</a>	<i>Not Supported</i>
<a href="#">CatalogSeparator</a>	<i>Not Supported</i>
<a href="#">ConflictOption</a>	<i>Not Supported</i>
<a href="#">DataAdapter</a>	Indicates the OracleDataAdapter for which the SQL statements are generated
<a href="#">QuotePrefix</a>	Specifies the beginning character or characters used to specify database objects whose names contain special characters such as spaces or reserved words
<a href="#">QuoteSuffix</a>	Specifies the ending character or characters used to specify database objects whose names contain special characters such as spaces or reserved words

**Table 7-19 (Cont.) OracleCommandBuilder Properties**

Property	Description
<a href="#">SchemaSeparator</a>	Specifies the character to be used for the separator between the schema identifier and other identifiers
Site	Inherited from <code>System.ComponentModel.Component</code>

**OracleCommandBuilder Public Methods**

`OracleCommandBuilder` public methods are listed in [Table 7-20](#).

**Table 7-20 OracleCommandBuilder Public Methods**

Public Method	Description
<code>CreateObjRef</code>	Inherited from <code>System.MarshalByRefObject</code>
<code>Dispose</code>	Inherited from <code>System.ComponentModel.Component</code>
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)
<a href="#">GetDeleteCommand</a>	Gets the automatically generated <code>OracleCommand</code> object that has the SQL statement ( <code>CommandText</code> ) perform deletions on the database (Overloaded)
<code>GetHashCode</code>	Inherited from <code>System.Object</code>
<a href="#">GetInsertCommand</a>	Gets the automatically generated <code>OracleCommand</code> object that has the SQL statement ( <code>CommandText</code> ) perform insertions on the database (Overloaded)
<code>GetLifetimeService</code>	Inherited from <code>System.MarshalByRefObject</code>
<code>GetType</code>	Inherited from <code>System.Object</code>
<a href="#">GetUpdateCommand</a>	Gets the automatically generated <code>OracleCommand</code> object that has the SQL statement ( <code>CommandText</code> ) perform updates on the database (Overloaded)
<code>InitializeLifetimeService</code>	Inherited from <code>System.MarshalByRefObject</code>
<a href="#">QuoteIdentifier</a>	Returns the correct quoted form of the provided unquoted identifier, with any embedded quotes in the identifier properly escaped
<a href="#">RefreshSchema</a>	Refreshes the database schema information used to generate INSERT, UPDATE, or DELETE statements
<a href="#">UnquoteIdentifier</a>	Returns the correct unquoted form of the provided quoted identifier, removing any escape notation for quotes embedded in the identifier
<code>ToString</code>	Inherited from <code>System.Object</code>

**OracleCommandBuilder Events**

The `OracleCommandBuilder` event is listed in [Table 7-21](#).

**Table 7-21 OracleCommandBuilder Events**

Event Name	Description
Disposed	Inherited from <code>System.ComponentModel.Component</code>

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommandBuilder Class](#)

## OracleCommandBuilder Constructors

`OracleCommandBuilder` constructors create new instances of the `OracleCommandBuilder` class.

**Overload List:**

- [OracleCommandBuilder\(\)](#)  
This constructor creates an instance of the `OracleCommandBuilder` class.
- [OracleCommandBuilder\(OracleDataAdapter\)](#)  
This constructor creates an instance of the `OracleCommandBuilder` class and sets the `DataAdapter` property to the provided `OracleDataAdapter` object.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommandBuilder Class](#)
- [OracleCommandBuilder Members](#)

## OracleCommandBuilder()

This constructor creates an instance of the `OracleCommandBuilder` class.

**Declaration**

```
// C#  
public OracleCommandBuilder();
```

**Remarks**

Default constructor.

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommandBuilder Class](#)
- [OracleCommandBuilder Members](#)

## OracleCommandBuilder(OracleDataAdapter)

This constructor creates an instance of the `OracleCommandBuilder` class and sets the `DataAdapter` property to the provided `OracleDataAdapter` object.

### Declaration

```
// C#
public OracleCommandBuilder(OracleDataAdapter da);
```

### Parameters

- `da`  
The `OracleDataAdapter` object provided.

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommandBuilder Class](#)
- [OracleCommandBuilder Members](#)

## OracleCommandBuilder Static Methods

`OracleCommandBuilder` static methods are listed in [Table 7-22](#).

**Table 7-22 OracleCommandBuilder Static Methods**

Method	Description
<a href="#">DeriveParameters</a>	Queries for the parameters of a stored procedure or function, represented by a specified <code>OracleCommand</code> , and populates the <code>OracleParameterCollection</code> of the command with the return values
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommandBuilder Class](#)
- [OracleCommandBuilder Members](#)

## DeriveParameters

This method queries for the parameters of a stored procedure or function, represented by a specified `OracleCommand`, and populates the `OracleParameterCollection` of the command with the return values.

### Declaration

```
// C#  
public static void DeriveParameters(OracleCommand command);
```

### Parameters

- `command`

The command that represents the stored procedure or function for which parameters are to be derived.

### Exceptions

`InvalidOperationException` - The `CommandText` is not a valid stored procedure or function name, the `CommandType` is not `CommandType.StoredProcedure`, or the `Connection.State` is not `ConnectionState.Open`.

### Remarks

When `DeriveParameters` is used to populate the `Parameter` collection of an `OracleCommand` object that represents a stored function, the return value of the function is bound as the first parameter (at position 0 of the `OracleParameterCollection`).

`DeriveParameters` can only be used for stored procedures or functions, not for anonymous PL/SQL blocks.

`DeriveParameters` incurs a database round-trip to retrieve parameter metadata prior to executing the stored procedure/function. It should only be used during design time. To avoid unnecessary database round-trips in a production environment, the `DeriveParameters` method itself should be replaced with the explicit parameter settings that were returned by the `DeriveParameters` method at design time.

`DeriveParameters` can only preserve the case of the stored procedure or function name if it is encapsulated by double-quotes. For example, if the stored procedure in the database is named `GetEmployees` with mixed-case, the `CommandText` property on the `OracleCommand` object must be set appropriately as in the following example:

```
cmd.CommandText = "\"GetEmployees\"";
```

Stored procedures and functions in a package must be provided in the following format:

```
<package name>.<procedure or function name>
```

For example, to obtain parameters for a stored procedure named `GetEmployees` (mixed-case) in a package named `EmpProcedures` (mixed-case), the name provided to the `OracleCommand` is:

```
"\"EmpProcedures\".\"GetEmployees\""
```

`DeriveParameters` cannot be used for object type methods.

The derived parameters contain all the metadata information that is needed for the stored procedure to execute properly. The application must provide the value of the parameters before execution, if required. The application may also modify the metadata information of the parameters before execution. For example, the `Size` property of the `OracleParameter` may be modified for PL/SQL character and string types to optimize the execution of the stored procedure.

The output values of derived parameters return as .NET Types by default. To obtain output parameters as provider types, the `OracleDbType` property of the parameter must be set explicitly by the application to override this default behavior. One quick way to do this is to set the `OracleDbType` to itself for all output parameters that should be returned as provider types.

The `BindByName` property of the supplied `OracleCommand` is left as is, but the application can change its value.

If the specified stored procedure or function is overloaded, the first overload is used to populate the parameters collection.

```
// Database Setup
/*
connect scott/tiger@oracle
CREATE OR REPLACE PROCEDURE MyOracleStoredProc (arg_in IN VARCHAR2,
  arg_out OUT VARCHAR2) IS
BEGIN
  arg_out := arg_in;
END;
/
*/

// C#
using System;
using System.Data;
using Oracle.DataAccess.Client;

class DeriveParametersSample
{
  static void Main()
  {
    // Create the PL/SQL Stored Procedure MyOracleStoredProc as indicated in
    // the preceding Database Setup

    string constr = "User Id=scott;Password=tiger;Data Source=oracle";
    OracleConnection con = new OracleConnection(constr);
    con.Open();

    // Create an OracleCommand
    OracleCommand cmd = new OracleCommand("MyOracleStoredProc", con);
    cmd.CommandType = CommandType.StoredProcedure;
  }
}
```

```
// Derive Parameters
OracleCommandBuilder.DeriveParameters(cmd);
Console.WriteLine("Parameters Derived");

// Prints "Number of Parameters for MyOracleStoredProc = 2"
Console.WriteLine("Number of Parameters for MyOracleStoredProc = {0}",
    cmd.Parameters.Count);

// The PL/SQL stored procedure MyOracleStoredProc has one IN and
// one OUT parameter. Set the Value for the IN parameter.
cmd.Parameters[0].Value = "MyText";

// The application may modify the other OracleParameter properties also
// This sample uses the default Size for the IN parameter and modifies
// the Size for the OUT parameter

// The default size for OUT VARCHAR2 is 4000
// Prints "cmd.Parameters[1].Size = 4000"
Console.WriteLine("cmd.Parameters[1].Size = " + cmd.Parameters[1].Size);

// Set the Size for the OUT parameter
cmd.Parameters[1].Size = 6;

// Execute the command
cmd.ExecuteNonQuery();

// Prints "cmd.Parameters[1].Value = MyText"
Console.WriteLine("cmd.Parameters[1].Value = " + cmd.Parameters[1].Value);

con.Close();
con.Dispose();
}
}
```

## Example



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommandBuilder Class](#)
- [OracleCommandBuilder Members](#)
- [OracleCommand Class](#)
- [OracleParameter Class](#)
- [OracleParameterCollection Class](#)
- <http://msdn.microsoft.com/library> for detailed information about this Microsoft .NET Framework feature

## OracleCommandBuilder Properties

OracleCommandBuilder properties are listed in [Table 7-23](#).

**Table 7-23 OracleCommandBuilder Properties**

Property	Description
Container	Inherited from <code>System.ComponentModel.Component</code>
<a href="#">CaseSensitive</a>	Indicates whether or not double quotes are used around Oracle object names when generating SQL statements
<a href="#">CatalogLocation</a>	<i>Not Supported</i>
<a href="#">CatalogSeparator</a>	<i>Not Supported</i>
<a href="#">ConflictOption</a>	<i>Not Supported</i>
<a href="#">DataAdapter</a>	Indicates the <code>OracleDataAdapter</code> for which the SQL statements are generated
<a href="#">QuotePrefix</a>	Specifies the beginning character or characters used to specify database objects whose names contain special characters such as spaces or reserved words
<a href="#">QuoteSuffix</a>	Specifies the ending character or characters used to specify database objects whose names contain special characters such as spaces or reserved words
<a href="#">SchemaSeparator</a>	Specifies the character to be used for the separator between the schema identifier and other identifiers
Site	Inherited from <code>System.ComponentModel.Component</code>

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommandBuilder Class](#)
- [OracleCommandBuilder Members](#)

## CaseSensitive

This property indicates whether or not double quotes are used around Oracle object names (for example, tables or columns) when generating SQL statements.

**Declaration**

```
// C#
bool CaseSensitive {get; set;}
```

**Property Value**

A `bool` that indicates whether or not double quotes are used.

**Remarks**

Default = `false`

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommandBuilder Class](#)
- [OracleCommandBuilder Members](#)

## CatalogLocation

This property is not supported.

### Declaration

```
// C#  
public override CatalogLocation CatalogLocation {get; set;}
```

### Exceptions

NotSupportedException - This property is not supported.

### Remarks

This property is not supported.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommandBuilder Class](#)
- [OracleCommandBuilder Members](#)

## CatalogSeparator

This property is not supported.

### Declaration

```
// C#  
public override string CatalogSeparator {get; set;}
```

### Exceptions

NotSupportedException - This property is not supported.

### Remarks

This property is not supported.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommandBuilder Class](#)
- [OracleCommandBuilder Members](#)

## ConflictOption

This property is not supported.

### Declaration

```
// C#  
public override string ConflictOption {get; set;}
```

### Exceptions

NotSupportedException - This property is not supported.

### Remarks

This property is not supported.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommandBuilder Class](#)
- [OracleCommandBuilder Members](#)

## DataAdapter

This property indicates the `OracleDataAdapter` object for which the SQL statements are generated.

### Declaration

```
// C#  
OracleDataAdapter DataAdapter{get; set;}
```

### Property Value

An `OracleDataAdapter` object.

### Remarks

Default = null

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommandBuilder Class](#)
- [OracleCommandBuilder Members](#)

## QuotePrefix

This property specifies the beginning character or characters used to specify database objects whose names contain special characters such as spaces or reserved words.

### Declaration

```
// C#  
public override string QuotePrefix {get; set;}
```

### Property Value

The beginning character or characters to use. The default value is "\".

### Remarks

This property is independent of any `OracleConnection` or `OracleCommand` objects.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommandBuilder Class](#)
- [OracleCommandBuilder Members](#)

## QuoteSuffix

This property specifies the ending character or characters used to specify database objects whose names contain special characters such as spaces or reserved words.

### Declaration

```
// C#  
public override string QuoteSuffix {get; set;}
```

### Property Value

The ending character or characters to use. The default value is "\".

### Remarks

This property is independent of any `OracleConnection` or `OracleCommand` objects.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommandBuilder Class](#)
- [OracleCommandBuilder Members](#)

## SchemaSeparator

This property specifies the character to be used for the separator between the schema identifier and other identifiers.

### Declaration

```
// C#  
public override string SchemaSeparator {get; set; }
```

### Property Value

The character to be used as the schema separator.

### Exceptions

`NotSupportedException` - The input value is not a dot (.).

### Remarks

The default schema separator is a dot (.). The only acceptable value for this property is a dot (.).

This property is independent of any `OracleConnection` or `OracleCommand` objects.

### Example

```
// C#  
  
using System;  
using System.Data;  
using System.Data.Common;  
using Oracle.DataAccess.Client;  
  
class SchemaSeparatorSample  
{  
    static void Main(string[] args)  
    {  
        try  
        {  
            OracleCommandBuilder cmdBuilder = new OracleCommandBuilder();  
  
            //schemaSeparator is dot(.)  
            Console.WriteLine("schemaSeparator is {0}",  
                cmdBuilder.SchemaSeparator);  
  
            //set the schemaseparator, only '.' is allowed.  
            cmdBuilder.SchemaSeparator = ".";  
        }  
        catch { }  
    }  
}
```

```

// the only acceptable value for this property is a dot (.)
// Hence the following line will throw NotSupportedException
cmdBuilder.SchemaSeparator = "!";
}
catch (Exception ex)
{
    Console.WriteLine(ex.Message);
    Console.WriteLine(ex.StackTrace);
}
}
}
}

```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommandBuilder Class](#)
- [OracleCommandBuilder Members](#)

## OracleCommandBuilder Public Methods

OracleCommandBuilder public methods are listed in [Table 7-24](#).

**Table 7-24 OracleCommandBuilder Public Methods**

Public Method	Description
CreateObjRef	Inherited from System.MarshalByRefObject
Dispose	Inherited from System.ComponentModel.Component
Equals	Inherited from System.Object (Overloaded)
<a href="#">GetDeleteCommand</a>	Gets the automatically generated OracleCommand object that has the SQL statement (CommandText) perform deletions on the database (Overloaded)
GetHashCode	Inherited from System.Object
<a href="#">GetInsertCommand</a>	Gets the automatically generated OracleCommand object that has the SQL statement (CommandText) perform insertions on the database (Overloaded)
GetLifetimeService	Inherited from System.MarshalByRefObject
GetType	Inherited from System.Object
<a href="#">GetUpdateCommand</a>	Gets the automatically generated OracleCommand object that has the SQL statement (CommandText) perform updates on the database (Overloaded)
InitializeLifetimeService	Inherited from System.MarshalByRefObject
<a href="#">QuotIdentifier</a>	Returns the correct quoted form of the provided unquoted identifier, with any embedded quotes in the identifier properly escaped

Table 7-24 (Cont.) OracleCommandBuilder Public Methods

Public Method	Description
<a href="#">RefreshSchema</a>	Refreshes the database schema information used to generate INSERT, UPDATE, or DELETE statements
<a href="#">UnquoteIdentifier</a>	Returns the correct unquoted form of the provided quoted identifier, removing any escape notation for quotes embedded in the identifier
<code>ToString</code>	Inherited from <code>System.Object</code>

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommandBuilder Class](#)
- [OracleCommandBuilder Members](#)

## GetDeleteCommand

Gets the automatically generated `OracleCommand` object that has the SQL statement (`CommandText`) perform deletions on the database

### Overload List

- [GetDeleteCommand\(\)](#)

This method gets the automatically generated `OracleCommand` object that has the SQL statement (`CommandText`) perform deletions on the database when an application calls `Update()` on the `OracleDataAdapter`.

- [GetDeleteCommand\(bool\)](#)

This method gets the automatically generated `OracleCommand` object that has the SQL statement (`CommandText`) perform deletions on the database when an application calls `Update()` on the `OracleDataAdapter`.

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommandBuilder Class](#)
- [OracleCommandBuilder Members](#)

## GetDeleteCommand()

This method gets the automatically generated `OracleCommand` object that has the SQL statement (`CommandText`) perform deletions on the database when an application calls `Update()` on the `OracleDataAdapter`.

### Declaration

```
// C#  
public OracleCommand GetDeleteCommand();
```

### Return Value

An `OracleCommand`.

### Exceptions

`ObjectDisposedException` - The `OracleCommandBuilder` object is already disposed.

`InvalidOperationException` - Either the `SelectCommand` or the `DataAdapter` property is null, or the primary key cannot be retrieved from the `SelectCommand` property of the `OracleDataAdapter`.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommandBuilder Class](#)
- [OracleCommandBuilder Members](#)

## GetDeleteCommand(bool)

This method gets the automatically generated `OracleCommand` object that has the SQL statement (`CommandText`) perform deletions on the database when an application calls `Update()` on the `OracleDataAdapter`.

### Declaration

```
// C#  
public OracleCommand GetDeleteCommand(bool useColumnsForParameterNames);
```

### Parameters

- `useColumnsForParameterNames`

If true, the method generates parameter names matching column names if possible. If false, the method binds parameters by position.

### Return Value

An `OracleCommand`.

## Exceptions

`ObjectDisposedException` - The `OracleCommandBuilder` object is already disposed.

`InvalidOperationException` - Either the `SelectCommand` or the `DataAdapter` property is null, or the primary key cannot be retrieved from the `SelectCommand` property of the `OracleDataAdapter`.

## Remarks

If the `bool` is `true`, the method generates parameter names matching column names if possible. If `false`, the method binds parameters by position.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommandBuilder Class](#)
- [OracleCommandBuilder Members](#)

## GetInsertCommand

Gets the automatically generated `OracleCommand` object that has the SQL statement (`CommandText`) perform insertions on the database

### Overload List

- [GetInsertCommand\(\)](#)

This method gets the automatically generated `OracleCommand` object that has the SQL statement (`CommandText`) perform insertions on the database when an application calls `Update()` on the `OracleDataAdapter`.

- [GetInsertCommand\(bool\)](#)

This method gets the automatically generated `OracleCommand` object that has the SQL statement (`CommandText`) perform insertions on the database when an application calls `Update()` on the `OracleDataAdapter`.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommandBuilder Class](#)
- [OracleCommandBuilder Members](#)

## GetInsertCommand()

This method gets the automatically generated `OracleCommand` object that has the SQL statement (`CommandText`) perform insertions on the database when an application calls `Update()` on the `OracleDataAdapter`.

### Declaration

```
// C#  
public OracleCommand GetInsertCommand();
```

### Return Value

An `OracleCommand`.

### Exceptions

`ObjectDisposedException` - The `OracleCommandBuilder` object is already disposed.

`InvalidOperationException` - Either the `SelectCommand` or the `DataAdapter` property is null, or the primary key cannot be retrieved from the `SelectCommand` property of the `OracleDataAdapter`.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommandBuilder Class](#)
- [OracleCommandBuilder Members](#)

## GetInsertCommand(bool)

This method gets the automatically generated `OracleCommand` object that has the SQL statement (`CommandText`) perform insertions on the database when an application calls `Update()` on the `OracleDataAdapter`.

### Declaration

```
// C#  
public OracleCommand GetInsertCommand(bool useColumnsForParameterNames);
```

### Parameters

- `useColumnsForParameterNames`

If true, the method generates parameter names matching column names if possible. If false, the method binds parameters by position.

### Return Value

An `OracleCommand`.

## Exceptions

`ObjectDisposedException` - The `OracleCommandBuilder` object is already disposed.

`InvalidOperationException` - Either the `SelectCommand` or the `DataAdapter` property is null, or the primary key cannot be retrieved from the `SelectCommand` property of the `OracleDataAdapter`.

## Remarks

If the `bool` is `true`, the method generates parameter names matching column names if possible. If `false`, the method binds parameters by position.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommandBuilder Class](#)
- [OracleCommandBuilder Members](#)

## GetUpdateCommand

Gets the automatically generated `OracleCommand` object that has the SQL statement (`CommandText`) perform updates on the database

### Overload List

- [GetUpdateCommand\(\)](#)

This method gets the automatically generated `OracleCommand` object that has the SQL statement (`CommandText`) perform updates on the database when an application calls `Update()` on the `OracleDataAdapter`.

- [GetUpdateCommand\(bool\)](#)

This method gets the automatically generated `OracleCommand` object that has the SQL statement (`CommandText`) perform updates on the database when an application calls `Update()` on the `OracleDataAdapter`.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommandBuilder Class](#)
- [OracleCommandBuilder Members](#)

## GetUpdateCommand()

This method gets the automatically generated `OracleCommand` object that has the SQL statement (`CommandText`) perform updates on the database when an application calls `Update()` on the `OracleDataAdapter`.

### Declaration

```
// C#  
public OracleCommand GetUpdateCommand();
```

### Return Value

An `OracleCommand`.

### Exceptions

`ObjectDisposedException` - The `OracleCommandBuilder` object is already disposed.

`InvalidOperationException` - Either the `SelectCommand` or the `DataAdapter` property is null, or the primary key cannot be retrieved from the `SelectCommand` property of the `OracleDataAdapter`.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommandBuilder Class](#)
- [OracleCommandBuilder Members](#)

## GetUpdateCommand(bool)

This method gets the automatically generated `OracleCommand` object that has the SQL statement (`CommandText`) perform updates on the database when an application calls `Update()` on the `OracleDataAdapter`.

### Declaration

```
// C#  
public OracleCommand GetUpdateCommand(bool useColumnsForParameterNames);
```

### Parameters

- `useColumnsForParameterNames`

If true, the method generates parameter names matching column names if possible. If false, the method binds parameters by position.

### Return Value

An `OracleCommand`.

## Exceptions

`ObjectDisposedException` - The `OracleCommandBuilder` object is already disposed.

`InvalidOperationException` - Either the `SelectCommand` or the `DataAdapter` property is null, or the primary key cannot be retrieved from the `SelectCommand` property of the `OracleDataAdapter`.

## Remarks

If the `bool` is `true`, the method generates parameter names matching column names if possible. If `false`, the method binds parameters by position.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommandBuilder Class](#)
- [OracleCommandBuilder Members](#)

## QuoteIdentifier

This method returns the correct quoted form of the provided unquoted identifier, with any embedded quotes in the identifier properly escaped.

### Declaration

```
// C#  
public override string QuoteIdentifier(string unquotedIdentifier);
```

### Parameters

- *UnquotedIdentifier*  
An unquoted identifier string.

### Return Value

The quoted version of the identifier. Embedded quotes within the identifier are properly escaped.

### Exceptions

`ArgumentNullException` - The input parameter is null.

### Remarks

This method is independent of any `OracleConnection` or `OracleCommand` objects.

### Example

```
// C#
```

```
using System;
using System.Data;
using System.Data.Common;
using Oracle.DataAccess.Client;

class QuoteIdentifierSample
{
    static void Main(string[] args)
    {
        OracleCommandBuilder builder = new OracleCommandBuilder();
        string quoteIdentifier = builder.QuoteIdentifier("US\"ER");

        //quoteIdentifier for "US\"ER" is (\\"US\\"\"ER\\")
        Console.WriteLine("quoteIdentifier is {0}" , quoteIdentifier);
    }
}
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommandBuilder Class](#)
- [OracleCommandBuilder Members](#)

## RefreshSchema

This method refreshes the database schema information used to generate INSERT, UPDATE, or DELETE statements.

### Declaration

```
// C#
public override void RefreshSchema();
```

### Remarks

An application should call `RefreshSchema` whenever the `SelectCommand` value of the `OracleDataAdapter` object changes.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommandBuilder Class](#)
- [OracleCommandBuilder Members](#)

## UnquoteIdentifier

This method returns the correct unquoted form of the provided quoted identifier, removing any escape notation for quotes embedded in the identifier.

### Declaration

```
// C#  
public override string UnquoteIdentifier(string quotedIdentifier);
```

### Parameters

- *quotedIdentifier*  
The quoted string identifier.

### Return Value

The unquoted identifier, with escape notation for any embedded quotes removed.

### Exceptions

*ArgumentNullException* - The input parameter is null.

*ArgumentException* - The input parameter is empty.

### Remarks

This method is independent of any *OracleConnection* or *OracleCommand* objects.

### Example

```
// C#  
  
using System;  
using System.Data;  
using System.Data.Common;  
using Oracle.DataAccess.Client;  
  
class UnQuoteIdentifierSample  
{  
    static void Main(string[] args)  
    {  
        //create an OracleCommandBuilder object.  
        OracleCommandBuilder builder = new OracleCommandBuilder();  
  
        string identifier = "US\"ER\"";  
        Console.WriteLine("Identifier is {0}", identifier);  
  
        // quote the identifier  
        string quoteIdentifier = builder.QuoteIdentifier(identifier);  
  
        //quoteIdentifier of "US\"ER\" is (\\"US\"\\\"ER\\")  
        Console.WriteLine("QuotedIdentifier is {0}" , quoteIdentifier);  
        string unquoteIdentifier = builder.UnquoteIdentifier(quoteIdentifier);  
  
        //And its unquoteIdentifier is US\"ER  
        Console.WriteLine("UnquotedIdentifier is {0}" , unquoteIdentifier);  
    }  
}
```

```
}
}
```

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommandBuilder Class](#)
- [OracleCommandBuilder Members](#)

## OracleCommandBuilder Events

The `OracleCommandBuilder` event is listed in [Table 7-25](#).

**Table 7-25 OracleCommandBuilder Event**

Event Name	Description
Disposed	Inherited from <code>System.ComponentModel.Component</code>

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCommandBuilder Class](#)
- [OracleCommandBuilder Members](#)

## OracleConfiguration Class

An `OracleConfiguration` is a static class for setting ODP.NET configuration data using a single programming interface.

### Class Inheritance

`System.Object`

`Oracle.ManagedDataAccess.Client.OracleConfiguration`

### Declaration

```
// C#
public sealed class OracleConfiguration
```

## Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>



### Note:

Unmanaged ODP.NET implements the `OracleConfiguration` debug tracing properties only.

## Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

## Example

```
// C#

using System;
using Oracle.ManagedDataAccess.Client;

namespace ODP_Core_Config_API
{
    class odp_core_config
    {
        static void Main(string[] args)
        {
            // This sample demonstrates how to use ODP.NET Core Configuration API

            // Add connect descriptors and net service names entries.
            OracleConfiguration.OracleDataSources.Add("orclpdb",
                "(DESCRIPTION=(ADDRESS=(PROTOCOL=TCP) (HOST=<hostname or IP>) (PORT=1521))
                (CONNECT_DATA=(SERVICE_NAME=<service name>) (SERVER=dedicated)))");
            OracleConfiguration.OracleDataSources.Add("orcl",
                "(DESCRIPTION=(ADDRESS=(PROTOCOL=TCP) (HOST=<hostname or IP>) (PORT=1521))
                (CONNECT_DATA=(SERVICE_NAME=<service name>) (SERVER=dedicated)))");

            // Set default statement cache size to be used by all connections.
            OracleConfiguration.StatementCacheSize = 25;

            // Disable self tuning by default.
            OracleConfiguration.SelfTuning = false;

            // Bind all parameters by name.
        }
    }
}
```

```
OracleConfiguration.BindByName = true;

// Set default timeout to 60 seconds.
OracleConfiguration.CommandTimeout = 60;

// Set default fetch size as 1 MB.
OracleConfiguration.FetchSize = 1024 * 1024;

// Set tracing options
OracleConfiguration.TraceOption = 1;
OracleConfiguration.TraceFileLocation = @"D:\traces";
// Uncomment below to generate trace files
//OracleConfiguration.TraceLevel = 7;

// Set network properties
OracleConfiguration.SendBufferSize = 8192;
OracleConfiguration.ReceiveBufferSize = 8192;
OracleConfiguration.DisableOOB = true;

OracleConnection orclCon = null;

try
{
    // Open a connection
    orclCon = new OracleConnection("user id=hr; password=<password>;
data source=orclpdb");
    orclCon.Open();

    // Execute simple select statement that returns first 10 names
    from EMPLOYEES table
    OracleCommand orclCmd = orclCon.CreateCommand();
    orclCmd.CommandText = "select first_name from employees where
rownum <= 10 ";
    OracleDataReader rdr = orclCmd.ExecuteReader();

    while (rdr.Read())
        Console.WriteLine("Employee Name: " + rdr.GetString(0));

    Console.ReadLine();

    rdr.Dispose();
    orclCmd.Dispose();
}
finally
{
    // Close the connection
    if (null != orclCon)
        orclCon.Close();
}
}
```

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Members](#)
- [OracleConfiguration Connection Properties](#)
- [OracleConfiguration Secure Connection Properties](#)
- [OracleConfiguration Command Properties](#)
- [OracleConfiguration High Availability Properties](#)
- [OracleConfiguration Performance Properties](#)
- [OracleConfiguration Debug Tracing Properties](#)

## OracleConfiguration Members

OracleConfiguration members are listed in the following tables.

### OracleConfiguration Connection Properties

OracleConfiguration Connection properties are listed in [Table 7-26](#).

**Table 7-26 OracleConfiguration Connection Properties**

Property	Description
<a href="#">DatabaseEditionName</a>	Specifies the Oracle edition name for the connection object
<a href="#">DisableOOB</a>	Specifies whether to enable Oracle Net Services to send or receive out-of-band break messages using urgent data provided by the underlying protocol
<a href="#">DrcpConnectionClass</a>	Specifies a logical name that identifies the DRCP connection pool that the ODP.NET connection will use
<a href="#">HostnameDefaultServiceIsHost</a>	Specifies whether to default the service name to the hostname in Oracle Easy Connect Naming so that the service name does not need to be specified
<a href="#">NamesDirectoryPath</a>	Specifies the naming method order used for client name resolution lookups
<a href="#">OciCompartment</a>	Gets or sets the Oracle Cloud Identifier (OCID) of the target database's compartment at the process level
<a href="#">OciDatabase</a>	Gets or sets the target database's Oracle Cloud Identifier (OCID) at the process level
<a href="#">OciIamUrl</a>	Gets or sets the URL end point at the process level for getting the database token
<a href="#">OciTenacy</a>	Gets or sets the Oracle Cloud Identifier (OCID) of the IAM user's cloud tenancy at the process level for retrieving the database token
<a href="#">OracleDataSources</a>	Returns a collection of TNS entries added through OracleConfiguration

**Table 7-26 (Cont.) OracleConfiguration Connection Properties**

Property	Description
<a href="#">TcpConnectTimeout</a>	Specifies the time, in seconds, for a client to establish a TCP connection (PROTOCOL=tcp in the TNS connect address) to the database server before it can time out
<a href="#">TnsAdmin</a>	Specifies the <code>tnsnames.ora</code> and/or <code>sqlnet.ora</code> directory location

**OracleConfiguration Secure Connection Properties**

OracleConfiguration Secure Connection Properties are listed in [Table 7-27](#).

**Table 7-27 OracleConfiguration Secure Connection Properties**

Property	Description
<a href="#">PasswordAuthentication</a>	Sets the process level <code>PASSWORD_AUTH</code> parameter value
<a href="#">SqlNetAuthenticationServices</a>	Enables one or more authentication services, such as TCP/IP with SSL
<a href="#">SqlNetCloudUser</a>	Specifies an user name for web server HTTP basic authentication
<a href="#">SqlNetCryptoChecksumClient</a>	Specifies the checksum client behavior
<a href="#">SqlNetCryptoChecksumTypesClient</a>	Specifies the crypto-checksum algorithms the client can use
<a href="#">SqlNetEncryptionClient</a>	Specifies the encryption client behavior
<a href="#">SqlNetEncryptionTypesClient</a>	Specifies encryption algorithms that the client can use
<a href="#">SqlNetWalletOverride</a>	Specifies whether the client overrides the strong authentication credential with the stored wallet password credential for the database connection
<a href="#">SqlNetURI</a>	Specifies the WebSocket universal resource identifier
<a href="#">SSLServerDNMatch</a>	Enforces the database server distinguished name (DN) matches its service name
<a href="#">SSLVersion</a>	Enforces the connection to use a specific SSL/TLS version
<a href="#">TokenAuthentication</a>	Sets the value for <code>TOKEN_AUTH</code> parameter at the process level
<a href="#">TokenLocation</a>	Gets or sets the token location directory at the process level where the access token , or database token and private key files, are present for ODP.NET token authentication.
<a href="#">WalletLocation</a>	Specifies the location of wallets

**OracleConfiguration Command Properties**

OracleConfiguration Command properties are listed in [Table 7-28](#).

**Table 7-28 OracleConfiguration Command Properties**

Property	Description
<a href="#">AddOracleTypesDeserialization</a>	Adds ODP.NET-specific data types to the “allow” list to permit deserialization into <code>DataSet</code> or <code>DataTable</code>
<a href="#">BindByName</a>	Specifies whether the binding method used for the parameter collection is by name or by position
<a href="#">CommandTimeout</a>	Specifies the number of seconds the command is allowed to execute before terminating the execution with an exception
<a href="#">GetDecimalRetainTrailingZeros</a>	Specifies whether to retain trailing zeros from an Oracle <code>NUMBER</code> in a .NET <code>Decimal</code>
<a href="#">UseClientInitiatedCQN</a>	Specifies whether to use Client Initiated Continuous Query Notification (CICQN) or traditional Continuous Query Notification (CQN) that does not rely on a persistent connection

**OracleConfiguration Directories Properties**

OracleConfiguration Directories properties are listed in [Table 7-29](#).

**Table 7-29 OracleConfiguration Directories Properties**

Property	Description
<a href="#">DefaultAdminContext</a>	Specifies the default directory entry that contains a LDAP Oracle Context from which connect identifiers can be created, modified, or looked up
<a href="#">DirectoryServers</a>	Lists the host names and port numbers of the primary and alternate LDAP directory servers
<a href="#">DirectoryServerType</a>	Specifies the directory server type used, such as Oracle Internet Directory or Microsoft Active Directory
<a href="#">LdapAdmin</a>	Specifies the <code>ldap.ora</code> directory location
<a href="#">NamesLdapAuthenticateBind</a>	Specifies whether the LDAP naming adapter should attempt to authenticate using a specified wallet when it connects to the LDAP directory to resolve the name in the connect string
<a href="#">NamesLdapAuthenticateBindMethod</a>	Specifies the authentication method the client LDAP naming adapter should use while connecting to the LDAP directory to resolve connect string names
<a href="#">NamesLdapConnTimeout</a>	specifies the non-blocking connection timeout to the LDAP server

**OracleConfiguration High Availability Properties**

OracleConfiguration High Availability properties are listed in [Table 7-30](#).

**Table 7-30 OracleConfiguration High Availability Properties**

Property	Description
<a href="#">DbNotificationAddress</a>	Specifies the address that the provider listens to for all notifications sent by the database for continuous query notification feature.
<a href="#">DbNotificationPort</a>	Specifies the port number that the provider listens to for all notifications sent by the database for continuous query notification, Fast Connection Failover, and/or Runtime Connection Load Balancing features
<a href="#">HAEvents</a>	Enables the application to receive Fast Connection Failover events for maintaining application high availability
<a href="#">OnsConfigFile</a>	Specifies the configuration file to define Oracle Notification Service (ONS) behavior
<a href="#">OnsMode</a>	Specifies the ONS daemon mode as either <code>local</code> or <code>remote</code>
<a href="#">OnsProtocol</a>	Defines whether the ONS connection uses TCP/IP or TCP/IP with SSL/TLS
<a href="#">OnsWalletLocation</a>	Specifies the directory location of the ONS wallets
<a href="#">OracleOnsServers</a>	Returns a collection of logical ONS servers added through <code>OracleConfiguration</code>
<a href="#">ServiceRelocationConnectionTimeout</a>	Specifies the time to wait before retrying connecting to a service that becomes unavailable.

**OracleConfiguration Performance Properties**

`OracleConfiguration` Performance properties are listed in [Table 7-31](#).

**Table 7-31 OracleConfiguration Performance Properties**

Property	Description
<a href="#">FetchSize</a>	Specifies the total memory size, in bytes, that the provider allocates to cache data fetched in one database round-trip
<a href="#">LoadBalancing</a>	Enables the application to receive runtime connection load balancing information
<a href="#">MaxStatementCacheSize</a>	Specifies the maximum number of statements that can be cached when self-tuning is enabled
<a href="#">PerformanceCounters</a>	Specifies the ODP.NET connection performance counters to publish so that they can be monitored
<a href="#">ReceiveBufferSize</a>	Specifies the buffer space limit for receive operations of sessions
<a href="#">SelfTuning</a>	Specifies whether self-tuning is enabled for an ODP.NET application
<a href="#">SendBufferSize</a>	Specifies the buffer space limit for send operations of sessions

**Table 7-31 (Cont.) OracleConfiguration Performance Properties**

Property	Description
<a href="#">StatementCacheSize</a>	Specifies the number of cursors or statements to be cached for each database connection
<a href="#">TcpNoDelay</a>	Preempts delays in buffer flushing within the TCP/IP protocol stack

**OracleConfiguration Debug Tracing Properties**

OracleConfiguration Debug Tracing properties are listed in [Table 7-32](#).

**Table 7-32 OracleConfiguration Debug Tracing Properties**

Property	Description
<a href="#">TraceFileLocation</a>	Specifies the destination directory to output provider traces
<a href="#">TraceFileMaxSize</a>	Specifies the maximum file size of each trace file
<a href="#">TraceLevel</a>	Specifies the generated trace level to trace ODP.NET calls and diagnose provider issues
<a href="#">TraceOption</a>	Specifies whether to generate a single trace file or multiple trace files for multithreaded applications

## OracleConfiguration Connection Properties

OracleConfiguration Connection properties are listed in [Table 7-33](#).

**Table 7-33 OracleConfiguration Connection Properties**

Property	Description
<a href="#">DatabaseEditionName</a>	Specifies the Oracle edition name for the connection object
<a href="#">DisableOOB</a>	Specifies whether to enable Oracle Net Services to send or receive out-of-band break messages using urgent data provided by the underlying protocol
<a href="#">DrcpConnectionClass</a>	Specifies a logical name that identifies the DRCP connection pool that the ODP.NET connection will use
<a href="#">HostnameDefaultServiceIsHost</a>	Specifies whether to default the service name to the hostname in Oracle Easy Connect Naming so that the service name does not need to be specified
<a href="#">NamesDirectoryPath</a>	Specifies the naming method order used for client name resolution lookups
<a href="#">OciCompartment</a>	Gets or sets the Oracle Cloud Identifier (OCID) of the target database's compartment at the process level
<a href="#">OciDatabase</a>	Gets or sets the target database's Oracle Cloud Identifier (OCID) at the process level
<a href="#">OciIamUrl</a>	Gets or sets the URL end point at the process level for getting the database token

Table 7-33 (Cont.) OracleConfiguration Connection Properties

Property	Description
<a href="#">OciTenancy</a>	Gets or sets the Oracle Cloud Identifier (OCID) of the IAM user's cloud tenancy at the process level for retrieving the database token
<a href="#">OracleDataSources</a>	Returns a collection of TNS entries added through OracleConfiguration
<a href="#">TcpConnectTimeout</a>	Specifies the time, in seconds, for a client to establish a TCP connection (PROTOCOL=tcp in the TNS connect address) to the database server before it can time out
<a href="#">TnsAdmin</a>	Specifies the <code>tnsnames.ora</code> and/or <code>sqlnet.ora</code> directory location

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## DatabaseEditionName

This property specifies the Oracle edition name for the connection object. This property is used with the Oracle Edition-Based Redefinition feature.

### Declaration

```
// C#  
public static string DatabaseEditionName { get; set; }
```

### Property Type

System.String

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## DisableOOB

This property specifies whether to enable Oracle Net Services to send or receive out-of-band break messages using urgent data provided by the underlying protocol. Default is `false`.

### Declaration

```
// C#  
public static bool DisableOOB { get; set; }
```

### Property Type

System.Boolean

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## DrcpConnectionClass

This property specifies a logical name that identifies the DRCP connection pool that the ODP.NET connection will use. It will be used as a default if the `DrcpConnectionClass` property on the `OracleConnection` object is not set. It will be ignored for non-DRCP connections. Default value is `null`.

### Declaration

```
// C#  
public static string DrcpConnectionClass { get; set; }
```

### Property Type

System.String

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## HostnameDefaultServiceIsHost

This property specifies whether to default the service name to the hostname in Oracle Easy Connect Naming so that the service name does not need to be specified.

### Declaration

```
// C#  
public static bool HostnameDefaultServiceIsHost { get; set; }
```

### Property Type

System.Boolean

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## NamesDirectoryPath

This property specifies the naming method order used for client name resolution lookups.

### Declaration

```
// C#  
public static string NamesDirectoryPath { get; set; }
```

### Property Type

System.String

### Example

```
C#  
OracleConfiguration.NamesDirectoryPath = "(tnsnames, ldap)";
```

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## OciCompartment

This property gets or sets the Oracle Cloud Identifier (OCID) of the target database's compartment at the process level.

### Declaration

```
// C#  
public static string OciCompartment { get; set; }
```

### Property Type

System.String

### Remarks

This property is optional by default. This property is mandatory if the `OciDatabase` property is set.

If `OciCompartment` is not set, then ODP.NET requests access to all the cloud tenancy's databases identified in the `OciTenancy` property.

There is no default value for this property.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## OciDatabase

This property gets or sets the target database's Oracle Cloud Identifier (OCID) at the process level.

### Declaration

```
// C#  
public static string OciCompartment { get; set; }
```

### Property Type

System.String

### Remarks

This property is optional.

If it is not set, then ODP.NET requests access to all the cloud compartment's databases identified in the `OciCompartment` property. If `OciCompartment` property is also not set, then ODP.NET requests access to all the tenancy's databases specified in the `OciTenancy` property.

There is no default value for this property.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## OciIamUrl

This property gets or sets the URL end point at the process level for getting the database token.

#### Declaration

```
// C#  
public static string OciIamUrl { get; set; }
```

#### Property Type

System.String

#### Remarks

This is a mandatory property for IAM alternate password use. If not set in that usage scenario, ODP.NET raises an error.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## OciTenacy

This property gets or sets the Oracle Cloud Identifier (OCID) of the IAM user's cloud tenancy at the process level for retrieving the database token.

#### Declaration

```
// C#  
public static string OciTenacy { get; set; }
```

#### Property Type

System.String

### Remarks

This is a mandatory property for IAM alternate password use. If not set in that usage scenario, ODP.NET raises an error.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## OracleDataSources

This property returns a collection of TNS entries added through `OracleConfiguration`.

### Declaration

```
// C#  
public static OracleDataSourceCollection OracleDataSources
```

### Property

Type: `Oracle.ManagedDataAccess.Client.OracleDataSourceCollection`

Returns a static `OracleDataSourceCollection` object.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)
- [OracleDataSourceCollection Class](#)

## TcpConnectTimeout

This property specifies the time, in seconds, for a client to establish a TCP connection (`PROTOCOL=tcp` in the TNS connect address) to the database server before it can time out. Default value is 60 seconds.

### Declaration

```
// C#  
public static string TcpConnectTimeout { get; set; }
```

### Property Type

System.String

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## TnsAdmin

This property specifies the `tnsnames.ora` and/or `sqlnet.ora` directory location.

### Declaration

```
// C#  
public static string TnsAdmin { get; set; }
```

### Property Type

System.String

The backslash (\) is a special character in .NET that represents the beginning of an escape sequence. To specify a directory location, use any one of the following formats in .NET so that backslashes are correctly represented in a directory location:

```
// C#  
OracleConfiguration.TnsAdmin = "D:\\oracle\\client\\admin";  
OracleConfiguration.TnsAdmin = @"D:\oracle\client\admin";  
OracleConfiguration.TnsAdmin = "D:/oracle/client/admin";
```

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## OracleConfiguration Secure Connection Properties

OracleConfigurationSecure Connection properties are listed in [Table 7-34](#).

Table 7-34 OracleConfiguration Secure Connection Properties

Property	Description
<a href="#">OciCompartment</a>	Gets or sets the Oracle Cloud Identifier (OCID) of the target database's compartment at the process level
<a href="#">OciDatabase</a>	Gets or sets the target database's Oracle Cloud Identifier (OCID) at the process level
<a href="#">OciIamUrl</a>	Gets or sets the URL end point at the process level for getting the database token
<a href="#">OciTenacy</a>	Gets or sets the Oracle Cloud Identifier (OCID) of the IAM user's cloud tenancy at the process level for retrieving the database token
<a href="#">PasswordAuthentication</a>	Sets the process level <code>PASSWORD_AUTH</code> parameter value
<a href="#">SqlNetAuthenticationServices</a>	Enables one or more authentication services, such as TCP/IP with SSL
<a href="#">SqlNetCloudUser</a>	Specifies an user name for web server HTTP basic authentication
<a href="#">SqlNetCryptoChecksumClient</a>	Specifies the checksum client behavior
<a href="#">SqlNetCryptoChecksumTypesClient</a>	Specifies the crypto-checksum algorithms the client can use
<a href="#">SqlNetEncryptionClient</a>	Specifies the encryption client behavior
<a href="#">SqlNetEncryptionTypesClient</a>	Specifies encryption algorithms that the client can use
<a href="#">SqlNetWalletOverride</a>	Specifies whether the client overrides the strong authentication credential with the stored wallet password credential for the database connection
<a href="#">SqlNetURI</a>	Specifies the WebSocket universal resource identifier
<a href="#">SSLServerDNMatch</a>	Enforces the database server distinguished name (DN) matches its service name
<a href="#">SSLVersion</a>	Enforces the connection to use a specific SSL/TLS version
<a href="#">TokenAuthentication</a>	Sets the value for <code>TOKEN_AUTH</code> parameter at the process level
<a href="#">TokenLocation</a>	Gets or sets the token location directory at the process level where the access token , or database token and private key files, are present for ODP.NET token authentication.
<a href="#">WalletLocation</a>	Specifies the location of wallets

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## PasswordAuthentication

This property sets the process level `PASSWORD_AUTH` parameter value. The possible values are `OciToken` and `PasswordVerifier`. The default value is `PasswordVerifier`, which indicates the typical database username and password can be used for authentication.

### Declaration

```
// C#  
public static OraclePasswordAuth PasswordAuthentication { get; set; }
```

### Property Type

An `OraclePasswordAuth` enumeration

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## SqlNetAuthenticationServices

This property enables one or more authentication services, such as TCP/IP with SSL.

### Declaration

```
// C#  
public static string SqlNetAuthenticationServices { get; set; }
```

### Property Type

`System.String`

Default value is `NONE`.

Valid Values: `All`, `Kerberos5`, `NTS`, `TCPS`, or `NONE`.

#### Note:

ODP.NET Core does not currently support the `Kerberos5` value.

### Example

```
//C#  
con.SqlNetAuthenticationServices = "(nts, tcps)";
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## SqlNetCloudUser

This property specifies an user name for web server HTTP basic authentication.

### Declaration

```
// C#  
public static string SqlNetCloudUser { get; set; }
```

### Property Type

System.String

Default: none

### Remarks

When you use a secure websocket protocol, the client uses this user as the user name for authentication. The password for this user should be stored in a wallet using `mkstore` utility commands.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## SqlNetCryptoChecksumClient

This property specifies the checksum client behavior.

### Declaration

```
// C#  
public static string SqlNetCryptoChecksumClient { get; set; }
```

### Property Type

System.String

Default value is accepted.

**Valid Values:**

- `accepted` - to enable the security service if required or requested by the database.
- `rejected` - to disable the security service, even if required by the database.
- `requested` - to enable the security service if the database allows it.
- `required` - to enable the security service and disallow the connection if the database is not enabled for the security service.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## SqlNetEncryptionClient

This property specifies the encryption client behavior.

**Declaration**

```
// C#  
public static string SqlNetEncryptionClient { get; set; }
```

**Property Type**

`System.String`

**Default value is** `accepted`.

**Valid Values:**

- `accepted` - to enable the security service if required or requested by the database.
- `rejected` - to disable the security service, even if required by the database.
- `requested` - to enable the security service if the database allows it.
- `required` - to enable the security service and disallow the connection if the database is not enabled for the security service.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## SqlNetEncryptionTypesClient

This property specifies encryption algorithms that the client can use.

### Declaration

```
// C#  
public static string SqlNetEncryptionTypesClient { get; set; }
```

### Property Type

System.String

### Valid Values:

- AES128
- AES192
- AES256
- 3DES112
- 3DES168

### Example

```
C#  
OracleConfiguration.SqlNetEncryptionTypesClient = "(aes128, aes192)";
```



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## SqlNetCryptoChecksumTypesClient

This property specifies the crypto-checksum algorithms the client can use.

### Declaration

```
// C#  
public static string SqlNetCryptoChecksumTypesClient { get; set; }
```

### Property Type

System.String

### Valid Values:

- SHA1
- SHA256

- SHA384
- SHA512

### Example

```
C#  
OracleConfiguration.SqlNetCryptoChecksumTypesClient = "(SHA1, SHA256, SHA512)";
```



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## SqlNetWalletOverride

This property specifies whether the client overrides the strong authentication credential with the stored wallet password credential for the database connection.

### Declaration

```
// C#  
public static bool SqlNetWalletOverride { get; set; }
```

### Property Type

System.Boolean

### Description

Default is `false`. By setting this value to `true`, ODP.NET uses the stored wallet password credential to connect.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## SqlNetURI

This property specifies the WebSocket universal resource identifier.

### Declaration

```
// C#  
public static string SqlNetURI { get; set; }
```

### Property Type

System.String

This property is Request-URI of the HTTP GET method. It identifies the endpoint of the WebSocket connection, both to allow multiple domains to be served from one IP address and to allow multiple WebSocket endpoints to be served by a single server.

When setting the URI in unmanaged ODP.NET, it cannot begin with a forward slash character. For managed ODP.NET and ODP.NET Core, the forward slash at the beginning of the URI is optional.

Default value is `sqlnet`.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## SSLServerDNMatch

This property enforces the database server distinguished name (DN) matches its service name. Default value is `false`.

### Declaration

```
// C#  
public static bool SSLServerDNMatch { get; set; }
```

### Property Type

System.Boolean

#### Valid Values:

- `true` - to enforce a match. If the DN matches the service name, then the connection succeeds. If the DN does not match the service name, then the connection fails.
- `false` - to not enforce a match. If the DN does not match the service name, then the connection is successful, but an error is logged to the `sqlnet.log` file.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## SSLVersion

This property enforces the connection to use a specific SSL/TLS version. The default value is an undetermined version.

### Declaration

```
// C#  
public static string SSLVersion { get; set; }
```

### Property Type

System.String

### Description

Supported values are: `undetermined | 3.0 | 1.0 | 1.1 | 1.2`. To specify more than one SSL/TLS version allowed, use the `or` keyword between values. For example, `1.2 or 1.1 or 3.0`.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## TokenAuthentication

This property sets the value for `TOKEN_AUTH` parameter at the process level. The possible values for this property can be `OracleTokenAuth.OciToken`, `OracleTokenAuth.Disabled`, or `OracleTokenAuth.OAuth`.

### Declaration

```
// C#  
public static OracleTokenAuth TokenAuthentication { get; set; }
```

**Table 7-35 OracleTokenAuth Members**

Member Name	Description
Disabled	Default value. Token authentication is <code>DISABLED</code> .
OciToken	Token authentication is enabled for Oracle Identity and Access Management.
OAuth	Token authentication enabled for Azure Active Directory.

**Note:**

Only managed ODP.NET and ODP.NET Core can use this property.

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## TokenLocation

This property gets or sets the token location directory at the process level where the access token, or database token and private key files, are present for ODP.NET token authentication. The file names do not need to be specified.

**Declaration**

```
// C#  
public static string TokenLocation { get; set; }
```

**Property Value**

A directory location.

**Exceptions**

None.

**Description**

This property is mandatory for OAuth file-based access tokens, but optional for database tokens.

In the access token case, this property can be the directory where the file "token" is, or the full-path specification of the token file.

For OCI IAM PoP tokens, a file's full-path specification can be specified if it does not have the standard name, "token". A file name does not need to be specified when it uses this standard, fixed name. Bearer token default token location is an empty string.

**Note:**

Only managed ODP.NET and ODP.NET Core can use this property.

**Remarks**

Applications can override the default location of signature token and private key by setting a new custom location through this property.

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## WalletLocation

This property specifies the location of wallets. Wallets are certificates, keys, and trustpoints processed by SSL/TLS.

**Declaration**

```
// C#  
public static string WalletLocation { get; set; }
```

**Property Type**

System.String

**Remarks**

Microsoft Certificate Store (MCS) and file system wallets are supported.

**Note:**

MCS wallets are supported only on Windows operating systems.

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## OracleConfiguration Command Properties

OracleConfiguration Command properties are listed in [Table 7-36](#).

**Table 7-36 OracleConfiguration Command Properties**

Property	Description
<a href="#">AddOracleTypesDeserialization</a>	Adds ODP.NET-specific data types to the "allow" list to permit deserialization into DataSet or DataTable
<a href="#">BindByName</a>	Specifies whether the binding method used for the parameter collection is by name or by position
<a href="#">CommandTimeout</a>	Specifies the number of seconds the command is allowed to execute before terminating the execution with an exception
<a href="#">GetDecimalRetainTrailingZeros</a>	Specifies whether to retain trailing zeros from an Oracle NUMBER in a .NET Decimal
<a href="#">UseClientInitiatedCQN</a>	Specifies whether to use Client Initiated Continuous Query Notification (CICQN) or traditional Continuous Query Notification (CQN) that does not rely on a persistent connection

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## AddOracleTypesDeserialization

This static method adds ODP.NET-specific data types to the "allow" list to permit deserialization into DataSet or DataTable.

### Declaration

```
// C#
public static void AddOracleTypesDeserialization();
```

## Remarks

In newer .NET versions, the allowed `DataSet` and `DataTable` data types that can be deserialized are now restricted for security reasons. This change applies to .NET 5, plus .NET Core and .NET Framework updates. If application `DataSets` and `DataTables` use Oracle data types with one of these new .NET versions, use the `AddOracleTypesDeserialization` method to add ODP.NET-specific data types to the “allow” list so that they can be deserialized. If an attempt is made to deserialize ODP.NET-specific types without adding them to the “allow” list, an ODP.NET type initializer exception will be encountered.

If other software that is part of the application adds data types to the allow list as well, be careful not to overwrite the ODP.NET allowed types. Be sure to only append to the allow list, not overwrite it. If overwriting does occur, call `AddOracleTypesDeserialization` method afterwards to add the ODP.NET types back to the list.

The ODP.NET `AddOracleTypesDeserialization` method call itself appends to the allow list. It does not overwrite existing entries.

This property is available in ODP.NET 19.10 and higher. It has also been backported to the latest ODP.NET 18c, 12.2, and 12.1 patches.

## Example

```
// C#
// Sample demonstrating loading an XML file with Oracle data types into DataSet

using System.Data;
using Oracle.ManagedDataAccess.Client;

class OracleTypeDeserializationSample
{
    static void Main()
    {
        OracleConfiguration.AddOracleTypesDeserialization();
        DataSet ds = new DataSet();
        ds.ReadXml("dschl.xml");
    }
}
```

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## BindByName

This property specifies whether the binding method used for the parameter collection is by name or by position. Default value (`false`) is bind by position.

**Declaration**

```
// C#  
public static bool BindByName { get; set; }
```

**Property Type**

System.Boolean

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## CommandTimeout

This property specifies the number of seconds the command is allowed to execute before terminating the execution with an exception. Default value is 0 seconds, which results in no time limit.

**Declaration**

```
// C#  
public static int CommandTimeout { get; set; }
```

**Property Type**

System.Int32.

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## GetDecimalRetainTrailingZeros

This property specifies whether to retain trailing zeros from an Oracle NUMBER in a .NET Decimal.

**Declaration**

```
// C#  
public static bool GetDecimalRetainTrailingZeros { get; set; }
```

## Property Type

System.Boolean

## Remarks

Starting with ODP.NET 19.11, Oracle `NUMBER` column values retrieved as `.NET Decimals` retain a trailing zero if the number of digits on the right hand side of the decimal point is odd in number when this property is set to `true`.

The default value is `false`.

This property can be used whenever retrieving data into a `.NET Decimal`, including the following scenarios:

- `OracleDataReader.GetDecimal()`;
- `OracleDecimal.Value`
- Parameter output value of type `Decimal`
- JSON data with `Decimal` in it
- UDT with `Decimal` attribute



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## UseClientInitiatedCQN

This property specifies whether to use Client Initiated Continuous Query Notification (CICQN) or traditional Continuous Query Notification (CQN) that does not rely on a persistent connection.

## Declaration

```
// C#  
public static bool UseClientInitiatedCQN {get; set;}
```

## Remarks

When set to `true`, ODP.NET creates and uses a separate connection to receive server-initiated database change notifications. This is known as CICQN. This single connection aggregates all notifications for the pool, but the connection does not count toward the Min Pool Size nor the Max Pool Size limits. For managed ODP.NET, if there are five connection pools using CICQN, then ODP.NET will then have five additional connections, one per pool.

If `false` (default), then ODP.NET will use traditional CQN to receive the database change notifications. The client creates a listening end point (i.e. IP address and port) that does not rely on a database connection to continuously exist.

CICQN is commonly used in cloud scenarios or if firewalls between the database and client do not allow access to the client port. Otherwise, traditional CQN is used.

ODP.NET CICQN requires Oracle Database 21c or higher.

`UseClientInitiatedCQN` must be set to its intended value prior to opening a database connection.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## OracleConfiguration Directories Properties

`OracleConfiguration` Directories properties are listed in [Table 7-37](#).

**Table 7-37 OracleConfiguration Directories Properties**

Property	Description
<a href="#">DefaultAdminContext</a>	Specifies the default directory entry that contains a LDAP Oracle Context from which connect identifiers can be created, modified, or looked up
<a href="#">DirectoryServers</a>	Lists the host names and port numbers of the primary and alternate LDAP directory servers
<a href="#">DirectoryServerType</a>	Specifies the directory server type used, such as Oracle Internet Directory or Microsoft Active Directory
<a href="#">LdapAdmin</a>	Specifies the <code>ldap.ora</code> directory location
<a href="#">NamesLdapAuthenticateBind</a>	Specifies whether the LDAP naming adapter should attempt to authenticate using a specified wallet when it connects to the LDAP directory to resolve the name in the connect string
<a href="#">NamesLdapAuthenticateBindMethod</a>	Specifies the authentication method the client LDAP naming adapter should use while connecting to the LDAP directory to resolve connect string names
<a href="#">NamesLdapConnTimeout</a>	specifies the non-blocking connection timeout to the LDAP server

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## DefaultAdminContext

This property specifies the default directory entry that contains a LDAP Oracle Context from which connect identifiers can be created, modified, or looked up.

### Declaration

```
// C#  
public static string DefaultAdminContext { get; set; }
```

### Property Type

System.String

### Values

Valid distinguished name

### Example

```
// C#  
OracleConfiguration.DefaultAdminContext=@"o=OracleSoftware,c=US";
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## DirectoryServers

This property lists the host names and port numbers of the primary and alternate LDAP directory servers.

### Declaration

```
// C#  
public static string DirectoryServers { get; set; }
```

### Property Type

System.String

Use the following format to list the host names and port numbers:

```
<HOST>:<PORT>[:<TLS/SSL PORT>]
```

### Example

```
// C#  
OracleConfiguration.DirectoryServers="(ldap-server1:389, ldap-server2:400:636)";
```

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## DirectoryServerType

This property specifies the directory server type used, such as Oracle Internet Directory or Microsoft Active Directory.

### Declaration

```
// C#  
public static string DirectoryServerType { get; set; }
```

### Property Type

System.String

### Values

- *oid* for Oracle Internet Directory
- *ad* for Microsoft Active Directory

### Example

```
// C#  
OracleConfiguration.DirectoryServerType=@"oid";
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## LdapAdmin

This property specifies the `ldap.ora` directory location.

### Declaration

```
// C#  
public static string LdapAdmin { get; set; }
```

### Property Type

`System.String`

The `LdapAdmin` setting works in conjunction with the `TnsAdmin` setting to determine the `ldap.ora` search order.

### Example

```
// C#  
OracleConfiguration.LdapAdmin=@"D:\user\ldap\";
```

### Remarks

ODP.NET will search for `ldap.ora` using the location search order as listed in [Oracle Configuration Files](#) for ODP.NET Core and in [Oracle Client Configuration File Settings](#) for managed ODP.NET.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## NamesLdapAuthenticateBind

This property specifies whether the LDAP naming adapter should attempt to authenticate using a specified wallet when it connects to the LDAP directory to resolve the name in the connect string.

### Declaration

```
// C#  
public static bool NamesLdapAuthenticateBind { get; set; }
```

### Property Type

System.Boolean

If the parameter is set to `true`, then the LDAP connection is authenticated using a wallet whose location must be specified in the `OracleConfiguration.WalletLocation` property.

If the parameter is set to `false`, then the LDAP connection is established using an anonymous bind.

Default value is `false`.

### Example

```
// C#  
OracleConfiguration.NamesLdapAuthenticateBind = true;
```

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## NamesLdapAuthenticateBindMethod

This property specifies the authentication method the client LDAP naming adapter should use while connecting to the LDAP directory to resolve connect string names.

### Declaration

```
// C#  
public static string NamesLdapAuthenticateBindMethod { get; set; }
```

### Property Type

System.String

### Remarks

The simple authentication method over LDAPS (LDAP over TLS connection) is supported.

Store the directory entry distinguished name and password in an Oracle wallet. When the client connects to the LDAP server, it is authenticated using the credentials stored in this wallet. The wallet must contain client certificates. Its trust store must contain the certificates issued by the certificate authority of the LDAP server.

The parameter value is a string (`ldaps_simple_auth`).

The LDAP naming adapter uses the `oracle.ldap.client.dn` and `oracle.ldap.client.password` entries from the wallet for authenticating to the LDAP server. If these entries are not present, then the client attempts an anonymous authentication using TLS or LDAPS.

### Default

none

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## NamesLdapConnTimeout

This property specifies the non-blocking connection timeout to the LDAP server.

### Declaration

```
// C#  
public static Int32 NamesLdapConnTimeout { get; set; }
```

### Property Type

System.Int32

This property sets the time to wait (in seconds) for a LDAP server connection before a time out error can occur.

The minimum value is -1, which indicates no connection timeout. The default value is 15 seconds.

### Example

```
// C#  
OracleConfiguration.NamesLdapConnTimeout = -1;
```

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## OracleConfiguration High Availability Properties

OracleConfiguration High Availability properties are listed in [Table 7-38](#).

**Table 7-38 OracleConfiguration High Availability Properties**

Property	Description
<a href="#">ChunkMigrationConnectionTimeout</a>	This setting pauses the connection request until the migration completes or fails to migrate in the specified time, then connect to the correct shard with the data requested. <i>Not Available in ODP.NET, Unmanaged Driver</i>
<a href="#">DbNotificationAddress</a>	Specifies the address that the provider listens to for all notifications sent by the database for continuous query notification feature
<a href="#">DbNotificationPort</a>	Specifies the port number that the provider listens to for all notifications sent by the database for continuous query notification, Fast Connection Failover, and/or Runtime Connection Load Balancing features
<a href="#">HAEvents</a>	Enables the application to receive Fast Connection Failover events for maintaining application high availability
<a href="#">OnsConfigFile</a>	Specifies the configuration file to define Oracle Notification Service (ONS) behavior
<a href="#">OnsMode</a>	Specifies the ONS daemon mode as either <code>local</code> or <code>remote</code>
<a href="#">OnsProtocol</a>	Defines whether the ONS connection uses TCP/IP or TCP/IP with SSL/TLS
<a href="#">OnsWalletLocation</a>	Specifies the directory location of the ONS wallets
<a href="#">OracleOnsServers</a>	Returns a collection of logical ONS servers added through OracleConfiguration
<a href="#">ServiceRelocationConnectionTimeout</a>	Specifies the time to wait before retrying connecting to a service that becomes unavailable.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## ChunkMigrationConnectionTimeout

In sharding, a connection request to a specific shard can occur while data is migrating from the original shard to a new one. This setting will pause the connection request until the migration completes or fails to migrate in the specified time, then connect to the correct shard with the data requested.

### Declaration

```
// C#  
public static int ChunkMigrationConnectionTimeout {get;set;}
```

### Property Value

The minimum time, in seconds, for a pooled connection request to pause waiting for a chunk migration.

### Remarks

Default is 120 seconds. This setting requires connection pooling to be enabled.

ODP.NET reads the chunk migration connection timeout setting only upon pool creation. A new timeout setting will not be used until a new pool is created.

If the connection requires only read-only access, then this setting will not be used. This setting is in effect for connections with chunk write access.

During chunk migration, an ODP.NET connection request obeys only the chunk migration connection timeout. All other connection timeout values, such as `OracleConnection.ConnectionTimeout` are ignored and not used.

Oracle recommends setting the ODP.NET chunk migration connection timeout value to a value greater than the chunk movement server timeout. One way to set this server timeout is using the Global Data Services Control Utility (GDSCTL) `move chunk` command's timeout option.

The `OracleConnection.ChunkMigrationConnectionTimeout` property inherits from the `OracleConfiguration.ChunkMigrationConnectionTimeout` property. The `OracleConnection` property can be separately set to override the property set in the `OracleConfiguration` class.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## DbNotificationAddress

This property specifies the address that the provider listens to for all notifications sent by the database for continuous query notification feature.

### Declaration

```
// C#  
public static string DbNotificationAddress { get; set; }
```

**Property Type**

System.String

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## DbNotificationPort

This property specifies the port number that the provider listens to for all notifications sent by the database for continuous query notification, Fast Connection Failover, and/or Runtime Connection Load Balancing features. A value of -1 allows directs the provider to use a random port.

**Declaration**

```
// C#  
public static int DbNotificationPort { get; set; }
```

**Property Type**

System.Int32.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## HAEvents

This property enables the application to receive Fast Connection Failover events for maintaining application high availability. Default is `true`.

**Declaration**

```
// C#  
public static bool HAEvents { get; set; }
```

**Property Type**

System.Boolean

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## OnsConfigFile

This property specifies the configuration file to define Oracle Notification Service (ONS) behavior. The file specified should contain the same local port and remote port values as specified in the ons.config file used by the local ONS daemon. This will enable the application to receive events from the local ONS daemon.

### Declaration

```
// C#  
public static string OnsConfigFile { get; set; }
```

### Property Type

System.String

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## OnsMode

This property specifies the ONS daemon mode as either "local" or "remote".

For local configuration, configure and make available ONS on the node where ODP.NET is running so that ODP.NET can receive events directly from the local ONS daemon.

Remote configuration is used when the application directly receives ONS events from the ONS daemons running on remote machines. One of the advantages of this configuration is that no ONS daemon is needed on the client end and; therefore, there is no need to manage this process.

### Declaration

```
// C#  
public static OnsConfigMode OnsMode { get; set; }
```

**Property Type**

System.String

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## OnsProtocol

This property defines whether the ONS connection uses TCP/IP or TCP/IP with SSL/TLS.

**Declaration**

```
// C#  
public static string OnsProtocol { get; set; }
```

**Property Type**

System.String

**Usage Notes**

Valid values are TCP or TCPS. Default value is TCP.

**Example**

```
OracleConfiguration.OnsProtocol=TCPS
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## OnsWalletLocation

This property specifies the directory location of the ONS wallets. Wallets are certificates, keys, and trustpoints processed by SSL/TLS.

**Declaration**

```
// C#  
public static string OnsWalletLocation { get; set; }
```

**Property Type**

System.String

**Usage Notes**

Default value is none.

**Example**

```
OracleConfiguration.OnsWalletLocation=@"D:\user\wallets\"
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## OracleOnsServers

This property returns a collection of logical ONS servers added through OracleConfiguration.

**Declaration**

```
// C#  
public static OracleOnsServerCollection OracleOnsServers
```

**Property**

Type:Oracle.ManagedDataAccess.Client.OracleOnsServerCollection

Returns a static OracleOnsServerCollection object.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)
- [OracleDataSourceCollection Class](#)

## ServiceRelocationConnectionTimeout

This property specifies the time to wait before retrying connecting to a service that becomes unavailable. Default value is 90 seconds. Whenever a database service

becomes unavailable, such as due to a service being relocated, an application can encounter numerous connectivity errors during this time. To avoid unnecessary connection attempts to an unavailable service which will result in an error, the driver will block any connection attempts until the service is up or until this property's specified time limit expires from the time when the service DOWN event was received, whichever comes first.

### Declaration

```
// C#
public static string ServiceRelocationConnectionTimeout { get; set; }
```

### Property Type

System.String



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## OracleConfiguration Performance Properties

OracleConfiguration Performance properties are listed in [Table 7-39](#).

**Table 7-39 OracleConfiguration Performance Properties**

Property	Description
<a href="#">FetchSize</a>	Specifies the total memory size, in bytes, that the provider allocates to cache data fetched in one database round-trip
<a href="#">LoadBalancing</a>	Enables the application to receive runtime connection load balancing information
<a href="#">MaxStatementCacheSize</a>	Specifies the maximum number of statements that can be cached when self-tuning is enabled
<a href="#">PerformanceCounters</a>	Specifies the ODP.NET connection performance counters to publish so that they can be monitored
<a href="#">ReceiveBufferSize</a>	Specifies the buffer space limit for receive operations of sessions
<a href="#">SelfTuning</a>	Specifies whether self-tuning is enabled for an ODP.NET application
<a href="#">SendBufferSize</a>	Specifies the buffer space limit for send operations of sessions
<a href="#">StatementCacheSize</a>	Specifies the number of cursors or statements to be cached for each database connection
<a href="#">TcpNoDelay</a>	Preempts delays in buffer flushing within the TCP/IP protocol stack

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## FetchSize

This property specifies the total memory size, in bytes, that the provider allocates to cache data fetched in one database round-trip. Default value is 131072.

### Declaration

```
// C#  
public static int FetchSize { get; set; }
```

### Property Type

System.Int32

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## LoadBalancing

This property enables the application to receive runtime connection load balancing information. Default is `true`.

### Declaration

```
// C#  
public static bool LoadBalancing { get; set; }
```

### Property Type

System.Boolean

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## MaxStatementCacheSize

This property specifies the maximum number of statements that can be cached when self-tuning is enabled. Default value is 100.

### Declaration

```
// C#  
public static int MaxStatementCacheSize { get; set; }
```

### Property Type

System.Int32

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## PerformanceCounters

This property specifies the ODP.NET connection performance counters to publish so that they can be monitored.

### Declaration

```
// C#  
public static Int64 PerformanceCounters { get; set; }
```

### Property Type

System.Int64

### Remarks

ODP.NET enables monitoring many different connection counters, including pooled and non-pooled connections. These counters can be monitored individually or together. Developers can set which counters to monitor prior to application startup using the `PerformanceCounters` property.

By default, performance counters are not enabled.



#### See Also:

- [Connection Performance Counters](#) for more information on setting up and configuring counters.
- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## ReceiveBufferSize

This property specifies the buffer space limit for receive operations of sessions.

#### Declaration

```
// C#  
public static int ReceiveBufferSize { get; set; }
```

#### Property Type

System.Int32



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## SelfTuning

This property specifies whether self-tuning is enabled for an ODP.NET application. By default, self-tuning (`true`) is enabled.

#### Declaration

```
// C#  
public static bool SelfTuning { get; set; }
```

#### Property Type

System.Boolean

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## SendBufferSize

This property specifies the buffer space limit for send operations of sessions.

### Declaration

```
// C#  
public static int SendBufferSize { get; set; }
```

### Property Type

System.Int32

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## StatementCacheSize

This property specifies the number of cursors or statements to be cached for each database connection. This setting corresponds to the connection string Statement Cache Size attribute. A value greater than zero enables statement caching. Default value is zero.

### Declaration

```
// C#  
public static int StatementCacheSize { get; set; }
```

### Property Type

System.Int32

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## TcpNoDelay

This property preempts delays in buffer flushing within the TCP/IP protocol stack. Default value is `true`.

### Declaration

```
// C#
public static bool TcpNoDelay { get; set; }
```

### Property Type

System.Boolean

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## OracleConfiguration Debug Tracing Properties

OracleConfiguration Debug Tracing properties are listed in [Table 7-40](#).

**Table 7-40 OracleConfiguration Debug Tracing Properties**

Property	Description
<a href="#">TraceFileLocation</a>	Specifies the destination directory to output provider traces
<a href="#">TraceFileMaxSize</a>	Specifies the maximum file size of each trace file
<a href="#">TraceLevel</a>	Specifies the generated trace level to trace ODP.NET calls and diagnose provider issues
<a href="#">TraceOption</a>	Specifies whether to generate a single trace file or multiple trace files for multithreaded applications

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## TraceFileLocation

This property specifies the destination directory to output provider traces.

### Declaration

```
// C#  
public static string TraceFileLocation { get; set; }
```

### Property Type

System.String

### Remarks

On Windows, the default TraceFileLocation is *<Windows user temporary folder>\ODP.NET\core\trace*. On Linux, the default is *<current user temporary folder>/ODP.NET/core/trace*. If you modify the trace file location, then do not use a write-protected directory, such as C:\ on Windows. Write-protection may prevent ODP.NET from being able to write a trace file to that particular directory location.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## TraceFileMaxSize

This property specifies the maximum file size of each trace file.

### Declaration

```
// C#  
public static int TraceFileMaxSize { get; set; }
```

### Property Type

System.Int32

## Remarks

Administrators can maintain reasonably sized trace files by using this property to enforce a maximum size that any individual ODP.NET trace file can be. The `TraceFileMaxSize` value is in megabytes. If no value is set, `TraceFileMaxSize` defaults to a value of 100, which is 100 megabytes (MB).

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## TraceLevel

This property specifies the generated trace level to trace ODP.NET calls and diagnose provider issues. Errors will always be traced. Default value is 0 indicating tracing is disabled.

### Declaration

```
// C#  
public static int TraceLevel { get; set; }
```

### Property Type

`System.Int32`

### Valid Values:

- 1 = public APIs
- 2 = private APIs
- 4 = network APIs/data
- 8 = disables writing SQL statements and network packet contents

These values can be bitwise ORed. To enable all traces, set `TraceLevel` to 7. Use `TraceLevel` 8 if you require SQL statements and network packet contents to be excluded from the trace.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## TraceOption

This property specifies whether to generate a single trace file or multiple trace files for multithreaded applications. Default value is 0 indicating single trace file for all application threads.

### Declaration

```
// C#
public static int TraceOption { get; set; }
```

### Property Type

System.Int32

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConfiguration Class](#)
- [OracleConfiguration Members](#)

## OracleConnection Class

An `OracleConnection` object represents a connection to an Oracle database.

### Class Inheritance

```
System.Object
    System.MarshalByRefObject
        System.ComponentModel.Component
            System.Data.Common.DbConnection
                Oracle.DataAccess.Client.OracleConnection
```

### Declaration

```
// C#
public sealed class OracleConnection : DbConnection, IDbConnection, ICloneable
```

### Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

### Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

### Example

```
// C#

using System;
using System.Data;
using Oracle.DataAccess.Client;

class OracleConnectionSample
{
    static void Main()
    {
        // Connect
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();

        // Execute a SQL SELECT
        OracleCommand cmd = con.CreateCommand();
        cmd.CommandText = "select * from emp";
        OracleDataReader reader = cmd.ExecuteReader();

        // Print all employee numbers
        while (reader.Read())
            Console.WriteLine(reader.GetInt32(0));

        // Clean up
        reader.Dispose();
        cmd.Dispose();
        con.Dispose();
    }
}
```

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Members](#)
- [OracleConnection Constructors](#)
- [OracleConnection Static Properties](#)
- [OracleConnection Static Methods](#)
- [OracleConnection Properties](#)
- [OracleConnection Public Methods](#)
- [OracleConnection Events](#)

## OracleConnection Members

`OracleConnection` members are listed in the following tables.

### OracleConnection Constructors

`OracleConnection` constructors are listed in [Table 7-41](#).

**Table 7-41 OracleConnection Constructors**

Constructor	Description
<a href="#">OracleConnection Constructors</a>	Instantiates a new instance of the <code>OracleConnection</code> class (Overloaded)

### OracleConnection Static Properties

The `OracleConnection` static property is listed in [Table 7-43](#).

**Table 7-42 OracleConnection Static Property**

Property	Description
<a href="#">IsAvailable</a>	Indicates whether or not the implicit database connection is available for use

### OracleConnection Static Methods

The `OracleConnection` static methods are listed in [Table 7-43](#).

**Table 7-43 OracleConnection Static Methods**

Method	Description
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)

Table 7-43 (Cont.) OracleConnection Static Methods

Method	Description
<a href="#">ClearPool</a>	Clears the connection pool that is associated with the provided <code>OracleConnection</code> object <i>Not supported in a .NET stored procedure</i>
<a href="#">ClearAllPools</a>	Clears all connections from all the connection pools <i>Not supported in a .NET stored procedure</i>

### OracleConnection Properties

`OracleConnection` properties are listed in [Table 7-44](#).

Table 7-44 OracleConnection Properties

Property	Description
<a href="#">AccessToken</a>	Used to get or set <code>OracleAccessToken</code> on the connection
<a href="#">ActionName</a>	Specifies the action name for the connection
<a href="#">AllowCertificateSelectionUI</a>	Indicates whether to allow the user to select a specific TLS/SSL certificate via a graphical interface for their database connection when using a MCS wallet location <i>Not Available in ODP.NET, Unmanaged Driver</i>
<a href="#">ChunkMigrationConnectionTimeout</a>	This setting pauses the connection request until the migration completes or fails to migrate in the specified time, then connect to the correct shard with the data requested. <i>Not Available in ODP.NET, Unmanaged Driver</i>
<a href="#">ClientId</a>	Specifies the client identifier for the connection
<a href="#">ClientInfo</a>	Specifies the client information for the connection
<a href="#">ConnectionString</a>	Specifies connection information used to connect to an Oracle database
<a href="#">ConnectionTimeout</a>	Indicates the maximum amount of time that the <code>Open</code> method can take to obtain a pooled connection before the request is terminated
<a href="#">ConnectionType</a>	Determines whether a particular connection object is associated with a TimesTen database connection, an Oracle database connection, or no physical connection <i>Not Available in ODP.NET, Managed Driver and ODP.NET Core</i>
<code>Container</code>	Inherited from <code>System.ComponentModel.Component</code>
<a href="#">Credential</a>	Used to get or set an <code>OracleCredential</code> object on the connection
<a href="#">Database</a>	<i>Not Supported</i>

Table 7-44 (Cont.) OracleConnection Properties

Property	Description
<a href="#">DatabaseDomainName</a>	Specifies the name of the database domain to which the connection is set
<a href="#">DatabaseEditionName</a>	Sets or gets the edition name for the <code>OracleConnection</code> object
<a href="#">DatabaseName</a>	Specifies the name of the database to which the connection is set
<a href="#">DataSource</a>	Specifies the Oracle Net Services Name, Connect Descriptor, or an easy connect naming that identifies the database to which to connect
<a href="#">DRCPConnectionClass</a>	Specifies a logical name that identifies the DRCP connection pool that the ODP.NET connection will use
<a href="#">DRCPPurity</a>	Specifies whether an application can reuse a pooled session ( <code>Pooled</code> ) or must use a new session ( <code>New</code> )
<a href="#">HostName</a>	Specifies the name of the host to which the connection is set
<a href="#">InstanceName</a>	Specifies the name of the instance to which the connection is set
<a href="#">KeepAlive</a>	Specifies whether to keep an idle connection alive. <i>Not Available in ODP.NET, Unmanaged Driver</i>
<a href="#">KeepAliveInterval</a>	Specifies the time interval after an unacknowledged probe before a new probe is sent. <i>Not Available in ODP.NET, Unmanaged Driver</i>
<a href="#">KeepAliveTime</a>	Specifies the idle time before a keepalive probe is sent. <i>Not Available in ODP.NET, Unmanaged Driver</i>
<a href="#">ModuleName</a>	Specifies the module name for the connection
<a href="#">OciCompartment</a>	Gets or sets the Oracle Cloud Identifier (OCID) of the target database's compartment
<a href="#">OciDatabase</a>	Gets or sets the target database's Oracle Cloud Identifier (OCID)
<a href="#">OciIamUrl</a>	Gets or sets the URL end point for getting the database token
<a href="#">OciTenancy</a>	Gets or sets the Oracle Cloud Identifier (OCID) of the IAM user's cloud tenancy to retrieve the database token
<a href="#">PasswordAuthentication</a>	Sets the connection <code>PASSWORD_AUTH</code> parameter value
<a href="#">PDBName</a>	Used to set and get the name of the pluggable database to which the session is connected to
<a href="#">ProviderVersion</a>	Specifies the ODP.NET assembly version

Table 7-44 (Cont.) OracleConnection Properties

Property	Description
<a href="#">ServerVersion</a>	Specifies the version number of the Oracle database to which the <code>OracleConnection</code> has established a connection
<a href="#">ServiceName</a>	Specifies the name of the service to which the connection is set
Site	Inherited from <code>System.ComponentModel.Component</code>
<a href="#">SqlNetAuthenticationServices</a>	Enables one or more authentication services, such as TCP/IP with SSL.
<a href="#">State</a>	Specifies the current state of the connection
<a href="#">StatementCacheSize</a>	Specifies the current size of the statement cache associated with this connection
<a href="#">SwitchedConnection</a>	If the returned pooled connection changed its service name ( <code>ServiceName</code> ) or pluggable database ( <code>PDBName</code> ) in order to connect to the desired pluggable database, then this property will consider the connection switched
<a href="#">TnsAdmin</a>	Specifies the directory location of <code>tnsnames.ora</code> or <code>sqlnet.ora</code> , or both <i>Not Available in ODP.NET, Unmanaged Driver</i>
<a href="#">TokenAuthentication</a>	Sets the value for <code>TOKEN_AUTH</code> parameter for the connection
<a href="#">TokenLocation</a>	Gets or sets the token location path for the connection where the signature token and private key files are located
<a href="#">UseHourOffsetForUnsupportedTimezone</a>	Specifies whether the hour offset can be used for the session time zone, when the Oracle time zone region name that is associated with the .NET locale is not supported by the Oracle database being used <i>Not Available in ODP.NET, Unmanaged Driver</i>
<a href="#">WalletLocation</a>	Specifies the location of wallets. Wallets are certificates, keys, and trustpoints processed by SSL/TLS <i>Not Available in ODP.NET, Unmanaged Driver</i>

**OracleConnection Public Methods**

`OracleConnection` public methods are listed in [Table 7-45](#).

Table 7-45 OracleConnection Public Methods

Public Method	Description
<a href="#">BeginTransaction</a>	Begins a local transaction (Overloaded) <i>Not supported in a .NET stored procedure for context connection</i>

Table 7-45 (Cont.) OracleConnection Public Methods

Public Method	Description
<a href="#">ChangeDatabase</a>	<i>Not Supported</i>
<a href="#">Clone</a>	Creates a copy of an <code>OracleConnection</code> object <i>Not supported in a .NET stored procedure</i>
<a href="#">Close</a>	Closes the database connection
<a href="#">CreateCommand</a>	Creates and returns an <code>OracleCommand</code> object associated with the <code>OracleConnection</code> object
<code>CreateObjRef</code>	Inherited from <code>System.MarshalByRefObject</code>
<code>Dispose</code>	Inherited from <code>System.ComponentModel.Component</code>
<a href="#">EnlistDistributedTransaction</a>	Enables applications to explicitly enlist in a specified distributed transaction <i>Not supported in a .NET stored procedure and .NET Core</i>
<a href="#">EnlistTransaction</a>	Enables applications to enlist in a specified distributed transaction <i>Not supported in a .NET stored procedure</i>
<code>Equals</code>	Inherited from <code>System.Object (Overloaded)</code>
<a href="#">FlushCache</a>	Flushes all updates and deletes made through <code>REF</code> objects retrieved using this connection <i>Not Available in ODP.NET, Managed Driver and ODP.NET Core</i>
<code>GetHashCode</code>	Inherited from <code>System.Object</code>
<code>GetLifetimeService</code>	Inherited from <code>System.MarshalByRefObject</code>
<a href="#">GetSchema</a>	Returns schema information for the data source of the <code>OracleConnection</code>
<a href="#">GetSessionInfo</a>	Returns or refreshes the property values of the <code>OracleGlobalization</code> object that represents the globalization settings of the session (Overloaded)
<code>GetType</code>	Inherited from <code>System.Object</code>
<code>InitializeLifetimeService</code>	Inherited from <code>System.MarshalByRefObject</code>
<a href="#">Open</a>	Opens a database connection with the property settings specified by the <code>ConnectionString</code>
<a href="#">OpenWithNewPassword</a>	Opens a new connection with the new password (Overloaded) <i>Not supported in a .NET stored procedure for context connection</i>
<a href="#">OpenWithNewToken(char[])</a>	This method can be used to open a new connection by providing the refreshed/updated access token directly to ODP.NET instead of through the token refresh call back.
<a href="#">OpenWithNewToken(char[], char[])</a>	Used by the application to open a new connection by providing the refreshed/updated signature token and private key directly to ODP.NET instead of through the token refresh call back

**Table 7-45 (Cont.) OracleConnection Public Methods**

Public Method	Description
<a href="#">PurgeStatementCache</a>	Flushes the Statement Cache by closing all open cursors on the database, when statement caching is enabled
<a href="#">SetSessionInfo</a>	Alters the session's globalization settings with the property values provided by the <code>OracleGlobalization</code> object
<a href="#">SetShardingKey(OracleShardingKey, OracleShardingKey)</a>	Enables applications to set the sharding key and super sharding key before requesting a connection
<code>ToString</code>	Inherited from <code>System.Object</code>

**OracleConnection Events**

`OracleConnection` events are listed in [Table 7-46](#).

**Table 7-46 OracleConnection Events**

Event Name	Description
<a href="#">ConnectionOpen</a>	This event is triggered upon the <code>OracleConnection.Open()</code> method
<code>Disposed</code>	Inherited from <code>System.ComponentModel.Component</code>
<a href="#">Failover</a>	An event that is triggered when an Oracle failover occurs <i>Not supported in a .NET stored procedure</i> <i>Not Available in ODP.NET, Managed Driver and ODP.NET Core</i>
<a href="#">HAEvent</a>	An event that is triggered when an HA event occurs
<a href="#">InfoMessage</a>	An event that is triggered for any message or warning sent by the database
<a href="#">StateChange</a>	An event that is triggered when the connection state changes

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)

## OracleConnection Constructors

`OracleConnection` constructors instantiate new instances of the `OracleConnection` class.

**Overload List:**

- [OracleConnection\(\)](#)

This constructor instantiates a new instance of the `OracleConnection` class using default property values.

- [OracleConnection\(string\)](#)

This constructor instantiates a new instance of the `OracleConnection` class with the provided connection string.

- [OracleConnection\(string, OracleCredential\)](#)

This constructor instantiates a new `OracleConnection` class instance using the provided connection string and `OracleCredential` class.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## OracleConnection()

This constructor instantiates a new instance of the `OracleConnection` class using default property values.

**Declaration**

```
// C#  
public OracleConnection();
```

**Remarks**

The properties for `OracleConnection` are set to the following default values:

- `ConnectionString` = empty string
- `ConnectionTimeout` = 15 (default value of 0 is used for the implicit database connection)
- `DataSource` = empty string
- `ServerVersion` = empty string

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## OracleConnection(string)

This constructor instantiates a new instance of the `OracleConnection` class with the provided connection string.

### Declaration

```
// C#  
public OracleConnection(string connectionString);
```

### Parameters

- *connectionString*  
The connection information used to connect to the Oracle database.

### Remarks

The `ConnectionString` property is set to the supplied *connectionString*. The `ConnectionString` property is parsed and an exception is thrown if it contains invalid connection string attributes or attribute values.

The properties of the `OracleConnection` object default to the following values unless they are set by the connection string:

- `ConnectionString` = empty string
- `ConnectionTimeout` = 15 (default value of 0 is used for the implicit database connection)
- `DataSource` = empty string
- `ServerVersion` = empty string

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## OracleConnection(string, OracleCredential)

This constructor instantiates a new `OracleConnection` class instance using the provided connection string and `OracleCredential` class.

### Declaration

```
// C#  
public OracleConnection(string connectionString, OracleCredential orclCredential);
```

### Parameters

- *connectionString*  
connection string that does not contain any of user id, password, DBA Privilege, proxy user id, nor proxy password.
- *orclCredential*  
`OracleCredential` object containing user credentials. If this parameter is passed as null then the behavior of `OracleConnection` will be same as `OracleConnection` with normal connection string.

### Remarks

Use this constructor to create a new `OracleConnection` object with an `OracleCredential` object containing user credentials and a connection string that does not contain any of user id, password, DBA Privilege, proxy user id, nor proxy password.

### Exceptions

`InvalidOperationException` is raised when non-null `OracleCredential` object is used with a connection string containing any of user id, password, DBA Privilege, proxy user id, or proxy password.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## OracleConnection Static Properties

The `OracleConnection` static property is listed in [Table 7-47](#).

**Table 7-47 OracleConnection Static Property**

Property	Description
<a href="#">IsAvailable</a>	Indicates whether or not the implicit database connection is available for use

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## IsAvailable

This property indicates whether or the implicit database connection is available for use.

### Declaration

```
// C#  
public static bool IsAvailable {get;}
```

### Property Value

Returns `true` if the implicit database connection is available for use.

### Remarks

The availability of the implicit database connection can be checked at runtime through this static property. When Oracle Data Provider for .NET is used within a .NET stored procedure, this property always returns `true`. Otherwise, `false` is returned.

To obtain an `OracleConnection` object in a .NET stored procedure that represents the implicit database connection, set the `ConnectionString` property of the `OracleConnection` object to `"context connection=true"` and invoke the `Open` method.

Note that not all features that are available for an explicit user connection are available for an implicit database connection. See ["Implicit Database Connection"](#) for details.

### Example

```
// C# (Library/DLL)  
using System;  
using Oracle.DataAccess.Client;  
  
public class IsAvailableSample  
{  
    static void MyStoredProcedure()  
    {  
        OracleConnection con = new OracleConnection();
```

```

if (OracleConnection.IsAvailable)
{
    // This function is invoked as a stored procedure
    // Obtain the implicit database connection by setting
    // "context connection=true" in the connection string
    con.ConnectionString = "context connection=true";
}
else
{
    // This function is not invoked as a stored procedure
    // Set the connection string for a normal client connection
    con.ConnectionString = "user id=scott;password=tiger;data source=oracle";
}

con.Open();
Console.WriteLine("connected!");
}
}

```

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## OracleConnection Static Methods

The `OracleConnection` static methods are listed in [Table 7-48](#).

**Table 7-48 OracleConnection Static Methods**

Method	Description
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)
<a href="#">ClearPool</a>	Clears the connection pool that is associated with the provided <code>OracleConnection</code> object. <i>Not supported in a .NET stored procedure</i>
<a href="#">ClearAllPools</a>	Clears all connections from all the connection pools <i>Not supported in a .NET stored procedure</i>

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## ClearPool

This method clears the connection pool that is associated with the provided `OracleConnection` object.

### Declaration

```
// C#  
public static void ClearPool(OracleConnection connection);
```

### Remarks

When this method is invoked, all idle connections are closed and freed from the pool. Currently used connections are not discarded until they are returned to the pool.

`ClearPool` does not automatically repopulate the pool with new connections. This prevents the pool from being repopulated with invalid connections if client remains unable to connect with the database server. Developers programmatically control when the pool is repopulated by calling `OracleConnection.Open()`, which will repopulate the pool with at least the Min Pool Size number of connections.

Connections created after this method invocation are not cleared unless another invocation is made.

Starting with ODP.NET 21c, `ClearPool` will now clear the pool even if ODP.NET is in the process of populating the pool to the Min Pool Size number of connections.

This method can be invoked with an `OracleConnection` object before opening the connection as well as after, provided the `ConnectionString` is properly set.

### Exceptions

`InvalidOperationException` – Either the connection pool cannot be found or the provided connection string is invalid.

### Example

```
// C#  
// Sample demonstrating the use of ClearPool API in OracleConnection class  
  
using System;  
using Oracle.DataAccess.Client;  
  
class ClearPoolSample  
{  
    static void Main()  
    {  
        Console.WriteLine("Running ClearPool sample...");  
        // Set the connection string  
        string strConn = "User Id=scott;Password=tiger;Data Source=oracle;" +  
            "Min pool size=5;";  
        OracleConnection conn = new OracleConnection(strConn);  
  
        // Open the connection  
        conn.Open();  
  
        // Clears the connection pool associated with connection 'conn'  
        OracleConnection.ClearPool(conn);  
    }  
}
```

```
// This connection will be placed back into the pool
conn.Close ();

// Open the connection again to create additional connections in the pool
conn.Open ();

// Create a new connection object
OracleConnection connNew = new OracleConnection(strConn);

// Clears the pool associated with Connection 'connNew'
// Since the same connection string is set for both the connections,
// connNew and conn, they will be part of the same connection pool.
// We need not do an Open() on the connection object before calling
// ClearPool
OracleConnection.ClearPool (connNew);

// cleanup
conn.Close();
Console.WriteLine("Done!");
}
}
```

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## ClearAllPools

This method clears all connections from all the connection pools.

### Declaration

```
// C#
public static void ClearAllPools();
```

### Remarks

This call is analogous to calling `ClearPool` for all the connection pools that are created for the application.

### Exceptions

`InvalidOperationException` – No connection pool could be found for the application.

### Example

```
// C#
// Sample demonstrating the use of ClearAllPools API in OracleConnection class

using System;
using Oracle.DataAccess.Client;
```

```

class ClearAllPoolsSample
{
    static void Main()
    {
        Console.WriteLine("Running ClearAllPools sample...");
        // Set the connection string
        string strConn = "User Id=scott;Password=tiger;Data Source=oracle;" +
            "Min pool size=5;";
        OracleConnection conn = new OracleConnection(strConn);

        // Create another connection object with a different connection string
        string strConnNew = "User Id=scott;Password=tiger;Data Source=oracle;";
        OracleConnection connNew = new OracleConnection(strConnNew);

        // Open the connections. Separate pools are created for conn and connNew
        conn.Open();
        connNew.Open();

        // Clears the pools associated with conn and connNew
        OracleConnection.ClearAllPools ();

        // cleanup
        conn.Close();
        connNew.Close();
        Console.WriteLine("Done!");
    }
}

```

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)
- ["ClearPool"](#)

## OracleConnection Properties

OracleConnection properties are listed in [Table 7-49](#)

**Table 7-49 OracleConnection Properties**

Property	Description
<a href="#">AccessToken</a>	Used to get or set OracleAccessToken on the connection
<a href="#">ActionName</a>	Specifies the action name for the connection

Table 7-49 (Cont.) OracleConnection Properties

Property	Description
<a href="#">AllowCertificateSelectionUI</a>	Indicates whether to allow the user to select a specific TLS/SSL certificate via a graphical interface for their database connection when using a MCS wallet location <i>Not Available in ODP.NET, Unmanaged Driver</i>
<a href="#">ChunkMigrationConnectionTimeout</a>	This setting pauses the connection request until the migration completes or fails to migrate in the specified time, then connect to the correct shard with the data requested. <i>Not Available in ODP.NET, Unmanaged Driver</i>
<a href="#">ClientId</a>	Specifies the client identifier for the connection
<a href="#">ClientInfo</a>	Specifies the client information for the connection
<a href="#">ConnectionString</a>	Specifies connection information used to connect to an Oracle database
<a href="#">ConnectionTimeout</a>	Indicates the maximum amount of time that the <code>Open</code> method can take to obtain a pooled connection before the request is terminated
<a href="#">ConnectionType</a>	Determines whether a particular connection object is associated with a TimesTen database connection, an Oracle database connection, or no physical connection <i>Not Available in ODP.NET, Managed Driver and ODP.NET Core</i>
<code>Container</code>	Inherited from <code>System.ComponentModel.Component</code>
<a href="#">Credential</a>	Used to get or set an <code>OracleCredential</code> object on the connection
<a href="#">Database</a>	<i>Not Supported</i>
<a href="#">DatabaseDomainName</a>	Specifies the name of the database domain to which the connection is set
<a href="#">DatabaseEditionName</a>	Sets or gets the edition name for the <code>OracleConnection</code> object
<a href="#">DatabaseName</a>	Specifies the name of the database to which the connection is set
<a href="#">DataSource</a>	Specifies the Oracle Net Services Name, Connect Descriptor, or an easy connect naming that identifies the database to which to connect
<a href="#">DRCPConnectionClass</a>	Specifies a logical name that identifies the DRCP connection pool that the ODP.NET connection will use
<a href="#">DRCPpurity</a>	Specifies whether an application can reuse a pooled session ( <code>Pooled</code> ) or must use a new session ( <code>New</code> )

**Table 7-49 (Cont.) OracleConnection Properties**

Property	Description
HostName	Specifies the name of the host to which the connection is set
InstanceName	Specifies the name of the instance to which the connection is set
KeepAlive	Specifies whether to keep an idle connection alive. <i>Not Available in ODP.NET, Unmanaged Driver</i>
KeepAliveInterval	Specifies the time interval after an unacknowledged probe before a new probe is sent. <i>Not Available in ODP.NET, Unmanaged Driver</i>
KeepAliveTime	Specifies the idle time before a keepalive probe is sent. <i>Not Available in ODP.NET, Unmanaged Driver</i>
ModuleName	Specifies the module name for the connection
OciCompartment	Gets or sets the Oracle Cloud Identifier (OCID) of the target database's compartment
OciDatabase	Gets or sets the target database's Oracle Cloud Identifier (OCID)
OciUrl	Gets or sets the URL end point for getting the database token
OciTenancy	Gets or sets the Oracle Cloud Identifier (OCID) of the IAM user's cloud tenancy to retrieve the database token
PasswordAuthentication	Sets the connection <code>PASSWORD_AUTH</code> parameter value
PDBName	Used to set and get the name of the pluggable database to which the session is connected to
ProviderVersion	Specifies the ODP.NET assembly version
ServerVersion	Specifies the version number of the Oracle database to which the <code>OracleConnection</code> has established a connection
ServiceName	Specifies the name of the service to which the connection is set
Site	Inherited from <code>System.ComponentModel.Component</code>
SqlNetAuthenticationServices	Enables one or more authentication services, such as TCP/IP with SSL.
State	Specifies the current state of the connection
StatementCacheSize	Specifies the current size of the statement cache associated with this connection

Table 7-49 (Cont.) OracleConnection Properties

Property	Description
<a href="#">SwitchedConnection</a>	If the returned pooled connection changed its service name ( <code>ServiceName</code> ) or pluggable database ( <code>PDBName</code> ) in order to connect to the desired pluggable database, then this property will consider the connection switched.
<a href="#">TnsAdmin</a>	Specifies the directory location of <code>tnsnames.ora</code> or <code>sqlnet.ora</code> , or both <i>Not Available in ODP.NET, Unmanaged Driver</i>
<a href="#">TokenAuthentication</a>	Sets the value for <code>TOKEN_AUTH</code> parameter for the connection
<a href="#">TokenLocation</a>	Gets or sets the token location path for the connection where the signature token and private key files are located
<a href="#">UseHourOffsetForUnsupportedTimezone</a>	Specifies whether the hour offset can be used for the session time zone, when the Oracle time zone region name that is associated with the .NET locale is not supported by the Oracle database being used <i>Not Available in ODP.NET, Unmanaged Driver</i>
<a href="#">WalletLocation</a>	Specifies the location of wallets. Wallets are certificates, keys, and trustpoints processed by SSL/TLS <i>Not Available in ODP.NET, Unmanaged Driver</i>

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## AccessToken

This property is used to get or set `OracleAccessToken` on the connection.

### Declaration

```
// C#
public OracleAccessToken AccessToken { get; set; }
```

### Property Value

An `OracleAccessToken` object containing a database token and private key, or an access token, used for opening a connection.

## Exceptions

- An `InvalidOperationException` will be raised if
  - the connection is already open,
  - the value of the `TokenAuthentication` property is not compatible with the type of token being set. This is applicable for managed ODP.NET and ODP.NET Core only,
  - `TokenAuthentication` has been set by the application as disabled, or the `TokenLocation` property is set. This is applicable for managed ODP.NET and ODP.NET Core only.
  - The `Credential` property is set.
  - Or, the user or proxy information in the connection string is not compatible with token authentication.
- `ArgumentNullException` if any argument is null.
- `OracleException` if `Credential` is set.
- `OracleException` if user id value is other than `/`.
- `OracleException` if password, proxy user id and proxy password is set.

## Description

If the token represents the same identity, then the same `OracleAccessToken` object should be set on the `OracleConnection`. The `OracleAccessToken` object, not the token, is used to identify the connection pool.

If an access token has expired, then `OracleConnection.OpenWithNewToken` must be called to open a new connection. Since the `OracleAccessToken` object cannot be modified, it is not possible to specify a refreshed access token on the `AccessToken` property. However, existing connections can still be dispensed, even after the access token has expired.

In unmanaged ODP.NET, if `CPVersion` is not set to any value, `AccessToken` property is set by the application, and `Open()` method is invoked, then the connection will set the value of `CPVersion` to 2.0. `CPVersion` cannot be set to 1.0 in this scenario. Doing so will result in an exception.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## ActionName

This property specifies the action name for the connection.

### Declaration

```
// C#  
public string ActionName {set;}
```

### Property Value

The string to be used as the action name.

### Remarks

The default value is `null`.

Using the `ActionName` property allows the application to set the action name in the application context for a given `OracleConnection` object.

In unmanaged ODP.NET, the `ActionName` property is reset to `null` when the `Close` or `Dispose` method is called on the `OracleConnection` object. In managed ODP.NET, it is reset to `null` (assuming no new value is assigned) upon the next database round trip following a `Close` or `Dispose` method call on the `OracleConnection` object.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)
- ["Client Identifier and End-to-End Tracing"](#)
- [Oracle Database Security Guide](#)

## AllowCertificateSelectionUI

This property indicates whether to allow the user to select a specific TLS/SSL certificate via a graphical interface for their database connection when using a MCS wallet location.

### Declaration

```
// C#  
public Boolean AllowCertificateSelectionUI { get; set; }
```

### Property Type

`System.Boolean`

### Remarks

The property default value is `false`.

This property generates a pop up window for the end user to select a TLS/SSL certificate only when all of the following conditions are met:

- `AllowCertificateSelectionUI` is set to `true`

- App is running on Windows operating system
- App has specified a Microsoft Certificate Store (MCS) wallet location
- The connection uses mutual TLS
- There is more than one private key containing certificates in the MY/CurrentUser MCS

If `AllowCertificateSelectionUI` is `false` and configuration-based certificate selection is not set (e.g. thumbprint is not set), then ODP.NET will choose the first certificate with a private key in the MCS.

If enabling this property, set its value to `true` prior to opening the ODP.NET connection.

ODP.NET will filter out trusted certificates (public key only) from the end user display to simplify their selection process.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## ChunkMigrationConnectionTimeout

In sharding, a connection request to a specific shard can occur while data is migrating from the original shard to a new one. This setting will pause the connection request until the migration completes or fails to migrate in the specified time, then connect to the correct shard with the data requested.

### Declaration

```
// C#  
public int ChunkMigrationConnectionTimeout {get;set;}
```

### Property Value

The minimum time, in seconds, for a pooled connection request to pause waiting for a chunk migration.

### Remarks

Default is 120 seconds. This setting requires connection pooling to be enabled.

ODP.NET reads the chunk migration connection timeout setting only upon pool creation. Modifying the timeout setting A new timeout setting will not be used until a new pool is created.

If the connection requires only read-only access, then this setting will not be used. This setting is in effect for connections with chunk write access.

During chunk migration, an ODP.NET connection request obeys only the chunk migration connection timeout. All other connection timeout values, such as `OracleConnection.ConnectionTimeout` are ignored and not used.

Oracle recommends setting the ODP.NET chunk migration connection timeout value to a value greater than the chunk movement server timeout. One way to set this server timeout is using the Global Data Services Control Utility (GDSCTL) `move chunk` command's timeout option.

The `OracleConnection.ChunkMigrationConnectionTimeout` property inherits from the `OracleConfiguration.ChunkMigrationConnectionTimeout` property. The `OracleConnection` property can be separately set to override the property set in the `OracleConfiguration` class.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## ClientId

This property specifies the client identifier for the connection.

### Declaration

```
// C#  
public string ClientId {set;}
```

### Property Value

The string to be used as the client identifier.

### Remarks

The default value is `null`.

Using the `ClientId` property allows the application to set the client identifier in the application context for a given `OracleConnection` object.

In unmanaged ODP.NET, the `ClientId` property is reset to `null` when the `Close` or `Dispose` method is called on the `OracleConnection` object. In managed ODP.NET, it is reset to `null` (assuming no new value is assigned) upon the next database round trip following a `Close` or `Dispose` method call on the `OracleConnection` object.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)
- ["Client Identifier and End-to-End Tracing"](#)
- *Oracle Database Security Guide*

## ClientInfo

This property specifies the client information for the connection.

### Declaration

```
// C#  
public string ClientInfo {set;}
```

### Property Value

The string to be used as the client information.

### Remarks

The default value is `null`.

Using the `ClientInfo` property allows the application to set the client information in the application context for a given `OracleConnection` object.

In unmanaged ODP.NET, the `ClientInfo` property is reset to `null` when the `Close` or `Dispose` method is called on the `OracleConnection` object. In managed ODP.NET, it is reset to `null` (assuming no new value is assigned) upon the next database round trip following a `Close` or `Dispose` method call on the `OracleConnection` object.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)
- ["Client Identifier and End-to-End Tracing"](#)
- *Oracle Database Security Guide*

## ConnectionString

This property specifies connection information used to connect to an Oracle database.

## Declaration

```
// C#  
public override string ConnectionString { get; set; }
```

## Property Value

If the connection string is supplied through the constructor, this property is set to that string.

## Implements

IDbConnection

## Exceptions

ArgumentException - An invalid syntax is specified for the connection string.

InvalidOperationException - ConnectionString is being set while the connection is open.

## Remarks

The default value is an empty string.

ConnectionString must be a string of attribute name and value pairings, separated by a semi-colon, for example:

```
"User Id=scott;password=tiger;data source=oracle"
```

If the ConnectionString is not in a proper format, an exception is thrown. All spaces are ignored unless they are within double quotes.

When the ConnectionString property is set, the OracleConnection object immediately parses the string for errors. An ArgumentException is thrown if the ConnectionString contains invalid attributes or invalid values. Attribute values for User Id, Password, Proxy User Id, Proxy Password, and Data Source (if provided) are not validated until the Open method is called.

The connection must be closed to set the ConnectionString property. When the ConnectionString property is reset, all previously set values are reinitialized to their default values before the new values are applied.

Starting with ODP.NET 11.1, password and proxy password connection string attribute values are accepted as case-sensitive strings. Thus, they are passed to the database for authentication in the case provided in the connection string. Therefore, if the database is configured to support case-sensitive passwords, passwords must be passed in the correct case.

If a connection string attribute is set more than once, the last setting takes effect and no exceptions are thrown.

Boolean connection string attributes can be set to either true, false, yes, or no.

## Remarks (.NET Stored Procedure)

To obtain an OracleConnection object in a .NET stored procedure that represents the implicit database connection, set the ConnectionString property of the OracleConnection object to "context connection=true" and invoke the Open method. Other connection string attributes cannot be used in conjunction with "context connection" when it is set to true.

## Supported Connection String Attributes

Table 7-50 lists the supported connection string attributes.

**Table 7-50 Supported Connection String Attributes**

Connection String Attribute	Description	Default Value
Application Continuity	Enables database requests to automatically replay transactional or non-transactional operations in a non-disruptive and rapid manner in the event of a severed database session, which results in a recoverable error. <i>Not Available in ODP.NET, Managed Driver and ODP.NET Core</i>	true
Connection Lifetime	Minimum life time (in seconds) of the connection. This attribute specifies the lifetime of the connection in seconds. Before the <code>Connection</code> is placed back into the pool upon a <code>Close()</code> or <code>Dispose()</code> call, the lifetime of the connection is checked. If the lifetime of the connection exceeds this property value and the number of connections will not fall below <code>Min Pool Size</code> , then the connection is destroyed. If this property value is 0, then the connection lifetime is never checked.	0
Connection Timeout	The time to wait (in seconds) for a new connection or an idle connection from the connection pool before a connection time out error can occur. This attribute specifies the minimum amount of time (in seconds) that the <code>Open()</code> method must take to obtain a pooled connection before it terminates the request. This value comes into effect only if no free connection is available from the connection pool and the <code>Max Pool Size</code> is reached. If a free connection is not available within the specified time, an exception is thrown. <code>Connection Timeout</code> does not limit the time required to open new connections. This attribute value takes effect for pooled connection requests and not for new connection requests. (The default value is 0 for the implicit database connection in a .NET stored procedure.)	15
Context Connection	Returns an implicit database connection if set to true. An implicit database connection can only be obtained from within a .NET stored procedure. Other connection string attributes cannot be used in conjunction with "context connection" when it is set to true. <i>Supported in a .NET stored procedure only</i>	false

Table 7-50 (Cont.) Supported Connection String Attributes

Connection String Attribute	Description	Default Value
Data Source	Oracle Net Services Name, Connect Descriptor, or an easy connect naming that identifies the database to which to connect.	empty string
DBA Privilege	Administrative privileges. This connection string attribute accepts SYSASM, SYSBACKUP, SYSDBA, SYSDG, SYSKM, SYSOPER, and SYSRAC as the attribute value. It is case-insensitive.	empty string
Decr Pool Size	Number of connections that are closed when an excessive amount of established connections are unused.  This connection string attribute controls the maximum number of unused connections that are closed when the pool regulator makes periodic checks. The regulator thread is spawned every 3 minutes and closes up to Decr Pool Size amount of pooled connections if they are not used. The pool regulator never takes the total number of connections below the Min Pool Size by closing pooled connections.	1
Enlist	Controls the enlistment behavior and capabilities of a connection in context of COM+ transactions or System.Transactions.  If this attribute is set to true, the connection is automatically enlisted in the thread's transaction context. If this attribute is false, no enlistments are made. If this attribute is set to dynamic, applications can dynamically enlist in distributed transactions. This attribute can be set to true, false, yes, no, or dynamic.	true
HA Events	Enables ODP.NET connection pool to proactively remove connections from the pool when an Oracle database service, service member, or node goes down.  This feature can be used with Global Data Services, including Oracle RAC, Data Guard, GoldenGate, and single instance deployments. "pooling=true" must also be set  This attribute can be set to true, false, yes, or no.	true

Table 7-50 (Cont.) Supported Connection String Attributes

Connection String Attribute	Description	Default Value
Load Balancing	<p>Enables ODP.NET connection pool to balance work requests across Oracle database instances based on the load balancing advisory and service goal.</p> <p>This feature can be used with Global Data Services, including Oracle RAC, Active Data Guard, and GoldenGate. "pooling=true" must also be set.</p> <p>This attribute can be set to <code>true</code>, <code>false</code>, <code>yes</code>, or <code>no</code>.</p>	<code>true</code>
Incr Pool Size	<p>Number of new connections to be created when all connections in the pool are in use.</p> <p>This connection string attribute determines the number of new connections that are established when a pooled connection is requested, but no unused connections are available and <code>Max Pool Size</code> is not reached. If new connections have been created for a pool, the regulator thread skips a cycle and does not have an opportunity to close any connections for 6 minutes. Note, however, that some connections can be still be closed during this time if their lifetime has been exceeded.</p>	5
Max Pool Size	<p>Maximum number of connections in a pool.</p> <p>This attribute specifies the maximum number of connections allowed in the particular pool used by that <code>OracleConnection</code>. Simply changing this attribute in the connection string does not change the <code>Max Pool Size</code> restriction on a currently existing pool. Doing so simply creates a new pool with a different <code>Max Pool Size</code> restriction. This attribute must be set to a value greater than the <code>Min Pool Size</code>. This value is ignored unless <code>Pooling</code> is turned on.</p>	100
Metadata Pooling	<p>Caches metadata information.</p> <p>This attribute indicates whether or not metadata information for executed queries are cached for improved performance.</p>	<code>True</code>
Min Pool Size	<p>Minimum number of connections in a pool.</p> <p>This attribute specifies the minimum number of connections to be maintained by the pool during its entire lifetime. Simply changing this attribute in the connection string does not change the <code>Min Pool Size</code> restriction on a currently existing pool. Doing so simply creates a new pool with a different <code>Min Pool Size</code> restriction. This value is ignored unless <code>Pooling</code> is turned on.</p>	1

Table 7-50 (Cont.) Supported Connection String Attributes

Connection String Attribute	Description	Default Value
Password	<p>Password for the user specified by <code>User Id</code>.</p> <p>This attribute specifies an Oracle user's password. <code>Password</code> is case-sensitive by default for Oracle Database 11g release 1 (11.1) and later.</p>	empty string
Persist Security Info	<p>Retrieval of the password in the connection string.</p> <p>If this attribute is set to <code>false</code>, the <code>Password</code> value setting is not returned when the application requests the <code>ConnectionString</code> after the connection is successfully opened by the <code>Open()</code> method. This attribute can be set to either <code>true</code>, <code>false</code>, <code>yes</code>, or <code>no</code>.</p>	false
Pooling	<p>Connection pooling.</p> <p>This attribute specifies whether or not connection pooling is to be used. Pools are created using an attribute value matching algorithm. This means that connection strings which only differ in the number of spaces in the connection string use the same pool. If two connection strings are identical except that one sets an attribute to a default value while the other does not set that attribute, both requests obtain connections from the same pool. This attribute can be set to either <code>true</code>, <code>false</code>, <code>yes</code>, or <code>no</code>.</p>	true
Proxy User Id	<p>User name of the proxy user.</p> <p>This connection string attribute specifies the middle-tier user, or the proxy user, who establishes a connection on behalf of a client user specified by the <code>User Id</code> attribute. ODP.NET attempts to establish a proxy connection if either the <code>Proxy User Id</code> or the <code>Proxy Password</code> attribute is set to a non-empty string.</p> <p>For the proxy user to connect to an Oracle database using operating system authentication, the <code>Proxy User Id</code> must be set to <code>"/</code>". The <code>Proxy Password</code> is ignored in this case. The <code>User Id</code> cannot be set to <code>"/</code>" when establishing proxy connections. The case of this attribute value is preserved.</p>	empty string

Table 7-50 (Cont.) Supported Connection String Attributes

Connection String Attribute	Description	Default Value
Proxy Password	<p>Password of the proxy user.</p> <p>This connection string attribute specifies the password of the middle-tier user or the proxy user. This user establishes a connection on behalf of a client user specified by the <code>User Id</code> attribute. ODP.NET attempts to establish a proxy connection if either the <code>Proxy User Id</code> or the <code>Proxy Password</code> attribute is set to a non-empty string.</p> <p>The case of this attribute value is preserved if it is surrounded by double quotes.</p>	empty string
Statement Cache Purge	<p>Statement cache purged when the connection goes back to the pool.</p> <p>If statement caching is enabled, setting this attribute to <code>true</code> purges the Statement Cache when the connection goes back to the pool.</p>	false
Statement Cache Size	<p>Statement cache enabled and cache size set size, that is, the maximum number of statements that can be cached.</p> <p>A value greater than zero enables statement caching and sets the cache size to itself. This value should not be greater than the value of the <code>OPEN_CURSORS</code> parameter set in the <code>init.ora</code> database configuration file.</p>	0
Self Tuning	<p>Enables or disables self-tuning for the connection.</p> <p>If self-tuning is enabled, then the <code>StatementCacheSize</code> settings in the registry, configuration files, and connection string are ignored.</p> <p>If self-tuning is disabled, then a <code>StatementCacheSize</code> value of 0 is used unless <code>StatementCachSize</code> is specified in the registry, configuration file, or connection string.</p>	true
Tns_Admin	<p>Directory where ODP.NET can find its <code>sqlnet.ora</code> and <code>tnsnames.ora</code> configuration files.</p> <p><i>Not available in ODP.NET, Unmanaged Driver</i></p>	empty string
Token_Auth	<p>This attribute specifies the access token authentication type. Possible values are <code>OCITOKEN</code>, <code>OAUTH</code>, or <code>DISABLED</code>.</p> <p>Only supported for managed ODP.NET and ODP.NET Core.</p>	DISABLED

Table 7-50 (Cont.) Supported Connection String Attributes

Connection String Attribute	Description	Default Value
Token_Location	This attribute is the file-based token location. The value can be a directory where a file named "token" is or it can be the file's full path specification.  Only supported for managed ODP.NET and ODP.NET Core.	Varies depending on token authentication type
User Id	Oracle user name.  This attribute specifies the Oracle user name. The case of this attribute value is preserved if it is surrounded by double quotes. For the user to connect to an Oracle database using operating system authentication, set the <code>User Id</code> to <code>"/"</code> . Any <code>Password</code> attribute setting is ignored in this case.	empty string
Validate Connection	Validation of connections coming from the pool.  Validation causes a round-trip to the database for each connection. Therefore, it should only be used when necessary.	false
Wallet_Location	ODP.NET wallet directory  <i>Not available in ODP.NET, Unmanaged Driver</i>	empty string

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## ConnectionTimeout

This property indicates the minimum amount of time that the `Open` method can take to obtain a pooled connection before the request is terminated.

**Declaration**

```
// C#
public override int ConnectionTimeout {get;}
```

**Property Value**

The minimum time allowed for a pooled connection request, in seconds.

**Implements**

IDbConnection

### Remarks

This property indicates the connection timeout that has been set using the `ConnectionString` attribute `Connection Timeout`.

This property is read-only.

### Remarks (.NET Stored Procedure)

There is no connection string specified by the application and a connection on the implicit database is always available, therefore, this property is set to 0.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## ConnectionType

This property enables an ODP.NET application to determine whether a particular connection object is associated with an Oracle database connection, a TimesTen database connection, or no physical connection at all.

### Declaration

```
// C#  
public OracleConnectionType ConnectionType {get;}
```

### Property Value

The `OracleConnectionType` that this connection object is associated with.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)
- [OracleConnectionType Enumeration](#)

## Credential

This property is used to get or set an `OracleCredential` object on the connection.

### Declaration

```
// C#  
public OracleCredential Credential { get; set; }
```

### Property Value

An `OracleCredential` object to be used for opening connection.

### Exceptions

An `InvalidOperationException` will be raised in following scenarios:

- If connection is already open.
- If connection string has already been set on this connection and it contains any of user id, password, DBA Privilege, proxy user id or proxy password.
- The `AccessToken` property is set.
- The `TokenLocation` properties is set. This is applicable for managed ODP.NET and ODP.NET Core only.
- `TokenAuthentication` is set to something other than disabled. This is applicable for managed ODP.NET and ODP.NET Core only.

### Remarks

To obtain the `OracleCredential` object through the property getter, "persist security info" must be set to true in the connection string.

If "Persist security info" is set to false in the Connection String, then the `OracleCredential` object is not returned through the property getter after the password has been validated.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)
- [OracleConnectionType Enumeration](#)

## Database

This property is not supported.

### Declaration

```
// C#  
public override string Database {get;}
```

### Property Value

A string.

## Implements

IDbConnection.Database

## Remarks

This property is not supported. It always returns an empty string.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## DatabaseDomainName

This property specifies the name of the database domain that this connection is connected to.

## Declaration

```
// C#  
public string DatabaseDomainName {get;}
```

## Property Value

The database domain that this connection is connected to.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## DatabaseEditionName

DatabaseEditionName property sets or gets the edition name for the OracleConnection object.

## Declaration

```
// C#  
public string DatabaseEditionName{get;set;}
```

### Property Value

A string to be used as the edition name for the `OracleConnection` object.

### Exceptions

- `InvalidOperationException()` - if the connection is already open.
- `InvalidOperationException()` - If `CPVersion` is set to 1.0 when the connection is opened. `DatabaseEditionName` property is supported only with `CPVersion` of 2.0 or higher.

### Remarks

Property must be set before opening a connection or after closing a connection.

The edition name for the connection to use can be set in one of three places: `DatabaseEditionName` in the application code, `Edition` in the .NET configuration file, or `Edition` in the Windows Registry. The .NET configuration value overrides the Registry value and the `DatabaseEditionName` property value overrides the .NET configuration value.

`DatabaseEditionName` property value is case sensitive.

Only supported for .NET Framework 4 and higher.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## DatabaseName

This property specifies the name of the database that this connection is connected to.

### Declaration

```
// C#  
public string DatabaseName {get;}
```

### Property Value

The database that this connection is connected to.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## DataSource

This property specifies the Oracle Net Services Name, Connect Descriptor, or an easy connect naming that identifies the database to which to connect

### Declaration

```
// C#  
public override string DataSource {get;}
```

### Property Value

Oracle Net Services Name, Connect Descriptor, or an easy connect naming that identifies the database to which to connect.

### Remarks (.NET Stored Procedure)

The value of this property is always an empty string for the implicit database connection.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## DRCPConnectionString

This property specifies a logical name that identifies the DRCP connection pool that the ODP.NET connection will use.

### Declaration

```
// C#  
public string DRCPConnectionString {get; set;}
```

### Property Value

The string to be used that uniquely identifies the DRCP server side connection pool for the ODP.NET application to use.

## Exceptions

- `InvalidOperationException()` - if `CPVersion=1.0` and the `DRCPConnectionString` is set to a non-null / non-empty string. Applies to unmanaged ODP.NET only.
- `InvalidOperationException()` - if the `DRCPConnectionString` is set to a non-null / non-empty string after opening a connection.
- `InvalidOperationException()` - if DRCP is not enabled and the `DRCPConnectionString` is set to a non-null / non-empty string.

## Remarks

A different client-side connection pool will be created for each unique `DRCPConnectionString` property value. Each of these pools will use the same DRCP.

The default value is null. The character limit is 1024 minus the number of characters in the user id.

If this property is used, it must be set prior to opening the connection.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## DRCPPurity

Session purity specifies whether an application can reuse a pooled session (`Pooled`) or must use a new session (`New`).

## Declaration

```
// C#  
public OracleDRCPPurity DRCPPurity {get; set;}
```

## Property Value

`OracleDRCPPurity` Enumeration values.

## Exceptions

- `InvalidOperationException()` - if `CPVersion=1.0` and the `DRCPPurity` is set to a non-null / non-empty string. Applies to unmanaged ODP.NET only.
- `InvalidOperationException()` - if the `DRCPPurity` is set to a non-null / non-empty string after opening a connection.
- `InvalidOperationException()` - if DRCP is not enabled and the `DRCPPurity` is set to a non-null / non-empty string.

## Remarks

The default value is `Pooled`.

If set to `New`, then ODP.NET will dispense a new DRCP connection, rather than try to find an existing connection from the DRCP. In general, this property is used by applications that want a connection without any preexisting session state set.

If set to `Pooled`, then ODP.NET will first attempt to use a preexisting connection, that already exists in the DRCP pool.

Using this property will not cause a new DRCP to be created, just a new connection from an existing DRCP.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)
- [OracleDRCP Purity Enumeration](#)

## HostName

This property specifies the name of the host that this connection is connected to.

### Declaration

```
// C#  
public string HostName {get;}
```

### Property Value

The host that this connection is connected to.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## InstanceName

This property specifies the name of the instance that this connection is connected to.

### Declaration

```
// C#  
public string InstanceName {get;}
```

### Property Value

The instance that this connection is connected to.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## KeepAlive

This property specifies whether to keep an idle connection alive.

### Declaration

```
// C#  
public static Boolean KeepAlive { get; set; }
```

### Property Type

System.Boolean

### Remarks

Turn `KeepAlive` on to prevent an idle TCP connection from being killed, such as a by a firewall. `KeepAlive` will keep the connection alive by periodically sending a probe packet with no data in it and the ACK flag turned on.

This setting is used in conjunction with `KeepAliveInterval` and `KeepAliveTime`.

The `KeepAlive` default is false.

Starting in ODP.NET Core 19.10, `KeepAlive` is supported on non-Windows operating systems, such as Oracle Linux. For these non-Windows operating systems, .NET Core 3 or higher is required.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## KeepAliveInterval

This property specifies the time interval after an unacknowledged probe before a new probe is sent.

### Declaration

```
// C#  
public static int KeepAliveInterval { get; set; }
```

### Property Type

System.Int32

### Remarks

In seconds. The interval default is 6 seconds between unacknowledged probes.

When keepalive probes are sent, they are normally acknowledged by the remote TCP. If the connection remains idle, but TCP does see the probe acknowledgements, then TCP will send the probes at a rate of once every `KeepAliveTime` duration.

When these probes are not acknowledged, the probes are then sent at intervals set by `KeepAliveInterval`. Probes will continue to be sent at the `KeepAliveInterval` until the server acknowledges the probe, independent connection activity occurs, or 10 consecutive unacknowledged probes have been sent.

After a probe is acknowledged, future probes will be sent again at the `KeepAliveTime` interval.

If 10 probes are sent without acknowledgement, the connection is deemed EOF/Reset.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## KeepAliveTime

This property specifies the idle time before a keepalive probe is sent.

### Declaration

```
// C#  
public static int KeepAliveTime { get; set; }
```

### Property Type

System.Int32

## Remarks

In seconds. The default is 60 seconds.

`KeepAliveTime` specifies the idle time to wait until sending a probe to verify the connection remains active and to keep that connection active. If the remote TCP sends back an acknowledgement of receiving the probe, then no further probe is sent until another `KeepAliveTime` idle period has elapsed.

Whenever independent connection activity occurs, `KeepAliveTime` is reset. When that activity ends, the `KeepAliveTime` starts its countdown to sending a probe.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## ModuleName

This property specifies the module name for the connection.

### Declaration

```
// C#  
public string ModuleName {set;}
```

### Property Value

The string to be used as the module name.

### Remarks

The default value is `null`.

Using the `ModuleName` property allows the application to set the module name in the application context for a given `OracleConnection` object.

In unmanaged ODP.NET, the `ModuleName` property is reset to `null` when the `Close` or `Dispose` method is called on the `OracleConnection` object. In managed ODP.NET, it is reset to `null` (assuming no new value is assigned) upon the next database round trip following a `Close` or `Dispose` method call on the `OracleConnection` object.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)
- ["Client Identifier and End-to-End Tracing"](#)
- [Oracle Database Security Guide](#)

## OciCompartment

This property gets or sets the Oracle Cloud Identifier (OCID) of the target database's compartment.

### Declaration

```
// C#  
public string OciCompartment { get; set; }
```

### Property Type

System.String

### Remarks

This property is optional by default. This property is mandatory if the `OciDatabase` property is set.

If `OciCompartment` is not set, then ODP.NET requests access to all the cloud tenancy's databases identified in the `OciTenancy` property.

There is no default value for this property.

The value of this property will be part of pool manager identification so different value for this property will result in different connection pools.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## OciDatabase

This property gets or sets the target database's Oracle Cloud Identifier (OCID).

**Declaration**

```
// C#  
public string OciDatabase { get; set; }
```

**Property Type**

System.String

**Remarks**

This property is optional.

If it is not set, then ODP.NET requests access to all the cloud compartment's databases identified in the `OciCompartment` property. If `OciCompartment` property is also not set, then ODP.NET requests access to all the tenancy's databases specified in the `OciTenancy` property.

There is no default value for this property.

The value of this property will be part of pool manager identification so different value for this property will result in different connection pools.

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## OciIamUrl

This property gets or sets the URL end point for getting the database token.

**Declaration**

```
// C#  
public string OciIamUrl { get; set; }
```

**Property Type**

System.String

**Remarks**

This is a mandatory property for IAM alternate password use. If not set in that usage scenario, ODP.NET raises an error.

The property value is part of the connection pool manager identification. Different property values result in different connection pools.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## OciTenacy

This property gets or sets the Oracle Cloud Identifier (OCID) of the IAM user's cloud tenancy to retrieve the database token.

### Declaration

```
// C#  
public string OciTenacy { get; set; }
```

### Property Type

System.String

### Remarks

This is a mandatory property for IAM alternate password use. If not set in that usage scenario, ODP.NET raises an error.

The property value is part of the connection pool manager identification. Different property values result in different connection pools.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## PasswordAuthentication

This property sets the connection `PASSWORD_AUTH` parameter value. The possible parameter values are `OciToken` and `PasswordVerifier`. The default value is `PasswordVerifier`, which indicates the typical database username and password can be used for authentication.

### Declaration

```
// C#  
public OraclePasswordAuth PasswordAuthentication { get; set; }
```

## Property Type

An `OraclePasswordAuth` enumeration

## Remarks

The property value is part of the connection pool manager identification. Different property values result in different connection pools.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## PDBName

This property is used to set and get the name of the pluggable database to which the session is connected to.

### Declaration

```
// C#  
public string PDBName{ get; set; }
```

### Property Value

`PDBName` returns a string specifying the pluggable database name for the connection.

### Exceptions

- `InvalidOperationException()` - if the connection is already open.
- `InvalidOperationException()` - if the `CPVersion` is set to 1.0 and the `PDBName` property is set. Applicable only to ODP.NET, Unmanaged Driver.
- `InvalidOperationException()` - If `PDBName` value is retrieved when `CPVersion` is set to 1.0. Applicable only to ODP.NET, Unmanaged Driver.

### Remarks

Pluggable databases are available in Oracle Database 12c and higher. The `ServiceName` and `PDBName` properties can be used to connect to the specified Service that is running on a particular PDB.

Property must be set before opening the connection so that a connection with requested pluggable database name is returned.

If the `PDBName` property is set before connection is opened, then the connection's pluggable database name will be the same as `PDBName` when `OracleConnection.Open()` is successfully executed.

If only the `PDBName` property is set, then the default service of the pluggable database is used as the `ServiceName` for this connection.

In unmanaged ODP.NET, if the `PDBName` property is set *and* if the .NET configuration setting, `CPVersion`, is *not* set, then the `CPVersion` attribute will be automatically set to 2.0.

`PDBName` property's value is case insensitive.

The `PDBName` property can be used to retrieve the session's pluggable database name after the connection has been opened. If it is used to get the pluggable database name before the connection is opened, then it just returns the pluggable database name provided by the application, if any.

Only supported for .NET Framework 4 and higher.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## ProviderVersion

This property specifies the ODP.NET assembly version.

### Declaration

```
// C#  
public static string ProviderVersion { get; }
```

### Property Type

System.String

### Property Values

The first ODP.NET Core 19c release has a `ProviderVersion` of 2.0.19.1. Managed and managed ODP.NET have version 4.122.19.1.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## ServerVersion

This property specifies the version number of the Oracle database to which the `OracleConnection` has established a connection.

### Declaration

```
// C#  
public override string ServerVersion {get;}
```

### Property Value

The version of the Oracle database.

### Exceptions

`InvalidOperationException` - The connection is closed.

### Remarks

The default is an empty string.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## ServiceName

This property is used to set and get the database service name to which the session will be connected to when connecting to a pluggable database.

### Declaration

```
// C#  
public string ServiceName{ get; set;}
```

### Property Value

`ServiceName` returns a string specifying the service name of the connection.

### Exceptions

`InvalidOperationException()` - the connection is already open.

`InvalidOperationException()` - if the `CPVersion` is set to 1.0 and the `ServiceName` property is set. Applicable only to ODP.NET, Unmanaged Driver.

## Remarks

Pluggable databases are available in Oracle Database 12c and higher. The `ServiceName` and `PDBName` properties can be used to connect to the specified Service that is running on a particular PDB.

`ServiceName` must be set before opening the connection so that the correct service is used for the connection.

`PDBName` property must be set when the `ServiceName` property is set. Otherwise, an exception is thrown when the connection is opened.

If the `ServiceName` property is specified before connection is opened, then the connection's service will be the same as the specified `ServiceName` when the connection is opened.

If the service name is not changed before the connection is next opened, then the connection will continue using the `ServiceName` value that had been previously set.

In unmanaged ODP.NET, if the `ServiceName` property is set *and* if the `CPVersion` attribute is *not* set, then the `CPVersion` attribute will be automatically set to 2.0.

`ServiceName` property's value is case insensitive.

The `ServiceName` property can also be used to retrieve the session service name after opening the connection. If retrieved before opening the connection, then `ServiceName` returns the service name provided by the application, if any.

Only supported for .NET Framework 4 and higher.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## SqlNetAuthenticationServices

This property enables one or more authentication services, such as TCP/IP with SSL.

### Declaration

```
// C#  
public string SqlNetAuthenticationServices { get; set; }
```

### Property Type

System.String

Valid values are: All, Kerberos5, NTS, TCPS, or NONE.

**Note:**

ODP.NET Core does not currently support the Kerberos5 value.

**Example**

```
//C#  
con.SqlNetAuthenticationServices = "(nts, tcps)";
```

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## State

This property specifies the current state of the connection.

**Declaration**

```
// C#  
public override ConnectionState State {get;}
```

**Property Value**

The `ConnectionState` of the connection.

**Implements**

`IDbConnection`

**Remarks**

ODP.NET supports `ConnectionState.Closed` and `ConnectionState.Open` for this property. The default value is `ConnectionState.Closed`.

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## StatementCacheSize

This property specifies the current size of the statement cache associated with this connection.

### Declaration

```
// C#  
public int StatementCacheSize{get;}
```

### Property Value

An integer value indicating the size of the statement cache.

### Remarks

If self tuning is not enabled, then the default value of this property depends upon the statement cache size specified in the connection string, application configuration file, or the registry. If none of these values are specified, then a default value of 0 is used.

If self tuning is enabled, then the property value is adjusted automatically. Any values specified in the connection string, application configuration file, or the registry are ignored.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## SwitchedConnection

This property applies to pluggable database connections. Upon an `OracleConnection.Open()`, if the connection returned from the pool had to change its service name (`ServiceName`) or pluggable database (`PDBName`) in order to connect to the desired pluggable database, then the connection is considered switched. Thus, `SwitchedConnection` will then return `TRUE`. In all other cases, it will return `FALSE`.

### Declaration

```
// C#  
public bool SwitchedConnection { get; }
```

### Remarks

Applications should use this property carefully when using `DRCPConnectionString` values that are common across PDBs/Services. If the same `DRCPConnectionString` values are used across PDBs/Services, but their semantics are different, then this property value can help determine if the requested connection is returned or not.

For example, in a scenario where the same `DRCPCConnectionClass` that is used across PDBs/Services has a different semantic, the application should first check to see if the session has been switched or not. If it has switched between PDBs/Services, then the application should consider that the connection with a matching `DRCPCConnectionClass` was not dispensed.

Only supported for .NET Framework 4 and higher.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## TnsAdmin

This property specifies the directory location of `tnsnames.ora` or `sqlnet.ora`, or both.

### Declaration

```
// C#  
public static string TnsAdmin { get; set; }
```

### Property Type

System.String

### Remarks

The backslash (\) is a special character in .NET that represents the beginning of an escape sequence. To specify a directory location, use any one of the following formats in .NET so that backslashes are correctly represented in a directory location:

```
// C#  
OracleConnection con = new OracleConnection();  
con.TnsAdmin = "D:\\oracle\\client\\admin";  
con.TnsAdmin = @"D:\oracle\client\admin";  
con.TnsAdmin = "D:/oracle/client/admin";
```

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## TokenAuthentication

This property sets the value for `TOKEN_AUTH` parameter for the connection. The possible values for this property can be `OracleTokenAuth.OciToken`, `OracleTokenAuth.Disabled`, or `OracleTokenAuth.OAuth`.

### Declaration

```
// C#
public OracleTokenAuth TokenAuthentication { get; set; }
```

### Remarks

The value of this property will be part of connection pool manager identification so different values for this property will result in different connection pools.

**Table 7-51 OracleTokenAuth Members**

Member Name	Description
Disabled	Default value. Token authentication is DISABLED.
OciToken	Token authentication is enabled for Oracle Identity and Access Management.
OAuth	Token authentication enabled for Azure Active Directory.

### Exceptions

- An `InvalidOperationException` will be raised if
  - the connection is already open,
  - the value of the `AccessToken` property is not compatible with the type of token authentication being set,
  - `TokenAuthentication` is set to disabled and the `AccessToken` or `TokenLocation` properties are set,
  - or, `TokenAuthentication` is set to a value other than disabled, and the `Credential` property is set.
  - It can also be raised if the user or proxy information in the connection string is not compatible with token authentication.
- `OracleException` if `Credential` is set.
- `OracleException` if user id value is other than `/`.
- `OracleException` if password, proxy user id and proxy password is set.



#### Note:

Only managed ODP.NET and ODP.NET Core can use this property.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## TokenLocation

This property gets or sets the token location path for the connection where the access token, or database token and private key files, are present for ODP.NET token authentication. The file names do not need to be specified.

### Declaration

```
// C#  
public string TokenLocation { get; set; }
```

### Property Value

A directory location.

### Remarks

The value of this property will be part of connection pool manager identification so different values for this property will result in different connection pools.

### Expections

- An `InvalidOperationException` will be raised if
  - the connection is already open,
  - the `AccessToken` or `Credential` properties are set,
  - or if `TokenAuthentication` has been set to disabled by the application.
  - It can also be raised if the user or proxy information in the connection string is not compatible with token authentication.
- `OracleException` if `Credential` is set.
- `OracleException` if user id value is other than `/`.
- `OracleException` if password, proxy user id and proxy password is set.

### Description

This property is mandatory for OAuth file-based access tokens, but optional for database tokens.

In the access token case, this property can be the directory where the file "token" is, or the full-path specification of the token file.

For OCI IAM PoP tokens, a file's full-path specification can be specified if it does not have the standard name, "token". A file name does not need to be specified when it uses this standard, fixed name. Bearer token default token location is an empty string.

**Note:**

Only managed ODP.NET and ODP.NET Core can use this property.

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## UseHourOffsetForUnsupportedTimezone

This property specifies whether the hour offset can be used for the session time zone, when the Oracle time zone region name that is associated with the .NET locale is not supported by the Oracle Database being used.

### Declaration

```
// C#  
public bool UseHourOffsetForUnsupportedTimezone { get; set; }
```

### Property Type

System.Boolean

### Exceptions

`InvalidOperationException` – This exception will be thrown if this property is set when the Connection is in an `Open` state.

### Remarks

ODP.NET is built to support the latest available time zones the Oracle database client supports. However, older Oracle database server versions may not have the latest time zone files that support all the same time zones the client supports. Thus, the client could request a connection time zone the Oracle database does not support. In these situations, the connection request returns an "ORA-01882: timezone region not found" error.

When the `UseHourOffsetForUnsupportedTimezone` property is set to `true`, then ODP.NET will initialize the connection/session time zone using a "hour offset" instead of a time zone region name only if the Oracle Database cannot support the Oracle time zone associated with the .NET locale. ODP.NET can then successfully connect and avoid the ORA-01882 error. This also means if the Oracle Database does support the Oracle time zone associated with the .NET locale, then the connection/session will be initialized with an Oracle time zone region name, regardless of the `UseHourOffsetForUnsupportedTimezone` property setting.

By default, the `UseHourOffsetForUnsupportedTimezone` property is set to `false`.

Oracle does not recommend using the hour offset since datetimes with time zone values will *not* be daylight savings time sensitive. Even when the hour offset is enabled, ODP.NET first attempts to use the Oracle time zone region name associated with the .NET locale. Only when the ORA-01882 error is encountered will ODP.NET use the hour offset as the session time zone during a second connection attempt. Thus, there can be two connection requests if the first connection attempt fails with the ORA-01882 error.

The `UseHourOffsetForUnsupportedTimezone` property value specified for the first successfully created connection is used for all subsequent connections in that pool. When pooling is not used, the property's value will be specific for the particular `OracleConnection.Open()` invocation.

Oracle recommends resolving ORA-01882 errors by upgrading the Oracle database with the latest time zone/DST files. Oracle also recommends using the time zone region name for the session time zone so that datetime conversions with time zone values are daylight savings time sensitive.

If the Oracle Database time zone / DST files cannot be upgraded, the application should then set the `UseHourOffsetForUnsupportedTimezone` property to `true`.

### Sample Code

```
using System;
using Oracle.ManagedDataAccess.Client;

class Test
{
    static void Main(string[] args)
    {
        string constr = "user id=hr;password=<password>;data source=oracle;"

        OracleConnection con = new OracleConnection(constr);

        // Have the connection created with the 'hour offset' being used as the session
time zone
        // if the Oracle Database does not support the Oracle Time Zone associated with
the
        // .NET application's locale
        con.UseHourOffsetForUnsupportedTimezone = true;

        // Establish a connection to Oracle
        con.Open();
        con.Dispose();
    }
}
```

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## WalletLocation

This property specifies the location of wallets. Wallets are certificates, keys, and trustpoints processed by SSL/TLS.

### Declaration

```
// C#
public static string WalletLocation { get; set; }
```

### Property Type

System.String

### Remarks

Microsoft Certificate Store (MCS) and file system wallets are supported.

The backslash (\) is a special character in .NET that represents the beginning of an escape sequence. To specify a directory location, use any one of the following formats in .NET so that backslashes are correctly represented in a directory location:

```
// C#
OracleConnection con = new OracleConnection();
con.WalletLocation = "D:\\oracle\\client\\wallets";
con.WalletLocation = @"D:\oracle\client\wallets";
con.WalletLocation = "D:/oracle/client/wallets";
```



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## OracleConnection Public Methods

OracleConnection public methods are listed in [Table 7-52](#).

**Table 7-52 OracleConnection Public Methods**

Public Method	Description
<a href="#">BeginTransaction</a>	Begins a local transaction (Overloaded) <i>Not supported in a .NET stored procedure for context connection</i>
<a href="#">ChangeDatabase</a>	<i>Not Supported</i>
<a href="#">Clone</a>	Creates a copy of an OracleConnection object <i>Not supported in a .NET stored procedure</i>
<a href="#">Close</a>	Closes the database connection

Table 7-52 (Cont.) OracleConnection Public Methods

Public Method	Description
<a href="#">CreateCommand</a>	Creates and returns an <code>OracleCommand</code> object associated with the <code>OracleConnection</code> object
<code>CreateObjRef</code>	Inherited from <code>System.MarshalByRefObject</code>
<code>Dispose</code>	Inherited from <code>System.ComponentModel.Component</code>
<a href="#">EnlistDistributedTransaction</a>	Enables applications to explicitly enlist in a specified distributed transaction <i>Not supported in a .NET stored procedure and ODP.NET Core</i>
<a href="#">EnlistTransaction</a>	Enables applications to enlist in a specified distributed transaction <i>Not supported in a .NET stored procedure</i>
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)
<a href="#">FlushCache</a>	Flushes all updates and deletes made through <code>REF</code> objects retrieved using this connection <i>Not Available in ODP.NET, Managed Driver and ODP.NET Core</i>
<code>GetHashCode</code>	Inherited from <code>System.Object</code>
<code>GetLifetimeService</code>	Inherited from <code>System.MarshalByRefObject</code>
<a href="#">GetSchema</a>	Returns schema information for the data source of the <code>OracleConnection</code>
<a href="#">GetSessionInfo</a>	Returns or refreshes the property values of the <code>OracleGlobalization</code> object that represents the globalization settings of the session (Overloaded)
<code>GetType</code>	Inherited from <code>System.Object</code>
<code>InitializeLifetimeService</code>	Inherited from <code>System.MarshalByRefObject</code>
<a href="#">Open</a>	Opens a database connection with the property settings specified by the <code>ConnectionString</code>
<a href="#">OpenWithNewPassword</a>	Opens a new connection with the new password (Overloaded) <i>Not supported in a .NET stored procedure for context connection</i>
<a href="#">OpenWithNewToken(char[])</a>	This method can be used to open a new connection by providing the refreshed/updated access token directly to ODP.NET instead of through the token refresh call back.
<a href="#">OpenWithNewToken(char[], char[])</a>	Used by the application to open a new connection by providing the refreshed/updated signature token and private key directly to ODP.NET instead of through the token refresh call back
<a href="#">PurgeStatementCache</a>	Flushes the Statement Cache by closing all open cursors on the database, when statement caching is enabled

Table 7-52 (Cont.) OracleConnection Public Methods

Public Method	Description
<a href="#">SetSessionInfo</a>	Alters the session's globalization settings with the property values provided by the <code>OracleGlobalization</code> object
<a href="#">SetShardingKey(OracleShardingKey, OracleShardingKey)</a>	Enables applications to set the sharding key and super sharding key before requesting a connection
<code>ToString</code>	Inherited from <code>System.Object</code>

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## BeginTransaction

`BeginTransaction` methods begin local transactions.

### Overload List

- [BeginTransaction\(\)](#)  
This method begins a local transaction.
- [BeginTransaction\(IsolationLevel\)](#)  
This method begins a local transaction with the specified isolation level.

## BeginTransaction()

This method begins a local transaction.

### Declaration

```
// C#
public OracleTransaction BeginTransaction();
```

### Return Value

An `OracleTransaction` object representing the new transaction.

### Implements

`IDbConnection`

### Exceptions

`InvalidOperationException` - A transaction has already been started.

### Remarks

The transaction is created with its isolation level set to its default value of `IsolationLevel.ReadCommitted`. All further operations related to the transaction must be performed on the returned `OracleTransaction` object.

### Remarks (.NET Stored Procedure)

Using this method in a .NET stored procedure for context connection causes a Not Supported exception.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## BeginTransaction(IsolationLevel)

This method begins a local transaction with the specified isolation level.

### Declaration

```
// C#  
public OracleTransaction BeginTransaction(IsolationLevel isolationLevel);
```

### Parameters

- *isolationLevel*  
The isolation level for the new transaction.

### Return Value

An `OracleTransaction` object representing the new transaction.

### Implements

`IDbConnection`

### Exceptions

`InvalidOperationException` - A transaction has already been started.

`ArgumentException` - The `isolationLevel` specified is invalid.

### Remarks

The following isolation levels are supported: `IsolationLevel.ReadCommitted` and `IsolationLevel.Serializable`.

Although the `BeginTransaction` method supports the `IsolationLevel.Serializable` isolation level, serializable transactions are not supported when using `System.Transactions` and `TransactionScope`.

Requesting other isolation levels causes an exception.

### Remarks (.NET Stored Procedure)

Using this method in a .NET stored procedure for context connection causes a `NotSupportedException`.

### Example

```
// C#

using System;
using System.Data;
using Oracle.DataAccess.Client;

class BeginTransactionSample
{
    static void Main()
    {
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();

        // Create an OracleCommand object using the connection object
        OracleCommand cmd = con.CreateCommand();

        // Start a transaction
        OracleTransaction txn = con.BeginTransaction(IsolationLevel.ReadCommitted);

        // Update EMP table
        cmd.CommandText = "update emp set sal = sal + 100";
        cmd.ExecuteNonQuery();

        // Rollback transaction
        txn.Rollback();
        Console.WriteLine("Transaction rolledback");

        // Clean up
        txn.Dispose();
        cmd.Dispose();
        con.Dispose();
    }
}
```

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## ChangeDatabase

This method is not supported.

### Declaration

```
// C#  
public override void ChangeDatabase(string databaseName);
```

### Parameters

- *databaseName*

The name of the database that replaces the current database name.

### Implements

IDbConnection.ChangeDatabase

### Exceptions

NotSupportedException - Method not supported.

### Remarks

This method is not supported and throws a `NotSupportedException` if invoked.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## Clone

This method creates a copy of an `OracleConnection` object.

### Declaration

```
// C#  
public object Clone();
```

### Return Value

An `OracleConnection` object.

### Implements

ICloneable

## Remarks

The cloned object has the same property values as that of the object being cloned.

## Remarks (.NET Stored Procedure)

This method is not supported for an implicit database connection.

## Example

```
// C#

using System;
using Oracle.DataAccess.Client;

class CloneSample
{
    static void Main()
    {
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();

        // Need a proper casting for the return value when cloned
        OracleConnection clonedCon = (OracleConnection)con.Clone();

        // Cloned connection is always closed, regardless of its source,
        // But the connection string should be identical
        clonedCon.Open();
        if (clonedCon.ConnectionString.Equals(con.ConnectionString))
            Console.WriteLine("The connection strings are the same.");
        else
            Console.WriteLine("The connection strings are different.");

        // Close and Dispose OracleConnection object
        clonedCon.Dispose();
    }
}
```



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## Close

This method closes the connection to the database.

## Declaration

```
// C#
public override void Close();
```

## Implements

IDbConnection

## Remarks

Performs the following:

- Rolls back any pending local transactions that are not yet committed. Distributed transactions will rely on the distributed transaction coordinator on whether roll back is necessary.
- Places the connection to the connection pool if connection pooling is enabled. Even if connection pooling is enabled, the connection can be closed if it exceeds the connection lifetime specified in the connection string. If connection pooling is disabled, the connection is closed.
- Closes the connection to the database.

The connection can be reopened using `Open()`.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## CreateCommand

This method creates and returns an `OracleCommand` object associated with the `OracleConnection` object.

### Declaration

```
// C#  
public OracleCommand CreateCommand();
```

### Return Value

The `OracleCommand` object.

### Implements

IDbConnection

### Example

```
// C#  
  
using System;  
using System.Data;  
using Oracle.DataAccess.Client;
```

```
class CreateCommandSample
{
    static void Main()
    {
        // Connect
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();

        // Execute a SQL SELECT
        OracleCommand cmd = con.CreateCommand();
        cmd.CommandText = "select * from emp";
        OracleDataReader reader = cmd.ExecuteReader();

        // Print all employee numbers
        while (reader.Read())
            Console.WriteLine(reader.GetInt32(0));

        // Clean up
        reader.Dispose();
        cmd.Dispose();
        con.Dispose();
    }
}
```



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## EnlistDistributedTransaction

This method enables applications to explicitly enlist in a specific distributed transaction after a connection has been opened.

### Declaration

```
// C#
public void EnlistDistributedTransaction(ITransaction transaction);
```

### Parameters

- *transaction*  
An `ITransaction` interface.

### Exceptions

`InvalidOperationException` - The connection is part of a local transaction or the connection is closed.

## Remarks

`EnlistDistributedTransaction` enables objects to enlist in a specific transaction that is passed to the method. The `ITransaction` interface can be obtained by applying an (`ITransaction`) cast to the `ContextUtil.Transaction` property within the component that started the distributed transaction.

The connection must be open before calling this method or an `InvalidOperationException` is thrown.

If a connection is part of a local transaction that was started implicitly or explicitly while attempting to enlist in a distributed transaction, the local transaction is rolled back and an exception is thrown.

By default, distributed transactions roll back, unless the method-level `AutoComplete` declaration is set.

Invoking the commit on the `ITransaction` raises an exception.

Invoking the rollback on the `ITransaction` method and calling `ContextUtil.SetComplete` on the same distributed transaction raises an exception.

## Remarks (.NET Stored Procedure)

Using this method causes a Not Supported exception.

## Example

### Application:

```
// C#

/* This is the class that will utilize the Enterprise Services
   component. This module needs to be built as an executable.

   The Enterprise Services Component DLL must be built first
   before building this module.
   In addition, the DLL needs to be referenced appropriately
   when building this application.
*/

using System;
using System.EnterpriseServices;
using DistribTxnSample;

class DistribTxnSample_App
{
    static void Main()
    {
        DistribTxnSample_Comp comp = new DistribTxnSample_Comp();
        comp.DoWork();
    }
}
```

### Component:

```
// C#

/* This module needs to be
   1) built as a component DLL/Library
```

2) built with a strong name

```
This library must be built first before the application is built.
*/

using System;
using System.Data;
using Oracle.DataAccess.Client;
using System.EnterpriseServices;

namespace DistribTxnSample
{
    [Transaction(TransactionOption.RequiresNew)]
    public class DistribTxnSample_Comp : ServicedComponent
    {
        public void DoWork()
        {
            string constr =
                "User Id=scott;Password=tiger;Data Source=oracle;enlist=false";
            OracleConnection con = new OracleConnection(constr);
            con.Open();

            // Enlist in a distributed transaction
            con.EnlistDistributedTransaction((ITransaction)ContextUtil.Transaction);

            // Update EMP table
            OracleCommand cmd = con.CreateCommand();
            cmd.CommandText = "UPDATE emp set sal = sal + .01";
            cmd.ExecuteNonQuery();

            // Commit
            ContextUtil.SetComplete();

            // Dispose OracleConnection object
            con.Dispose();
        }
    }
}
```



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)
- ["EnlistTransaction"](#)
- <http://msdn.microsoft.com/library> for detailed information about this Microsoft .NET Framework feature

## EnlistTransaction

This method enlists the connection to the specified transaction.

## Declaration

```
// C#  
public override void EnlistTransaction(Transaction transaction)
```

## Parameters

- *transaction*  
A `System.Transactions.Transaction` object.

## Exceptions

`InvalidOperationException` - The connection is part of a local transaction or the connection is closed.

## Remarks

Invocation of this method immediately enlists the connection to a transaction that is specified by the provided transaction parameter.

If `OracleConnection` is still associated with a distributed transaction that has not completed from a previous `EnlistTransaction` method invocation, calling this method will cause an exception to be thrown.

In general, for transaction enlistments to succeed, the "enlist" connection string attribute must be set to "true" before invoking the `Open` method. Setting the "enlist" connection string attribute to "true" will implicitly enlist the connection when the `Open` method is called, if the connection is within a transaction context. The "enlist" attribute should be set to "false" or "dynamic" only if the connection will never enlist in a transaction.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)
- ["System.Transactions and Promotable Transactions"](#)
- ["EnlistDistributedTransaction"](#)

## FlushCache

This method flushes all updates and deletes made through `REF` objects retrieved using this connection.

## Declaration

```
// c#  
public void FlushCache();
```

## Exceptions

`InvalidOperationException` - The specified connection is not open.

## Remarks

Before flushing objects, it is required that the application has explicitly started a transaction by executing the `BeginTransaction` method on the `OracleConnection` object. This is because if the object being flushed has not already been locked by the application, an exclusive lock is obtained implicitly for the object. The lock is only released when the transaction commits or rollbacks.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## GetSchema

`GetSchema` methods return schema information for the data source of the `OracleConnection`.

### Overload List

- [GetSchema\(\)](#)  
This method returns schema information for the data source of the `OracleConnection`.
- [GetSchema \(string collectionName\)](#)  
This method returns schema information for the data source of the `OracleConnection` using the specified string for the collection name.
- [GetSchema \(string collectionName, string\[\] restrictions\)](#)  
This method returns schema information for the data source of the `OracleConnection` using the specified string for the collection name and the specified string array for the restriction values.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## GetSchema()

This method returns schema information for the data source of the `OracleConnection`.

### Declaration

```
// C#  
public override DataTable GetSchema();
```

### Return Value

A `DataTable` object.

### Exceptions

`InvalidOperationException` – The connection is closed.

### Remarks

This method returns a `DataTable` object that contains a row for each metadata collection available from the database.

The method is equivalent to specifying the `String` value `"MetaDataCollections"` when using the `GetSchema(String)` method.

### Example

```
// C#  
  
using System;  
using System.Data;  
using System.Data.Common;  
using Oracle.DataAccess.Client;  
  
class GetSchemaSample  
{  
    static void Main(string[] args)  
    {  
        string constr = "User Id=scott; Password=tiger; Data Source=oracle;";  
        string ProviderName = "Oracle.DataAccess.Client";  
  
        DbProviderFactory factory = DbProviderFactories.GetFactory(ProviderName);  
  
        using (DbConnection conn = factory.CreateConnection())  
        {  
            try  
            {  
                conn.ConnectionString = constr;  
                conn.Open();  
  
                //Get all the schema collections and write to an XML file.  
                //The XML file name is Oracle.DataAccess.Client_Schema.xml  
                DataTable dtSchema = conn.GetSchema();  
                dtSchema.WriteXml(ProviderName + "_Schema.xml");  
            }  
            catch (Exception ex)  
            {  
                Console.WriteLine(ex.Message);  
            }  
        }  
    }  
}
```

```
        Console.WriteLine(ex.StackTrace);  
    }  
}  
}
```



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## GetSchema (string collectionName)

This method returns schema information for the data source of the `OracleConnection` using the specified string for the collection name.

### Declaration

```
// C#  
public override DataTable GetSchema (string collectionName);
```

### Parameters

*collectionName*

Name of the collection for which metadata is required.

### Return Value

A `DataTable` object.

### Exceptions

`ArgumentException` – The requested collection is not defined.

`InvalidOperationException` – The connection is closed.

`InvalidOperationException` – The requested collection is not supported by current version of Oracle database.

`InvalidOperationException` – No population string is specified for requested collection.

### Example

```
// C#  
  
using System;  
using System.Data;  
using System.Data.Common;  
using Oracle.DataAccess.Client;  
  
class GetSchemaSample
```

```
{
    static void Main(string[] args)
    {
        string constr = "User Id=scott; Password=tiger; Data Source=oracle;";
        string ProviderName = "Oracle.DataAccess.Client";

        DbProviderFactory factory = DbProviderFactories.GetFactory(ProviderName);

        using (DbConnection conn = factory.CreateConnection())
        {
            try
            {
                conn.ConnectionString = constr;
                conn.Open();

                //Get MetaDataCollections and write to an XML file.
                //This is equivalent to GetSchema()
                DataTable dtMetaddata =
                    conn.GetSchema(DbMetaDataCollectionNames.MetaDataCollections);
                dtMetaddata.WriteXml(ProviderName + "_MetaDataCollections.xml");

                //Get Restrictions and write to an XML file.
                DataTable dtRestrictions =
                    conn.GetSchema(DbMetaDataCollectionNames.Restrictions);
                dtRestrictions.WriteXml(ProviderName + "_Restrictions.xml");

                //Get DataSourceInformation and write to an XML file.
                DataTable dtDataSrcInfo =
                    conn.GetSchema(DbMetaDataCollectionNames.DataSourceInformation);
                dtDataSrcInfo.WriteXml(ProviderName + "_DataSourceInformation.xml");

                //data types and write to an XML file.
                DataTable dtDataTypes =
                    conn.GetSchema(DbMetaDataCollectionNames.DataTypes);
                dtDataTypes.WriteXml(ProviderName + "_DataTypes.xml");

                //Get ReservedWords and write to an XML file.
                DataTable dtReservedWords =
                    conn.GetSchema(DbMetaDataCollectionNames.ReservedWords);
                dtReservedWords.WriteXml(ProviderName + "_ReservedWords.xml");

                //Get all the tables and write to an XML file.
                DataTable dtTables = conn.GetSchema("Tables");
                dtTables.WriteXml(ProviderName + "_Tables.xml");

                //Get all the views and write to an XML file.
                DataTable dtViews = conn.GetSchema("Views");
                dtViews.WriteXml(ProviderName + "_Views.xml");

                //Get all the columns and write to an XML file.
                DataTable dtColumns = conn.GetSchema("Columns");
                dtColumns.WriteXml(ProviderName + "_Columns.xml");
            }
            catch (Exception ex)
            {
                Console.WriteLine(ex.Message);
                Console.WriteLine(ex.StackTrace);
            }
        }
    }
}
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## GetSchema (string collectionName, string[] restrictions)

This method returns schema information for the data source of the `OracleConnection` using the specified string for the collection name and the specified string array for the restriction values.

### Declaration

```
// C#  
public override DataTable GetSchema (string collectionName,  
    string[] restrictions);
```

### Parameters

- *collectionName*  
The name of the collection of metadata being retrieved.
- *restrictions*  
An array of restrictions that apply to the metadata being retrieved.

### Return Value

A `DataTable` object.

### Exception

- `ArgumentException` – The requested collection is not defined.
- `InvalidOperationException` – One of the following conditions exist:
  - The connection is closed.
  - The requested collection is not supported by the current version of Oracle database.
  - More restrictions were provided than the requested collection supports.
  - No population string is specified for requested collection.

### Remarks

This method takes the name of a metadata collection and an array of `String` values that specify the restrictions for filtering the rows in the returned `DataTable`. This returns a `DataTable` that contains only rows from the specified metadata collection that match the specified restrictions.

For example, if the `Columns` collection has three restrictions (`owner`, `tablename`, and `columnname`), to retrieve all the columns for the `EMP` table regardless of schema, the `GetSchema` method must pass in at least these values: `null`, `EMP`.

If no restriction value is passed in, default values are used for that restriction, which is the same as passing in `null`. This differs from passing in an empty string for the parameter value. In this case, the empty string (`""`) is considered the value for the specified parameter.

`collectionName` is not case-sensitive, but restrictions (string values) are.

### Example

```
// C#

using System;
using System.Data;
using System.Data.Common;
using Oracle.DataAccess.Client;

class GetSchemaSample
{
    static void Main(string[] args)
    {
        string constr = "User Id=scott; Password=tiger; Data Source=oracle;";
        string ProviderName = "Oracle.DataAccess.Client";

        DbProviderFactory factory = DbProviderFactories.GetFactory(ProviderName);

        using (DbConnection conn = factory.CreateConnection())
        {
            try
            {
                conn.ConnectionString = constr;
                conn.Open();

                //Get Restrictions
                DataTable dtRestrictions =
                    conn.GetSchema(DbMetaDataCollectionNames.Restrictions);

                DataView dv = dtRestrictions.DefaultView;

                dv.RowFilter = "CollectionName = 'Columns'";
                dv.Sort = "RestrictionNumber";

                for (int i = 0; i < dv.Count; i++)
                    Console.WriteLine("{0} (default) {1}" ,
                        dtRestrictions.Rows[i]["RestrictionName"],
                        dtRestrictions.Rows[i]["RestrictionDefault"]);

                //Set restriction string array
                string[] restrictions = new string[3];

                //Get all columns from all tables owned by "SCOTT"
                restrictions[0] = "SCOTT";
                DataTable dtAllScottCols = conn.GetSchema("Columns", restrictions);

                // clear collection
                for (int i = 0; i < 3; i++)
                    restrictions[i] = null;

                //Get all columns from all tables named "EMP" owned by any
```

```
//owner/schema
restrictions[1] = "EMP";
DataTable dtAllEmpCols = conn.GetSchema("Columns", restrictions);

// clear collection
for (int i = 0; i < 3; i++)
    restrictions[i] = null;

//Get columns named "EMPNO" from tables named "EMP",
//owned by any owner/schema
restrictions[1] = "EMP";
restrictions[2] = "EMPNO";
DataTable dtAllScottEmpCols = conn.GetSchema("Columns", restrictions);

// clear collection
for (int i = 0; i < 3; i++)
    restrictions[i] = null;

//Get columns named "EMPNO" from all
//tables, owned by any owner/schema
restrictions[2] = "EMPNO";
DataTable dtAllEmpNoCols = conn.GetSchema("Columns", restrictions);
}
catch (Exception ex)
{
    Console.WriteLine(ex.Message);
    Console.WriteLine(ex.Source);
}
}
}
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## GetSessionInfo

`GetSessionInfo` returns or refreshes an `OracleGlobalization` object that represents the globalization settings of the session.

### Overload List:

- [GetSessionInfo\(\)](#)

This method returns a new instance of the `OracleGlobalization` object that represents the globalization settings of the session.
- [GetSessionInfo\(OracleGlobalization\)](#)

This method refreshes the provided `OracleGlobalization` object with the globalization settings of the session.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## GetSessionInfo()

This method returns a new instance of the `OracleGlobalization` object that represents the globalization settings of the session.

### Declaration

```
// C#  
public OracleGlobalization GetSessionInfo();
```

### Return Value

The newly created `OracleGlobalization` object.

### Example

```
// C#  
  
using System;  
using Oracle.DataAccess.Client;  
  
class GetSessionInfoSample  
{  
    static void Main()  
    {  
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";  
        OracleConnection con = new OracleConnection(constr);  
        con.Open();  
  
        // Get session info from connection object  
        OracleGlobalization info = con.GetSessionInfo();  
  
        // Update session info  
        info.DateFormat = "YYYY-MM-DD";  
        con.SetSessionInfo(info);  
  
        // Execute SQL SELECT  
        OracleCommand cmd = con.CreateCommand();  
        cmd.CommandText = "select TO_CHAR(hiredate) from emp";  
        Console.WriteLine("Hire Date ({0}): {1}",  
            info.DateFormat, cmd.ExecuteScalar());  
  
        // Clean up  
        cmd.Dispose();  
        con.Dispose();  
    }  
}
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## GetSessionInfo(OracleGlobalization)

This method refreshes the provided `OracleGlobalization` object with the globalization settings of the session.

### Declaration

```
// C#  
public void GetSessionInfo(OracleGlobalization oraGlob);
```

### Parameters

- `oraGlob`

The `OracleGlobalization` object to be updated.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## Open

This method opens a connection to an Oracle database.

### Declaration

```
// C#  
public override void Open();
```

### Implements

`IDbConnection`

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The connection is already opened or the connection string is null or empty.

`OracleException` – For token authentication, errors include “ORA-25707: The token is invalid.”, and “ORA-25708: The token has expired.”

### Remarks

The connection is obtained from the pool if connection pooling is enabled. Otherwise, a new connection is established.

It is possible that the pool does not contain any unused connections when the `Open()` method is invoked. In this case, a new connection is established.

If no connections are available within the specified connection timeout value, when the `Max Pool Size` is reached, an `OracleException` is thrown.

For client-side validation of an access token:

- The access token must be 16KB bytes or less.
- There needs to be two periods, ".".
- It must be valid base 64.
- It must be valid JSON.
- There must be "sub" and "exp" claims.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## OpenWithNewPassword

`OpenWithNewPassword` opens a new connection with the new password.

### Overload List:

- [OpenWithNewPassword\(String\)](#)

`OpenWithNewPassword` opens a new connection with the new password.

- [OpenWithNewPassword\(SecureString\)](#)

`OpenWithNewPassword` opens a new connection with the new password. This method will also update the password in the `OracleCredential` instance that was passed using the `OracleConnection` constructor or through the `OracleConnection.Credential` property.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## OpenWithNewPassword(String)

This method opens a new connection with the new password.

### Declaration

```
// C#  
public void OpenWithNewPassword(string newPassword);
```

### Parameters

- *newPassword*  
A string that contains the new password.

### Remarks

This method uses the `ConnectionString` property settings to establish a new connection. The old password must be provided in the connection string as the `Password` attribute value.

This method can only be called on an `OracleConnection` in the *closed* state.

### Remarks (.NET Stored Procedure)

This method is not supported in a .NET stored procedure for context connection.

 **Note:**

If connection pooling is enabled, then invoking the `OpenWithNewPassword` method also clears the connection pool. This closes all idle connections created with the old password.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)
- ["Password Expiration"](#)

## OpenWithNewPassword(SecureString)

This method opens a new connection with the new password.

### Declaration

```
// C#  
public void OpenWithNewPassword(SecureString newSecurePassword)
```

### Parameters

- *newSecurePassword*  
The `SecureString` object that contains the new password for a user id.

### Remarks

Use this method to change the password for a user id. This method can only be used if an `OracleCredential` instance was passed using the `OracleConnection` constructor or through the `OracleConnection.Credential` property.

This method will also update the password in the `OracleCredential` instance that was passed using the `OracleConnection` constructor or through the `OracleConnection.Credential` property.

`OracleCredential` does not support double quotes around a `SecureString` password. Double quotes can be used within a password, however.

### Exceptions

`ArgumentNullException` is raised if *newSecurePassword* is NULL or is not read only.

`InvalidOperationException` is raised if `OracleCredential` is not already set on the `OracleConnection` either through the `OracleConnection` constructor or through the `Credential` property of the `OracleConnection`.

`InvalidOperationException` is raised if the `OracleConnection` is already in the open state.

`InvalidOperationException` is raised if the connection string is NULL or of length 0.

`InvalidOperationException` is raised if the user id, proxy user id, password, proxy password, DBA privilege is set using the connection string.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)
- ["Password Expiration"](#)

## OpenWithNewToken(char[])

This method can be used to open a new connection by providing the refreshed/updated access token directly to ODP.NET instead of through the token refresh call back. It is recommended to be used only in cases the application is unable or fails to provide the refreshed/updated access token through the token refresh call back.

### Declaration

```
// C#  
public void OpenWithNewToken(char[] token)
```

### Exceptions

- `ArgumentNullException` is raised if token is passed in as null.
- `InvalidOperationException` - The connection is already opened, or there is not an `OracleAccessToken` object set on the connection.
- `OracleException` – For token authentication, errors include “ORA-25707: The token is invalid.”, and “ORA-25708: The token has expired.”

### Description

ODP.NET uses the provided access token to open a new database connection. If the new connection is opened successfully, then the underlying `OracleAccessToken` object is updated with the new access token. If the driver fails to open the new connection, then an exception is thrown and the access token is ignored.

The `char[]` passed for the access token will be cleared ODP.NET for security reasons. The application should not depend on the `char[]` once this method is called.

For client-side validation of an access token:

- The access token must be 16KB bytes or less.
- There needs to be two periods, ".".
- It must be valid base 64.
- It must be valid JSON.
- There must be "sub" and "exp" claims.

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## OpenWithNewToken(char[], char[])

This method can be used by the application to open a new connection by providing the refreshed/updated signature token and private key directly to ODP.NET instead of through the token refresh call back. It is recommended to be used only in cases the application is unable or fails to provide the refreshed/updated token and private key through the token refresh call back.

### Declaration

```
// C#  
public void OpenWithNewToken(char[] dbToken, char[] privateKey)
```

### Exceptions

- `ArgumentNullException` is raised if any parameters are passed in as null.
- Exception if connection is already open.
- Exception if the 'sub' value of the new token does not match the 'sub' value of the current token.

### Description

The 'sub' value of the new token must be the same as the 'sub' value of the current token. ODP.NET will use the application provided signature token and private key to open a new connection to the database. If the new connection can be opened successfully, then the underlying `OracleAccessToken` object will be updated with these new token and private key. If ODP.NET fails to open the new connection, then an exception will be thrown to the application and the `OracleAccessToken` object will not be updated with the new token and private key.

The `char[]` passed by the application for DB token and private key will be cleared by ODP.NET. Applications should not depend on these `char[]` once this constructor is called.

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## PurgeStatementCache

This method flushes the statement cache by closing all open cursors on the database, when statement caching is enabled.

### Declaration

```
// C#  
public void PurgeStatementCache();
```

### Remarks

Flushing the statement cache repetitively results in decreased performance and may negate the performance benefit gained by enabling the statement cache.

Statement caching remains enabled after the call to `PurgeStatementCache`.

Invocation of this method purges the cached cursors that are associated with the `OracleConnection`. It does not purge all the cached cursors in the database.

### Example

```
// C#  
  
using System;  
using System.Data;  
using Oracle.DataAccess.Client;  
  
class PurgeStatementCacheSample  
{  
    static void Main()  
    {  
        string constr = "User Id=scott;Password=tiger;Data Source=oracle;" +  
            "Statement Cache Size=20";  
        OracleConnection con = new OracleConnection(constr);  
        con.Open();  
  
        OracleCommand cmd = new OracleCommand("select * from emp", con);  
        cmd.CommandType = CommandType.Text;  
        OracleDataReader reader = cmd.ExecuteReader();  
  
        // Purge Statement Cache  
        con.PurgeStatementCache();  
  
        // Close and Dispose OracleConnection object  
        Console.WriteLine("Statement Cache Flushed");  
        con.Close();  
        con.Dispose();  
    }  
}
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)
- ["Statement Caching"](#)
- [ConnectionString](#)

## SetSessionInfo

This method alters the session's globalization settings with all the property values specified in the provided `OracleGlobalization` object.

### Declaration

```
// C#  
public void SetSessionInfo(OracleGlobalization oraGlob);
```

### Parameters

- `oraGlob`

An `OracleGlobalization` object.

### Remarks

Calling this method is equivalent to calling an `ALTER SESSION SQL` on the session.

### Example

```
// C#  
  
using System;  
using Oracle.DataAccess.Client;  
  
class SetSessionInfoSample  
{  
    static void Main()  
    {  
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";  
        OracleConnection con = new OracleConnection(constr);  
        con.Open();  
  
        // Get session info from connection object  
        OracleGlobalization info = con.GetSessionInfo();  
  
        // Execute SQL SELECT  
        OracleCommand cmd = con.CreateCommand();  
        cmd.CommandText = "select TO_CHAR(hiredate) from emp";  
        Console.WriteLine("Hire Date ({0}): {1}",  
            info.DateFormat, cmd.ExecuteScalar());  
  
        // Update session info
```

```
info.DateFormat = "MM-DD-RR";
con.SetSessionInfo(info);

// Execute SQL SELECT again
Console.WriteLine("Hire Date ({0}): {1}",
    info.DateFormat, cmd.ExecuteScalar());

// Clean up
cmd.Dispose();
con.Dispose();
}
}
```

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## SetShardingKey(OracleShardingKey, OracleShardingKey)

This instance method enables applications to set the sharding key and the super sharding key before requesting a connection.

### Declaration

```
// C#
public void SetShardingKey(OracleShardingKey shardKey, OracleShardingKey
superShardingKey);
```

### Exceptions

*InvalidArgumentException* – An invalid Oracle sharding key is supplied.

*InvalidOperationException* – The method is invoked when the connection is in an **Open state**.

### Remarks

This method sets the sharding key and the super sharding key that is to be used for returning the proper connection upon the `Open` method invocation.

This method can only be invoked when the connection is in a `Closed` state.

### Example

```
// C#
using System;
using Oracle.DataAccess.Client;

class Sharding
{
    static void Main()
```

```

    {
        OracleConnection con = new OracleConnection("user id=hr;password=hr;Data
Source=orcl;");
        //Setting a shard key
        OracleShardingKey shardingKey = new OracleShardingKey(OracleDbType.Int32, 123);
        //Setting a second shard key value for a composite key
        shardingKey.SetShardingKey(OracleDbType.Varchar2, "gold");
        //Creating and setting the super shard key
        OracleShardingKey superShardingKey = new OracleShardingKey();
        superShardingKey.SetShardingKey(OracleDbType.Int32, 1000);

        //Setting super sharding key and sharding key on the connection
        con.SetShardingKey(shardingKey, superShardingKey);
        con.Open();

        //perform SQL query
    }
}

```

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)
- [OracleShardingKey Class](#)

## OracleConnection Events

OracleConnection events are listed in [Table 7-53](#).

**Table 7-53 OracleConnection Events**

Event Name	Description
<a href="#">ConnectionOpen</a>	This event is triggered upon the <code>OracleConnection.Open()</code> method
Disposed	Inherited from <code>System.ComponentModel.Component</code>
<a href="#">Failover</a>	An event that is triggered when an Oracle failover occurs <i>Not supported in a .NET stored procedure</i> <i>Not Available in ODP.NET, Managed Driver and ODP.NET Core</i>
<a href="#">HAEvent</a>	An event that is triggered when an HA event occurs
<a href="#">InfoMessage</a>	An event that is triggered for any message or warning sent by the database
<a href="#">StateChange</a>	An event that is triggered when the connection state changes

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)

## ConnectionOpen

This event is triggered upon the `OracleConnection.Open()` method.

### Declaration

```
// C#  
public event OracleConnectionOpenEventHandler ConnectionOpen;
```

### Event Data

The event handler receives a `OracleConnectionOpenEventArgs` object which exposes the following property containing information about the `ConnectionOpen` event.

- `Connection`  
`OracleConnection` object on which `Open()` is called.

### Exceptions

- `InvalidOperationException()` - if `CPVersion=1.0` and the `ConnectionOpen` event is used. Applies to unmanaged ODP.NET only.
- `InvalidOperationException()` - if the `ConnectionOpen` event is set after opening a connection.

### Remarks

This feature requires `CPVersion=2.0` to be used.

In order to configure the connection before it is dispensed, the application should register the callback to the `ConnectionOpen` event before `Open()` is called.

Only supported for .NET Framework 4 and higher.

### Example

```
// C#  
// NOTE: The sample below requires CPVersion=2.0 to be configured in  
// the .NET configuration  
using System;  
using Oracle.ManagedDataAccess.Client;  
  
class ConOpenEventSample  
{  
    public static void ConOpenCallback(OracleConnectionOpenEventArgs
```

```
eventArgs)
{
    OracleCommand cmd = new OracleCommand("ALTER SESSION SET
NLS_LANGUAGE='GERMAN'", eventArgs.Connection);
    cmd.ExecuteNonQuery();
    cmd.Dispose();
}

static void Main(string[] args)
{
    // Establish a connection
    string constr = "user id=hr;password=hr;data source=oracle";
    OracleConnection con = new OracleConnection(constr);
    con.ConnectionOpen += ConOpenCallback;
    con.Open();
    con.Dispose();
}
}
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)
- [OracleConnectionOpenEventArgs Properties](#)
- [OracleConnectionOpenEventHandler Delegate](#)

## Failover

This event is triggered when an Oracle failover occurs.

### Declaration

```
// C#
public event OracleFailoverEventHandler Failover;
```

### Event Data

The event handler receives an `OracleFailoverEventArgs` object which exposes the following properties containing information about the event.

- `FailoverType`  
Indicates the type of the failover.
- `FailoverEvent`  
Indicates the state of the failover.

## Remarks

The `Failover` event is raised when a connection to an Oracle instance is unexpectedly severed. The client should create an `OracleFailoverEventHandler` delegate to listen to this event.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)
- ["OracleFailoverEventArgs Properties"](#)
- ["OracleFailoverEventHandler Delegate"](#)

## HAEvent

This event is triggered when an HA event occurs.

### Declaration

```
// C#  
public static event OracleHAEventHandler HAEvent;
```

### Event Data

The event handler receives an `OracleHAEventArgs` object which exposes the following properties containing information about the event.

- `Source`  
Indicates the source of the event.
- `Status`  
Indicates the status of the event.
- `DatabaseName`  
Indicates the database name affected by this event.
- `DatabaseDomainName`  
Indicates the database domain name affected by this event.
- `HostName`  
Indicates the host name affected by this event.
- `InstanceName`  
Indicates the instance name affected by this event.
- `ServiceName`  
Indicates the service name affected by this event.

- Time  
Indicates the time of the event.

### Remarks

The `HAEvent` is static, which means that any HA Events that happen within the application domain can trigger this event. Note that in order to receive HA event notifications, `OracleConnection` objects that establish connections within the application domain must have `"ha events=true"` in the application. Otherwise, the application never receives any HA Events.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)
- ["OracleHAEventArgs Properties"](#)
- ["OracleHAEventHandler Delegate"](#)

## InfoMessage

This event is triggered for any message or warning sent by the database.

### Declaration

```
// C#  
public event OracleInfoMessageEventHandler InfoMessage;
```

### Event Data

The event handler receives an `OracleInfoMessageEventArgs` object which exposes the following properties containing information about the event.

- Errors  
The collection of errors generated by the data source.
- Message  
The error text generated by the data source.
- Source  
The name of the object that generated the error.

### Remarks

In order to respond to warnings and messages from the database, the client should create an `OracleInfoMessageEventHandler` delegate to listen to this event.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)
- ["OracleInfoMessageEventArgs Properties"](#)
- ["OracleInfoMessageEventHandler Delegate"](#)

## StateChange

This event is triggered when the connection state changes.

### Declaration

```
// C#  
public override event StateChangeEventHandler StateChange;
```

### Event Data

The event handler receives a `StateChangeEventArgs` object which exposes the following properties containing information about the event.

- `CurrentState`  
The new state of the connection.
- `OriginalState`  
The original state of the connection.

### Remarks

The `StateChange` event is raised after a connection changes state, whenever an explicit call is made to `Open`, `Close` or `Dispose`.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnection Class](#)
- [OracleConnection Members](#)
- [Microsoft ADO.NET documentation for a description of StateChangeEventHandler](#)

# OracleConnectionOpenEventArgs Class

The `OracleConnectionOpenEventArgs` class provides connection information for the `OracleConnection.Open()` method. When a connection is opened, the callback registered using `ConnectionOpen` is triggered along with the `OracleConnectionOpenEventArgs` object.

## Class Inheritance

System.Object

System.EventArgs

Oracle.DataAccess.Client.OracleConnectionOpenEventArgs

## Declaration

```
// C#
public sealed class OracleConnectionOpenEventArgs
```

## Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionOpenEventArgs Members](#)
- [OracleConnectionOpenEventArgs Properties](#)

## OracleConnectionOpenEventArgs Members

`OracleConnectionOpenEventArgs` members are listed in the following tables.

### OracleConnectionOpenEventArgsProperties

`OracleConnectionOpenEventArgs` properties are listed in [Table 7-54](#).

**Table 7-54 OracleConnectionOpenEventArgs Properties**

Property	Description
<a href="#">Connection</a>	Specifies the <code>OracleConnection</code> on which connection open event has occurred

 **See Also:**

- "Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"
- [OracleConnectionOpenEventArgs Class](#)

## OracleConnectionOpenEventArgs Properties

`OracleConnectionOpenEventArgs` properties are listed in [Table 7-55](#).

**Table 7-55 OracleConnectionOpenEventArgs Properties**

Property	Description
<a href="#">Connection</a>	Specifies the <code>OracleConnection</code> on which connection open event has occurred

 **See Also:**

- "Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"
- [OracleConnectionOpenEventArgs Class](#)
- [OracleConnectionOpenEventArgs Members](#)

## Connection

This property specifies the `OracleConnection` on which connection open event has occurred.

**Declaration**

```
// C#  
public Connection{ get;}
```

**Property Value**

Returns a `OracleConnection` object on which `Open()` is called.

**Remarks**

Only supported for .NET Framework 4 and higher.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionOpenEventArgs Class](#)
- [OracleConnectionOpenEventArgs Members](#)

## OracleConnectionOpenEventHandler Delegate

The `OracleConnectionOpenEventHandler` delegate represents the signature of the method that handles `OracleConnection.ConnectionOpen` event.

**Declaration**

```
// C#
public delegate void OracleConnectionOpenEventHandler (OracleConnectionOpenEventArgs
eventArgs);
```

**Requirements**

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

**Parameters**

- `eventArgs`  
The `OracleConnectionOpenEventArgs` object that contains the connection data.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [ConnectionOpen](#)

# OracleConnectionStringBuilder Class

An `OracleConnectionStringBuilder` object allows applications to create or modify connection strings.

## Class Inheritance

`System.Object`

`System.Data.Common.DbConnectionStringBuilder`

`Oracle.DataAccess.Client.OracleConnectionStringBuilder`

## Declaration

```
// C#
public sealed class OracleConnectionStringBuilder : DbConnectionStringBuilder
```

## Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

## Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

## Remarks

The following rules must be followed for setting values with reserved characters:

- Values containing characters enclosed within single quotes
 

If the value contains characters that are enclosed within single quotation marks, then the entire value must be enclosed within double quotation marks.

For example, `password = "'scoTT'"` where the value is `'scoTT'`.
- Values containing characters enclosed within double quotes
 

Values should be enclosed in double quotation marks to preserve the case and to avoid the upper casing of values.

If the value contains characters enclosed in double quotation marks, then it must be enclosed in single quotation marks.

For example, `password = "'scoTT'"` where the value is `"scoTT"`.
- Values containing characters enclosed in both single and double quotes

If the value contains characters enclosed in both single and double quotation marks, the quotation mark used to enclose the value must be doubled each time it occurs within the value.

For example, `password = ' "sco" 'TT"` where the value is `"sco"TT"`.

#### 4. Values containing spaces

All leading and trailing spaces are ignored, but the spaces between the value are recognized. If the value needs to have leading or trailing spaces then it must be enclosed in double quotation marks.

For example, `User ID = Sco TT` where the value is `<Sco TT>`.

For example, `User ID = "Sco TT "` where the value is `<Sco TT>`.

#### 5. Keywords occurring multiple times in a connection string

If a specific keyword occurs multiple times in a connection string, the last occurrence listed is used in the value set.

For example, with `"User ID = scott; password = tiger; User ID = david"` connection string, `User ID` value is `david`.

To limit malicious access, the APIs of `OracleConnectionStringBuilder`, `Add` and `Item`, insert double quotes around connection string attributes that use special characters. Using special characters in strings can be a format string attack method. Adding double quotes for attributes will not affect database access in most cases. However, there are attributes that require exact string matching, such as passwords. `OracleConnectionStringBuilder`'s addition of double quotes to a password with special characters may result in a generation of a connection string that fails to authenticate against the database.

### Example

```
// C#

using System;
using System.Data;
using System.Data.Common;
using Oracle.DataAccess.Client;
using System.Collections;

class ConnectionStringBuilderSample
{
    static void Main(string[] args)
    {
        bool bRet = false;

        // Create an instance of OracleConnectionStringBuilder
        OracleConnectionStringBuilder connStrBuilder =
            new OracleConnectionStringBuilder();

        // Add new key/value pairs to the connection string
        connStrBuilder.Add("User Id", "scott");
        connStrBuilder.Add("Password", "tiger");
        connStrBuilder.Add("Data Source", "oracle");
        connStrBuilder.Add("pooling", false);

        // Modify the existing value
        connStrBuilder["Data source"] = "inst1";

        // Remove an entry from the connection string
```

```
bRet = connStrBuilder.Remove("pooling");

//ContainsKey indicates whether or not the specific key exist
//returns true even if the user has not specified it explicitly
Console.WriteLine("Enlist exist: " +
    connStrBuilder.ContainsKey("Enlist"));

//returns false
connStrBuilder.ContainsKey("Invalid");

// ShouldSerialize indicates whether or not a specific key
// exists in connection string inherited from DbConnectionStringBuilder.
// returns true if the key is explicitly added the user otherwise false;
// this will return false as this key doesn't exists.
connStrBuilder.ShouldSerialize("user");

// returns false because this key is not added by user explicitly.
connStrBuilder.ShouldSerialize("Enlist");

// IsFixedSize [read-only property]
Console.WriteLine("Connection String is fixed size only: "
    + connStrBuilder.IsFixedSize);
Console.WriteLine("Key/Value Pair Count: " + connStrBuilder.Count);

//adding a new key which is not supported by the provider
//is not allowed.
try
{
    //this will throw an exception.
    connStrBuilder.Add("NewKey", "newValue");
}
catch (Exception ex)
{
    Console.WriteLine(ex.Message);
}

Console.WriteLine("Key/Value Pair Count: " + connStrBuilder.Count);

//modifying a existing key is allowed.
connStrBuilder.Add("Enlist", false);
Console.WriteLine("Key/Value Pair Count: " + connStrBuilder.Count);

// Get all the keys and values supported by the provider.
ICollection keyCollection = connStrBuilder.Keys;
ICollection valueCollection = connStrBuilder.Values;

IEnumerator keys = keyCollection.GetEnumerator();
IEnumerator values = valueCollection.GetEnumerator();

while (keys.MoveNext())
{
    values.MoveNext();
    Console.WriteLine("Key: {0}    Value: {1} \n"
        , keys.Current , values.Current);
}
}
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Members](#)
- [OracleConnectionStringBuilder Constructors](#)
- [OracleConnectionStringBuilder Public Properties](#)
- [OracleConnectionStringBuilder Public Methods](#)

## OracleConnectionStringBuilder Members

OracleConnectionStringBuilder members are listed in the following tables.

### OracleConnectionStringBuilder Constructors

OracleConnectionStringBuilder constructors are listed in [Table 7-56](#).

**Table 7-56 OracleConnectionStringBuilder Constructors**

Constructor	Description
<a href="#">OracleConnectionStringBuilder Constructors</a>	Instantiates a new instance of OracleConnectionStringBuilder class (Overloaded)

### OracleConnectionStringBuilder Public Properties

OracleConnectionStringBuilder instance properties are listed in [Table 7-57](#).

**Table 7-57 OracleConnectionStringBuilder Public Properties**

Properties	Description
BrowsableConnectionString	Inherited from System.Data.Common.DbConnectionStringBuilder
<a href="#">ConnectionLifeTime</a>	Specifies the value corresponding to the Connection Lifetime attribute in the ConnectionString property
ConnectionString	Inherited from System.Data.Common.DbConnectionStringBuilder
<a href="#">ConnectionTimeout</a>	Specifies the value corresponding to the Connection Timeout attribute in the ConnectionString property
<a href="#">ContextConnection</a>	Specifies the value corresponding to the Context Connection attribute in the ConnectionString property
Count	Inherited from System.Data.Common.DbConnectionStringBuilder
<a href="#">DataSource</a>	Specifies the value corresponding to the Data Source attribute in the ConnectionString property

Table 7-57 (Cont.) OracleConnectionStringBuilder Public Properties

Properties	Description
<a href="#">DBAPrivilege</a>	Specifies the value corresponding to the DBA Privilege attribute in the <code>ConnectionString</code> property
<a href="#">DecrPoolSize</a>	Specifies the value corresponding to the Decr Pool Size attribute in the <code>ConnectionString</code> property
<a href="#">Enlist</a>	Specifies the value corresponding to the Enlist attribute in the <code>ConnectionString</code> property
<a href="#">HAEvents</a>	Specifies the value corresponding to the HA Events attribute in the <code>ConnectionString</code> property
<a href="#">IncrPoolSize</a>	Specifies the value corresponding to the Incr Pool Size attribute in the <code>ConnectionString</code> property
<a href="#">IsFixedSize</a>	Indicates whether or not the Connection String Builder has a fixed size
<code>IsReadOnly</code>	Inherited from <code>System.Data.Common.DbConnectionStringBuilder</code>
<a href="#">Item</a>	Specifies the value associated with the specified attribute
<a href="#">Keys</a>	Specifies a collection of attributes contained in the Connection String Builder
<a href="#">LoadBalancing</a>	Specifies the value corresponding to the Load Balancing attribute in the <code>ConnectionString</code> property
<a href="#">MaxPoolSize</a>	Specifies the value corresponding to the Max Pool Size attribute in the <code>ConnectionString</code> property
<a href="#">MetadataPooling</a>	Specifies the value that corresponds to the Metadata Pooling attribute in the <code>ConnectionString</code> property
<a href="#">MinPoolSize</a>	Specifies the value corresponding to the Min Pool Size attribute in the <code>ConnectionString</code> property
<a href="#">Password</a>	Specifies the value corresponding to the Password attribute in the <code>ConnectionString</code> property
<a href="#">PersistSecurityInfo</a>	Specifies the value corresponding to the Persist Security Info attribute in the <code>ConnectionString</code> property
<a href="#">Pooling</a>	Specifies the value corresponding to the Pooling attribute in the <code>ConnectionString</code> property
<a href="#">ProxyPassword</a>	Specifies the value corresponding to the Proxy User Id attribute in the <code>ConnectionString</code> property
<a href="#">ProxyUserId</a>	Specifies the value corresponding to the Proxy User Id attribute in the <code>ConnectionString</code> property
<a href="#">SelfTuning</a>	Specifies the value corresponding to the Self Tuning attribute in the <code>ConnectionString</code> property
<a href="#">StatementCachePurge</a>	Specifies the value corresponding to the Statement Cache Purge attribute in the <code>ConnectionString</code> property
<a href="#">StatementCacheSize</a>	Specifies the value corresponding to the Statement Cache Size attribute in the <code>ConnectionString</code> property

**Table 7-57 (Cont.) OracleConnectionStringBuilder Public Properties**

Properties	Description
<a href="#">TnsAdmin</a>	Specifies the directory where ODP.NET can find its <code>sqlnet.ora</code> and <code>tnsnames.ora</code> configuration files
<a href="#">TokenAuthentication</a>	Specifies the value corresponding to the <code>token_auth</code> attribute in the <code>ConnectionString</code> property. This property is supported by managed ODP.NET and ODP.NET Core only.
<a href="#">TokenLocation</a>	Specifies the value corresponding to the <code>token_location</code> attribute in the <code>ConnectionString</code> property. This property is supported by managed ODP.NET and ODP.NET Core only.
<a href="#">UserID</a>	Specifies the value corresponding to the <code>User Id</code> attribute in the <code>ConnectionString</code> property
<a href="#">ValidateConnection</a>	Specifies the value corresponding to the <code>Validate Connection</code> attribute in the <code>ConnectionString</code> property
<a href="#">Values</a>	Specifies a collection of values contained in the <code>Connection String Builder</code>
<a href="#">WalletLocation</a>	Specifies the ODP.NET wallet directory

#### OracleConnectionStringBuilder Public Methods

`OracleConnectionStringBuilder` instance methods are listed in [Table 7-58](#).

**Table 7-58 OracleConnectionStringBuilder Public Methods**

Methods	Description
<code>Add</code>	Inherited from <code>System.Data.Common.DbConnectionStringBuilder</code>
<a href="#">Clear</a>	Clears the connection string contents
<a href="#">ContainsKey</a>	Indicates whether or not a specific attribute in the connection string is supported by ODP.NET
<code>EquivalentTo</code>	Inherited from <code>System.Data.Common.DbConnectionStringBuilder</code>
<a href="#">Remove</a>	Removes the entry corresponding to the specified attribute from the connection string
<code>ShouldSerialize</code>	Inherited from <code>System.Data.Common.DbConnectionStringBuilder</code>
<code>ToString</code>	Inherited from <code>System.Data.Common.DbConnectionStringBuilder</code>
<a href="#">TryGetValue</a>	Returns the value corresponding to the supplied attribute, as an output parameter

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)

## OracleConnectionStringBuilder Constructors

`OracleConnectionStringBuilder` constructors instantiate new instances of the `OracleConnectionStringBuilder` class.

**Overload List:**

- [OracleConnectionStringBuilder\(\)](#)  
This constructor instantiates a new instance of `OracleConnectionStringBuilder` class.
- [OracleConnectionStringBuilder\(string\)](#)  
This constructor instantiates a new instance of the `OracleConnectionStringBuilder` class with the provided connection string.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## OracleConnectionStringBuilder()

This constructor instantiates a new instance of the `OracleConnectionStringBuilder` class.

**Declaration**

```
// C#  
public OracleConnectionStringBuilder();
```

**Remarks**

The `ConnectionString` property is empty after the object is created.



**See Also:**

["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)

## OracleConnectionStringBuilder(string)

This constructor instantiates a new instance of the `OracleConnectionStringBuilder` class with the provided connection string.

### Declaration

```
// C#
public OracleConnectionStringBuilder(string connectionString);
```

### Parameters

- `connectionString`  
The connection information.

### Exceptions

`ArgumentNullException` - The `connectionString` parameter is null.

`ArgumentException` - The `connectionString` parameter is invalid.

### Remarks

The `ConnectionString` property of this instance is set to the supplied connection string.



**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## OracleConnectionStringBuilder Public Properties

`OracleConnectionStringBuilder` public properties are listed in [Table 7-59](#).

**Table 7-59 OracleConnectionStringBuilder Public Properties**

Properties	Description
<code>BrowsableConnectionString</code>	Inherited from <code>System.Data.Common.DbConnectionStringBuilder</code>
<a href="#">ConnectionLifeTime</a>	Specifies the value corresponding to the <code>Connection Lifetime</code> attribute in the <code>ConnectionString</code> property

Table 7-59 (Cont.) OracleConnectionStringBuilder Public Properties

Properties	Description
ConnectionString	Inherited from System.Data.Common.DbConnectionStringBuilder
ConnectionTimeout	Specifies the value corresponding to the Connection Timeout attribute in the ConnectionString property
ContextConnection	Specifies the value corresponding to the Context Connection attribute in the ConnectionString property
Count	Inherited from System.Data.Common.DbConnectionStringBuilder
DataSource	Specifies the value corresponding to the Data Source attribute in the ConnectionString property
DBAPrivilege	Specifies the value corresponding to the DBA Privilege attribute in the ConnectionString property
DecrPoolSize	Specifies the value corresponding to the Decr Pool Size attribute in the ConnectionString property
Enlist	Specifies the value corresponding to the Enlist attribute in the ConnectionString property
HAEvents	Specifies the value corresponding to the HA Events attribute in the ConnectionString property
IncrPoolSize	Specifies the value corresponding to the Incr Pool Size attribute in the ConnectionString property
IsFixedSize	Indicates whether or not the Connection String Builder has a fixed size
IsReadOnly	Inherited from System.Data.Common.DbConnectionStringBuilder
Item	Specifies the value associated with the specified attribute
Keys	Specifies a collection of attributes contained in the Connection String Builder
LoadBalancing	Specifies the value corresponding to the Load Balancing attribute in the ConnectionString property
MaxPoolSize	Specifies the value corresponding to the Max Pool Size attribute in the ConnectionString property
MetadataPooling	Specifies the value that corresponds to the Metadata Pooling attribute in the ConnectionString property
MinPoolSize	Specifies the value corresponding to the Min Pool Size attribute in the ConnectionString property
Password	Specifies the value corresponding to the Password attribute in the ConnectionString property
PersistSecurityInfo	Specifies the value corresponding to the Persist Security Info attribute in the ConnectionString property
Pooling	Specifies the value corresponding to the Pooling attribute in the ConnectionString property

Table 7-59 (Cont.) OracleConnectionStringBuilder Public Properties

Properties	Description
<a href="#">ProxyPassword</a>	Specifies the value corresponding to the Proxy User Id attribute in the ConnectionString property
<a href="#">ProxyUserId</a>	Specifies the value corresponding to the Proxy User Id attribute in the ConnectionString property
<a href="#">SelfTuning</a>	Specifies the value corresponding to the Self Tuning attribute in the ConnectionString property
<a href="#">StatementCachePurge</a>	Specifies the value corresponding to the Statement Cache Purge attribute in the ConnectionString property
<a href="#">StatementCacheSize</a>	Specifies the value corresponding to the Statement Cache Size attribute in the ConnectionString property
<a href="#">TnsAdmin</a>	Specifies the directory where ODP.NET can find its sqlnet.ora and tnsnames.ora configuration files
<a href="#">TokenAuthentication</a>	Specifies the value corresponding to the token_auth attribute in the ConnectionString property. This property is supported by managed ODP.NET and ODP.NET Core only.
<a href="#">TokenLocation</a>	Specifies the value corresponding to the token_location attribute in the ConnectionString property. This property is supported by managed ODP.NET and ODP.NET Core only.
<a href="#">UserID</a>	Specifies the value corresponding to the User Id attribute in the ConnectionString property
<a href="#">ValidateConnection</a>	Specifies the value corresponding to the Validate Connection attribute in the ConnectionString property
<a href="#">Values</a>	Specifies a collection of values contained in the Connection String Builder
<a href="#">WalletLocation</a>	Specifies the ODP.NET wallet directory

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## ConnectionLifeTime

This property specifies the value corresponding to the Connection LifeTime attribute in the ConnectionString property.

**Declaration**

```
// C#  
public int ConnectionLifeTime{get; set;}
```

**Property Value**

An `int` that represents the value of the supplied attribute.

**Exceptions**

`OracleException` - The specified value is less than zero.

**Remarks**

When an `OracleConnectionStringBuilder` instance is created, this property is set to the default value of the corresponding connection string attribute.

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## ConnectionTimeout

This property specifies the value corresponding to the `Connection Timeout` attribute in the `ConnectionString` property.

**Declaration**

```
// C#  
public int ConnectionTimeout{get; set;}
```

**Property Value**

An `int` that represents the value of the supplied attribute.

**Exceptions**

`OracleException` - The specified value is less than zero.

**Remarks**

When an `OracleConnectionStringBuilder` instance is created, this property is set to the default value of the corresponding connection string attribute.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## ContextConnection

This property specifies the value corresponding to the `Context Connection` attribute in the `ConnectionString` property.

### Declaration

```
// C#  
public bool ContextConnection {get; set;}
```

### Property Value

A `bool` that represents the value of the supplied attribute.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## DataSource

This property specifies the value corresponding to the `Data Source` attribute in the `ConnectionString` property.

### Declaration

```
// C#  
public string DataSource {get; set;}
```

### Property Value

A string that represents the value of the supplied attribute.

### Exceptions

`ArgumentNullException` - The specified value is null.

## Remarks

When an `OracleConnectionStringBuilder` instance is created, this property is set to the default value of the corresponding connection string attribute.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## DBAPrivilege

This property specifies the value corresponding to the `DBA Privilege` attribute in the `ConnectionString` property.

### Declaration

```
// C#  
public string DBAPrivilege{get; set;}
```

### Property Value

A string that represents the value of the supplied attribute.

Possible values are `SYSDBA`, `SYSASM`, `SYSOPER`, `SYSBACKUP`, `SYSDG`, `SYSKM`, or `SYSRAC`.

### Exceptions

`ArgumentNullException` - The specified value is null.

`OracleException` - The specified value is invalid.

### Remarks

When an `OracleConnectionStringBuilder` instance is created, this property is set to the default value of the corresponding connection string attribute.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## DecrPoolSize

This property specifies the value corresponding to the `Decr Pool Size` attribute in the `ConnectionString` property.

### Declaration

```
// C#  
public int DecrPoolSize{get; set;}
```

### Property Value

An `int` that represents the value of the supplied attribute.

### Exceptions

`OracleException` - The specified value is less than 1.

### Remarks

When an `OracleConnectionStringBuilder` instance is created, this property is set to the default value of the corresponding connection string attribute.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## Enlist

This property specifies the value corresponding to the `Enlist` attribute in the `ConnectionString` property.

### Declaration

```
// C#  
public string Enlist{get; set;};
```

### Property Value

A string that represents the value of the supplied attribute. Values are case-insensitive. Possible values are: `dynamic`, `true`, `false`, `yes`, and `no`.

### Exceptions

`ArgumentNullException` - The specified value is null.

`OracleException` - The supplied value is not one of following: `dynamic`, `true`, `false`, `yes`, or `no`.

### Remarks

When an `OracleConnectionStringBuilder` instance is created, this property is set to the default value of the corresponding connection string attribute.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## HAEvents

This property specifies the value corresponding to the `HA Events` attribute in the `ConnectionString` property.

### Declaration

```
// C#  
public bool HAEvents{get; set;}
```

### Property Value

A `bool` that represents the value of the supplied attribute.

### Remarks

When an `OracleConnectionStringBuilder` instance is created, this property is set to the default value of the corresponding connection string attribute.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## IncrPoolSize

This property specifies the value corresponding to the `Incr Pool Size` attribute in the `ConnectionString` property.

### Declaration

```
// C#  
public int IncrPoolSize{get; set;}
```

### Property Value

An `int` that represents the value of the supplied attribute.

### Exceptions

`OracleException` - The specified value is less than 1.

### Remarks

When an `OracleConnectionStringBuilder` instance is created, this property is set to the default value of the corresponding connection string attribute.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## IsFixedSize

Indicates whether or not the Connection String Builder has a fixed size.

### Declaration

```
// C#  
public override bool IsFixedSize{get;}
```

### Property Value

Returns `true` if the Connection String Builder has a fixed size; otherwise, returns `false`.

### Remarks

Attributes cannot be added or removed. They can only be modified for connection strings with a fixed size.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## Item

This property specifies the value associated with the specified attribute.

### Declaration

```
// C#  
public override object this[string keyword]{get; set;}
```

### Property Value

An object value corresponding to the attribute.

### Exceptions

`ArgumentNullException` - The specified attribute is null.

`OracleException` - The specified attribute is not supported or the specified value is invalid.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## Keys

This property specifies a collection of attributes contained in the Connection String Builder.

### Declaration

```
// C#  
public override ICollection Keys{get;}
```

### Property Value

Returns an `ICollection` that represents the attributes in the Connection String Builder.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## LoadBalancing

This property specifies the value corresponding to the `Load Balancing` attribute in the `ConnectionString` property.

### Declaration

```
// C#  
public bool LoadBalancing {get; set;}
```

### Property Value

A `bool` that contains the value of the supplied attribute.

### Remarks

When an `OracleConnectionStringBuilder` instance is created, this property is set to the default value of the corresponding connection string attribute.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## MaxPoolSize

This property specifies the value corresponding to the `Max Pool Size` attribute in the `ConnectionString` property.

### Declaration

```
// C#  
public int MaxPoolSize{get; set;}
```

### Property Value

An `int` that represents the value of the supplied attribute.

## Exceptions

OracleException - The specified value is less than 1.

## Remarks

When an `OracleConnectionStringBuilder` instance is created, this property is set to the default value of the corresponding connection string attribute.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## MetadataPooling

This property specifies the value that corresponds to the `Metadata Pooling` attribute in the `ConnectionString` property.

## Declaration

```
// C#  
public bool MetadataPooling { get; set; }
```

## Property Value

A `bool` containing the value of the supplied attribute.

## Remarks

When an `OracleConnectionStringBuilder` instance is created, this property is set to the default value of the corresponding connection string attribute.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## MinPoolSize

This property specifies the value corresponding to the `Min Pool Size` attribute in the `ConnectionString` property.

**Declaration**

```
// C#  
public int MinPoolSize{get; set;}
```

**Property Value**

An `int` that contains the value of the supplied attribute.

**Exceptions**

`OracleException` - The specified value is less than 0.

**Remarks**

When an `OracleConnectionStringBuilder` instance is created, this property is set to the default value of the corresponding connection string attribute.

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## Password

This property specifies the value corresponding to the `Password` attribute in the `ConnectionString` property.

**Declaration**

```
// C#  
public string Password{get; set;}
```

**Property Value**

A string that contains the value of the supplied attribute.

**Exception**

`ArgumentNullException` - The specified value is null.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## PersistSecurityInfo

This property specifies the value corresponding to the `Persist Security Info` attribute in the `ConnectionString` property.

### Declaration

```
// C#  
public bool PersistSecurityInfo {get; set;}
```

### Property Value

A `bool` that represents the value of the supplied attribute.

### Remarks

When an `OracleConnectionStringBuilder` instance is created, this property gets set to the default value of the corresponding connection string attribute.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## Pooling

This property specifies the value corresponding to the `Pooling` attribute in the `ConnectionString` property.

### Declaration

```
// C#  
public bool Pooling {get; set;}
```

### Property Value

A `bool` that represents the value of the supplied attribute.

## Remarks

When an `OracleConnectionStringBuilder` instance is created, this property is set to the default value of the corresponding connection string attribute.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## ProxyPassword

This property specifies the value corresponding to the `Proxy Password` attribute in the `ConnectionString` property.

### Declaration

```
// C#  
public string ProxyPassword {get; set;}
```

### Property Value

A string that represents the value of the supplied attribute.

### Exception

`ArgumentNullException` - The specified value is null.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## ProxyUserId

This property specifies the value corresponding to the `Proxy User Id` attribute in the `ConnectionString` property.

### Declaration

```
// C#  
public string ProxyUserId {get; set;}
```

### Property Value

A string that represents the value of the supplied attribute.

### Exception

`ArgumentNullException` - The specified value is null.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## SelfTuning

This property specifies the value corresponding to the `Self Tuning` attribute in the `ConnectionString` property.

### Declaration

```
// C#  
public bool SelfTuning {get; set;}
```

### Property Value

A `bool` that represents the value of the supplied attribute.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## StatementCachePurge

This property specifies the value corresponding to the `Statement Cache Purge` attribute in the `ConnectionString` property.

### Declaration

```
// C#  
public bool StatementCachePurge {get; set;}
```

### Property Value

A `bool` that represents the value of the supplied attribute.

### Remarks

When an `OracleConnectionStringBuilder` instance is created, this property is set to the default value of the corresponding connection string attribute.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## StatementCacheSize

This property specifies the value corresponding to the `Statement Cache Size` attribute in the `ConnectionString` property.

### Declaration

```
// C#  
public int StatementCacheSize{get; set;}
```

### Property Value

An `int` that represents the value of the supplied attribute.

### Exceptions

`OracleException` - The specified value is less than zero.

### Remarks

When an `OracleConnectionStringBuilder` instance is created, this property is set to the default value of the corresponding connection string attribute.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## TnsAdmin

This property specifies the directory where ODP.NET can find its `sqlnet.ora` and `tnsnames.ora` configuration files.

### Declaration

```
// C#  
public string TnsAdmin{get; set;}
```

### Property Value

A string that represents the value of the supplied attribute.

### Remarks

The default value is an empty string.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## TokenAuthentication

This property specifies the value corresponding to the `token_auth` attribute in the `ConnectionString`.

### Declaration

```
// C#  
public OracleTokenAuth TokenAuthentication { get; set; }
```

### Property Value

An `OracleTokenAuth` value.

### Exceptions

None.

### Remarks

When an `OracleConnectionStringBuilder` instance is created, this property is set to the default value of the corresponding connection string attribute.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## TokenLocation

This property specifies the value corresponding to the `token_location` attribute in the `ConnectionString` property.

### Declaration

```
// C#  
public string TokenLocation { get; set; }
```

### Property Value

A string that represents the value of the supplied attribute.

### Exceptions

None.

### Remarks

When an `OracleConnectionStringBuilder` instance is created, this property is set to the default value of the corresponding connection string attribute.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## UserID

This property specifies the value corresponding to the `User Id` attribute in the `ConnectionString` property.

### Declaration

```
// C#  
public string UserID { get; set; }
```

### Property Value

A string that represents the value of the supplied attribute.

### Exception

`ArgumentNullException` - The specified value is null.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## ValidateConnection

This property specifies the value corresponding to the `ValidateConnection` attribute in the `ConnectionString` property.

### Declaration

```
// C#  
public bool ValidateConnection { get; set; }
```

### Property Value

A `bool` that represents the value of the supplied attribute.

### Remarks

When an `OracleConnectionStringBuilder` instance is created, this property is set to the default value of the corresponding connection string attribute.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## Values

This property specifies a collection of values contained in the Connection String Builder.

**Declaration**

```
// C#  
public override ICollection Values{get;}
```

**Property Value**

Returns an `ICollection` that represents the values in the Connection String Builder.

**Remarks**

The order of the values in the `ICollection` is unspecified, but is the same as the associated attributes in the `ICollection` returned by the `Keys` property.

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## WalletLocation

This property specifies the ODP.NET wallet directory.

**Declaration**

```
// C#  
public string WalletLocation{get; set;}
```

**Property Value**

A string that represents the value of the supplied attribute.

**Remarks**

The default value is an empty string.

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## OracleConnectionStringBuilder Public Methods

OracleConnectionStringBuilder public methods are listed in [Table 7-60](#).

**Table 7-60 OracleConnectionStringBuilder Public Methods**

Methods	Description
Add	Inherited from System.Data.Common.DbConnectionStringBuilder
<a href="#">Clear</a>	Clears the connection string contents
<a href="#">ContainsKey</a>	Indicates whether or not a specific attribute in the connection string is supported by ODP.NET
EquivalentTo	Inherited from System.Data.Common.DbConnectionStringBuilder
<a href="#">Remove</a>	Removes the entry corresponding to the specified attribute from the connection string
ShouldSerialize	Inherited from System.Data.Common.DbConnectionStringBuilder
ToString	Inherited from System.Data.Common.DbConnectionStringBuilder
<a href="#">TryGetValue</a>	Returns the value corresponding to the supplied attribute, as an output parameter



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## Clear

This method clears the connection string contents.

### Declaration

```
// C#  
public override void Clear();
```

### Remarks

All key/value pairs are removed from the OracleConnectionStringBuilder object and the ConnectionString property is set to Empty.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## ContainsKey

This method indicates whether or not a specific attribute in the connection string is supported by ODP.NET.

### Declaration

```
// C#  
public override bool ContainsKey(string keyword);
```

### Parameters

- *keyword*  
The attribute being verified.

### Return Value

Returns `true` if the specified attribute exists; otherwise, returns `false`.

### Exceptions

`ArgumentNullException` - The specified attribute is null.

### Remarks

This method indicates if the attribute is part of the provider-supported attributes. It does not indicate if the user added the attribute to the connection string.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## Remove

This method removes the entry corresponding to the specified attribute from the connection string.

## Declaration

```
// C#  
public override bool Remove(string keyword);
```

## Parameters

- *keyword*

The attribute that specifies the entry to be removed.

## Return Value

Returns `true` if the attribute existed in the connection string and the corresponding entry was removed; otherwise, returns `false`.

## Exceptions

`ArgumentNullException` - The specified attribute is null.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## TryGetValue

This method returns the value corresponding to the supplied attribute, as an output parameter.

## Declaration

```
// C#  
public override bool TryGetValue(string keyword, out object value);
```

## Parameters

- *keyword*

The attribute for which the value is being retrieved.

- *value*

The value of the supplied attribute.

Sets *value* to the default value if the attribute is not present in the connection string.

### Return Value

Returns `true` if the value that corresponds to the attribute has been successfully retrieved; otherwise, returns `false`. If the attribute is not present in the connection string, returns `false` and sets the `value` to null.

### Exceptions

`ArgumentNullException` - The specified attribute is null.

### Remarks

If the function returns `false`, sets `value` to null.

If the attribute is not present in the connection string, sets `value` to the default value.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleConnectionStringBuilder Class](#)
- [OracleConnectionStringBuilder Members](#)

## OracleCredential Class

`OracleCredential` class provides a secure way to provide password while opening connection with Oracle Database using the ODP.NET driver. Use this class to avoid providing passwords in clear text in the connection string while opening a connection with Oracle Database. One can pass user id, password and DBA Privilege specific attributes through `OracleCredential` constructors and thus these attributes do not need to be in the connection string.

Operating system authenticated and context connections are not supported through `OracleCredential` class. An `ArgumentException` will be thrown if `"/` is passed for `userId` or `proxyUserId` arguments of `OracleCredential` constructor.

### Class Inheritance

`System.Object`

`Oracle.DataAccess.Client.OracleCredential`

### Declaration

```
// C#  
public sealed class OracleCredential
```

## Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

## Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

## Example

```
// C#
using System;
using System.Data;
using System.Security;
using Oracle.DataAccess.Client;
//using Oracle.ManagedDataAccess.Client;

class OracleCredentialSample
{
    static void Main()
    {
        // Connect
        string constr = "Data Source=oracle";

        SecureString secPwd = new SecureString();
        secPwd.AppendChar('h');
        secPwd.AppendChar('r');

        // Make the password read-only.
        secPwd.MakeReadOnly();

        // Create OracleCredential with userid and secure password.
        OracleCredential oc = new OracleCredential("hr", secPwd);

        OracleConnection con = new OracleConnection(constr, oc);
        con.Open();

        // Execute a SQL SELECT

        OracleCommand cmd = con.CreateCommand();
        cmd.CommandText = "select * from employees";

        OracleDataReader reader = cmd.ExecuteReader();

        // Print all employee numbers
        while (reader.Read())
```

```

        Console.WriteLine(reader.GetInt32(0));

        // Clean up
        reader.Dispose();
        cmd.Dispose();
        con.Dispose();
    }
}

```

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCredential Members](#)
- [OracleCredential Constructors](#)
- [OracleCredential Properties](#)
- [Connection Pooling with OracleCredential](#)

## OracleCredential Members

OracleCredential members are listed in the following tables.

### OracleCredential Constructors

OracleCredential constructors are listed in [Table 7-61](#).

**Table 7-61 OracleCredential Constructors**

Constructor	Description
<a href="#">OracleCredential Constructors</a>	Instantiates a new instance of OracleCredential class (Overloaded)

### OracleCredential Properties

OracleCredential properties are listed in [Table 7-62](#).

**Table 7-62 OracleCredential Properties**

Property	Description
<a href="#">DBAPrivilege</a>	Returns the DBA Privilege used to create the OracleCredential object. OracleDBAPrivilege.None is returned if it was not provided by the user.
<a href="#">Password</a>	Returns the password of the OracleCredential object
<a href="#">ProxyPassword</a>	Returns the proxy user password of the OracleCredential object
<a href="#">ProxyUserId</a>	Returns the proxy user id of the OracleCredential object

**Table 7-62 (Cont.) OracleCredential Properties**

Property	Description
<a href="#">UserId</a>	Returns the user id of the OracleCredential object

**OracleCredential Public Methods**

OracleCredential public methods are listed in [Table 7-68](#).

**Table 7-63 OracleCredential Public Methods**

Public Method	Description
<code>Equals (Object)</code>	Inherited from <code>System.Object</code>
<code>GetHashCode ()</code>	Inherited from <code>System.Object</code>
<code>GetType ()</code>	Inherited from <code>System.Object</code>
<code>ToString ()</code>	Inherited from <code>System.Object</code>

## OracleCredential Constructors

OracleCredential constructors instantiate new instances of an OracleCredential class.

**Overload List:**

- [OracleCredential\(string, SecureString\)](#)  
This constructor creates an OracleCredential object with the user id and the secured password.
- [OracleCredential\(string, SecureString, OracleDBAPrivilege\)](#)  
This constructor creates an OracleCredential object with the user id, the secured password, and the DBA privilege request.
- [OracleCredential\(string, SecureString, string, SecureString\)](#)  
This constructor creates an OracleCredential object with the user id and the secured password for the end user, as well as the user id and the secured password for the proxy user.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCredential Class](#)
- [OracleCredential Members](#)

## OracleCredential(string, SecureString)

This constructor creates an `OracleCredential` object with the user id and the secured password.

### Declaration

```
// C#  
public OracleCredential(string userId, SecureString password)
```

### Exceptions

- `ArgumentNullException` is raised if any parameters are passed as null.
- `ArgumentException` is raised if "/" is passed for `userId` argument.
- `ArgumentException` is raised if the `SecureString` containing the password is not read-only.
- `InvalidOperationException` is raised when `OracleCredential` object is used with any of user id, password, proxy user id, proxy password and/or dba privilegeconnection string attribute(s) present in the connection string.

### Remarks

With this constructor, `OracleDBAPrivilege.None` is used for the DBA privilege when requesting for a connection.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCredential Class](#)
- [OracleCredential Members](#)

## OracleCredential(string, SecureString, OracleDBAPrivilege)

This constructor creates an `OracleCredential` object with the user id, the secured password, and the DBA privilege request.

### Declaration

```
// C#  
public OracleCredential(string userId, SecureString password, OracleDBAPrivilege dbaprivilege)
```

### Exceptions

- `ArgumentNullException` is raised if any parameters are passed as null.
- `ArgumentException` is raised if "/" is passed for `userId` argument.

- `ArgumentException` is raised if the `SecureString` containing the password is not read-only.
- `InvalidOperationException` is raised when `OracleCredential` object is used with any of `user id`, `password`, `proxy user id`, `proxy password` and/or `dba privilegeconnection string` attribute(s) present in the connection string.

### Remarks

With this constructor, the specified `dbaprivilege` is for the DBA privilege when requesting for a connection.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataAdapter Class](#)
- [OracleDataAdapter Members](#)
- [OracleDBAPrivilege Enumeration](#)

## OracleCredential(string, SecureString, string, SecureString)

This constructor creates an `OracleCredential` object with the user id and the secured password for the end user, as well as the user id and the secured password for the proxy user.

### Declaration

```
// C#  
public OracleCredential(string userId, SecureString password, string  
proxyUserId, SecureString proxyPassword)
```

### Exceptions

- `ArgumentNullException` is raised if any parameters are passed as null.
- `ArgumentException` is raised if "/" is passed for `userId` argument.
- `ArgumentException` is raised if the `SecureString` containing the password is not read-only.
- `InvalidOperationException` is raised when `OracleCredential` object is used with any of `user id`, `password`, `proxy user id`, `proxy password` and/or `dba privilegeconnection string` attribute(s) present in the connection string.

### Remarks

With this constructor, `OracleDBAPrivilege.None` is for the DBA privilege when requesting for a connection.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCredential Class](#)
- [OracleCredential Members](#)

## OracleCredential Properties

OracleCredential properties are listed in [Table 7-64](#).

**Table 7-64 OracleCredential Properties**

Property	Description
DBAPrivilege	Returns the DBA Privilege used to create the OracleCredential object. OracleDBAPrivilege.None is returned if it was not provided by the user.
Password	Returns the password of the OracleCredential object.
ProxyPassword	Returns the proxy user password of the OracleCredential object.
ProxyUserId	Returns the proxy user id of the OracleCredential object.
UserId	Returns the user id of the OracleCredential object.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCredential Class](#)
- [OracleCredential Members](#)

## DBAPrivilege

This property returns the DBA Privilege that is associated with the user.

### Declaration

```
// C#
OracleDBAPrivilege DBAPrivilege { get; }
```

### Property Value

The OracleDBAPrivilege enum value that is associated with the user.

## Remarks

OracleDBAPrivilege.None is returned if it was not set by the user.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCredential Class](#)
- [OracleCredential Members](#)
- [OracleDBAPrivilege Enumeration](#)

## Password

This property returns the encrypted password of the user.

### Declaration

```
// C#  
SecureString Password { get; }
```

### Property Value

The encrypted password of the user.

OracleCredential does not support double quotes around a SecureString password. Double quotes can be used within a password, however.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCredential Class](#)
- [OracleCredential Members](#)

## ProxyPassword

This property returns the encrypted password of the proxy user.

### Declaration

```
// C#  
SecureString ProxyUserPassword { get; }
```

### Property Value

The encrypted password of the proxy user.

### Remarks

OracleCredential does not support double quotes around a SecureString password. Double quotes can be used within a password, however.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCredential Class](#)
- [OracleCredential Members](#)

## ProxyUserId

This property returns the proxy user id.

### Declaration

```
// C#  
string ProxyUserId { get; }
```

### Property Value

The proxy user id.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCredential Class](#)
- [OracleCredential Members](#)

## UserId

This property returns the user id.

### Declaration

```
// C#  
string UserId { get; }
```

### Property Value

The user id.

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCredential Class](#)
- [OracleCredential Members](#)

## OracleDataAdapter Class

An `OracleDataAdapter` object represents a data provider object that populates the `DataSet` and updates changes in the `DataSet` to the Oracle database.

### Class Inheritance

`System.Object``System.MarshalByRefObject``System.ComponentModel.Component``System.Data.Common.DataAdapter``System.Data.Common.DbDataAdapter``Oracle.DataAccess.Client.OracleDataAdapter`

### Declaration

```
// C#
public sealed class OracleDataAdapter : DbDataAdapter, IDbDataAdapter
```

### Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

### Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

## Example

The following example uses the `OracleDataAdapter` and the dataset to update the `EMP` table:

```
// C#

using System;
using System.Data;
using Oracle.DataAccess.Client;

class OracleDataAdapterSample
{
    static void Main()
    {
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        string cmdstr = "SELECT empno, sal from emp";

        // Create the adapter with the selectCommand txt and the
        // connection string
        OracleDataAdapter adapter = new OracleDataAdapter(cmdstr, constr);

        // Create the builder for the adapter to automatically generate
        // the Command when needed
        OracleCommandBuilder builder = new OracleCommandBuilder(adapter);

        // Create and fill the DataSet using the EMP
        DataSet dataset = new DataSet();
        adapter.Fill(dataset, "EMP");

        // Get the EMP table from the dataset
        DataTable table = dataset.Tables["EMP"];

        // Indicate DataColumn EMPNO is unique
        // This is required by the OracleCommandBuilder to update the EMP table
        table.Columns["EMPNO"].Unique = true;

        // Get the first row from the EMP table
        DataRow row = table.Rows[0];

        // Update the salary
        double sal = double.Parse(row["SAL"].ToString());
        row["SAL"] = sal + .01;

        // Now update the EMP using the adapter
        // The OracleCommandBuilder will create the UpdateCommand for the
        // adapter to update the EMP table
        adapter.Update(dataset, "EMP");

        Console.WriteLine("Row updated successfully");
    }
}
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataAdapter Members](#)
- [OracleDataAdapter Constructors](#)
- [OracleDataAdapter Static Methods](#)
- [OracleDataAdapter Properties](#)
- [OracleDataAdapter Public Methods](#)
- [OracleDataAdapter Events](#)

## OracleDataAdapter Members

OracleDataAdapter members are listed in the following tables.

### OracleDataAdapter Constructors

OracleDataAdapter constructors are listed in [Table 7-65](#).

**Table 7-65 OracleDataAdapter Constructors**

Constructor	Description
<a href="#">OracleDataAdapter Constructors</a>	Instantiates a new instance of OracleDataAdapter class (Overloaded)

### OracleDataAdapter Static Methods

The OracleDataAdapter static method is listed in [Table 7-66](#).

**Table 7-66 OracleDataAdapter Static Method**

Method	Description
Equals	Inherited from System.Object (Overloaded)

### OracleDataAdapter Properties

OracleDataAdapter properties are listed in [Table 7-67](#).

**Table 7-67 OracleDataAdapter Properties**

Property	Description
AcceptChangesDuringFill	Inherited from System.Data.Common.DataAdapter
Container	Inherited from System.ComponentModel.Component
ContinueUpdateOnError	Inherited from System.Data.Common.DataAdapter

Table 7-67 (Cont.) OracleDataAdapter Properties

Property	Description
<a href="#">DeleteCommand</a>	A SQL statement or stored procedure to delete rows from an Oracle database
<a href="#">IdentityInsert</a>	Determines whether or not to insert identity column values in the <code>DataSet</code> into the database when the <code>Update</code> method is invoked. <i>Not Available in the ODP.NET, Managed Driver and ODP.NET Core</i>
<a href="#">IdentityUpdate</a>	Determines whether or not to update identity column values in the <code>DataSet</code> into the database when the <code>Update</code> method is invoked. <i>Not Available in the ODP.NET, Managed Driver and ODP.NET Core</i>
<a href="#">InsertCommand</a>	A SQL statement or stored procedure to insert new rows into an Oracle database
<code>MissingMappingAction</code>	Inherited from <code>System.Data.Common.DataAdapter</code>
<code>MissingSchemaAction</code>	Inherited from <code>System.Data.Common.DataAdapter</code>
<a href="#">Requery</a>	Determines whether or not the <code>SelectCommand</code> is reexecuted on the next call to <code>Fill</code>
<a href="#">ReturnProviderSpecificTypes</a>	Determines if the <code>Fill</code> method returns ODP.NET-specific values or .NET common language specification values
<a href="#">SafeMapping</a>	Creates a mapping between column names in the result set to .NET types, to preserve the data <i>Not Available in the ODP.NET, Managed Driver and ODP.NET Core</i>
<a href="#">SelectCommand</a>	A SQL statement or stored procedure that returns a single or multiple result set
<code>Site</code>	Inherited from <code>System.ComponentModel.Component</code>
<a href="#">SuppressGetDecimalInvalidCastException</a>	Specifies whether to suppress the <code>InvalidCastException</code> and return a rounded-off 28 or 29 precision Oracle <code>NUMBER</code> value that can be represented as a .NET decimal.
<code>TableMappings</code>	Inherited from <code>System.Data.Common.DataAdapter</code>
<a href="#">UpdateBatchSize</a>	Specifies a value that enables or disables batch processing support, and specifies the number of SQL statements that can be executed in a single round-trip to the database
<a href="#">UpdateCommand</a>	A SQL statement or stored procedure to update rows from the <code>DataSet</code> to an Oracle database

**OracleDataAdapter Public Methods**

OracleDataAdapter public methods are listed in [Table 7-68](#).

**Table 7-68 OracleDataAdapter Public Methods**

Public Method	Description
CreateObjRef	Inherited from <code>System.MarshalByRefObject</code>
Dispose	Inherited from <code>System.ComponentModel.Component</code>
Equals	Inherited from <code>System.Object</code> (Overloaded)
Fill	Adds or refreshes rows in the <code>DataSet</code> to match the data in the Oracle database (Overloaded)
FillSchema	Inherited from <code>System.Data.Common.DbDataAdapter</code>
GetFillParameters	Inherited from <code>System.Data.Common.DbDataAdapter</code>
GetHashCode	Inherited from <code>System.Object</code>
GetLifetimeService	Inherited from <code>System.MarshalByRefObject</code>
GetType	Inherited from <code>System.Object</code>
InitializeLifetimeService	Inherited from <code>System.MarshalByRefObject</code>
ToString	Inherited from <code>System.Object</code>
Update	Inherited from <code>System.Data.Common.DbDataAdapter</code>

**OracleDataAdapter Events**

OracleDataAdapter events are listed in [Table 7-69](#).

**Table 7-69 OracleDataAdapter Events**

Event Name	Description
Disposed	Inherited from <code>System.ComponentModel.Component</code>
FillError	Inherited from <code>System.Data.Common.DbDataAdapter</code>
RowUpdated	This event is raised when row(s) have been updated by the <code>Update()</code> method
RowUpdating	This event is raised when row data are about to be updated to the database

## OracleDataAdapter Constructors

OracleDataAdapter constructors create new instances of an OracleDataAdapter class.

**Overload List:**

- [OracleDataAdapter\(\)](#)  
This constructor creates an instance of an OracleDataAdapter class.
- [OracleDataAdapter\(OracleCommand\)](#)

This constructor creates an instance of an `OracleDataAdapter` class with the provided `OracleCommand` as the `SelectCommand`.

- [OracleDataAdapter\(string, OracleConnection\)](#)

This constructor creates an instance of an `OracleDataAdapter` class with the provided `OracleConnection` object and the command text for the `SelectCommand`.

- [OracleDataAdapter\(string, string\)](#)

This constructor creates an instance of an `OracleDataAdapter` class with the provided connection string and the command text for the `SelectCommand`.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataAdapter Class](#)
- [OracleDataAdapter Members](#)

## OracleDataAdapter()

This constructor creates an instance of an `OracleDataAdapter` class with no arguments.

### Declaration

```
// C#  
public OracleDataAdapter();
```

### Remarks

Initial values are set for the following `OracleDataAdapter` properties as indicated:

- `MissingMappingAction = MissingMappingAction.Passthrough`
- `MissingSchemaAction = MissingSchemaAction.Add`

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataAdapter Class](#)
- [OracleDataAdapter Members](#)

## OracleDataAdapter(OracleCommand)

This constructor creates an instance of an `OracleDataAdapter` class with the provided `OracleCommand` as the `SelectCommand`.

### Declaration

```
// C#  
public OracleDataAdapter(OracleCommand selectCommand);
```

### Parameters

- *selectCommand*

The `OracleCommand` that is to be set as the `SelectCommand` property.

### Remarks

Initial values are set for the following `OracleDataAdapter` properties as indicated:

- `MissingMappingAction` = `MissingMappingAction.Passthrough`
- `MissingSchemaAction` = `MissingSchemaAction.Add`



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataAdapter Class](#)
- [OracleDataAdapter Members](#)

## OracleDataAdapter(string, OracleConnection)

This constructor creates an instance of an `OracleDataAdapter` class with the provided `OracleConnection` object and the command text for the `SelectCommand`.

### Declaration

```
// C#  
public OracleDataAdapter(string selectCommandText, OracleConnection  
    selectConnection);
```

### Parameters

- *selectCommandText*

The string that is set as the `CommandText` of the `SelectCommand` property of the `OracleDataAdapter`.

- *selectConnection*

The `OracleConnection` to connect to the Oracle database.

### Remarks

The `OracleDataAdapter` opens and closes the connection, if it is not already open. If the connection is open, it must be explicitly closed.

Initial values are set for the following `OracleDataAdapter` properties as indicated:

- `MissingMappingAction = MissingMappingAction.Passthrough`
- `MissingSchemaAction = MissingSchemaAction.Add`

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataAdapter Class](#)
- [OracleDataAdapter Members](#)

## OracleDataAdapter(string, string)

This constructor creates an instance of an `OracleDataAdapter` class with the provided connection string and the command text for the `SelectCommand`.

### Declaration

```
// C#  
public OracleDataAdapter(string selectCommandText, string  
    selectConnectionString);
```

### Parameters

- `selectCommandText`  
The string that is set as the `CommandText` of the `SelectCommand` property of the `OracleDataAdapter`.
- `selectConnectionString`  
The connection string.

### Remarks

Initial values are set for the following `OracleDataAdapter` properties as indicated:

- `MissingMappingAction = MissingMappingAction.Passthrough`
- `MissingSchemaAction = MissingSchemaAction.Add`

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataAdapter Class](#)
- [OracleDataAdapter Members](#)

## OracleDataAdapter Static Methods

The `OracleDataAdapter` static method is listed in [Table 7-70](#).

**Table 7-70 OracleDataAdapter Static Method**

Method	Description
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataAdapter Class](#)
- [OracleDataAdapter Members](#)

## OracleDataAdapter Properties

`OracleDataAdapter` properties are listed in [Table 7-71](#).

**Table 7-71 OracleDataAdapter Properties**

Property	Description
<code>AcceptChangesDuringFill</code>	Inherited from <code>System.Data.Common.DataAdapter</code>
<code>Container</code>	Inherited from <code>System.ComponentModel.Component</code>
<code>ContinueUpdateOnError</code>	Inherited from <code>System.Data.Common.DataAdapter</code>
<a href="#">DeleteCommand</a>	A SQL statement or stored procedure to delete rows from an Oracle database
<a href="#">IdentityInsert</a>	Determines whether or not to insert identity column values in the <code>DataSet</code> into the database when the <code>Update</code> method is invoked. <i>Not Available in the ODP.NET, Managed Driver and ODP.NET Core</i>
<a href="#">IdentityUpdate</a>	Determines whether or not to update identity column values in the <code>DataSet</code> into the database when the <code>Update</code> method is invoked. <i>Not Available in the ODP.NET, Managed Driver and ODP.NET Core</i>
<a href="#">InsertCommand</a>	A SQL statement or stored procedure to insert new rows into an Oracle database
<code>MissingMappingAction</code>	Inherited from <code>System.Data.Common.DataAdapter</code>
<code>MissingSchemaAction</code>	Inherited from <code>System.Data.Common.DataAdapter</code>

Table 7-71 (Cont.) OracleDataAdapter Properties

Property	Description
<a href="#">Requery</a>	Determines whether or not the <code>SelectCommand</code> is reexecuted on the next call to <code>Fill</code>
<a href="#">ReturnProviderSpecificTypes</a>	Determines if the <code>Fill</code> method returns ODP.NET-specific values or .NET common language specification values
<a href="#">SafeMapping</a>	Creates a mapping between column names in the result set to .NET types, to preserve the data <i>Not Available in ODP.NET, Managed Driver and ODP.NET Core</i>
<a href="#">SelectCommand</a>	A SQL statement or stored procedure that returns a single or multiple result set
<code>Site</code>	Inherited from <code>System.ComponentModel.Component</code>
<a href="#">SuppressGetDecimalInvalidCastException</a>	Specifies whether to suppress the <code>InvalidCastException</code> and return a rounded-off 28 or 29 precision Oracle <code>NUMBER</code> value that can be represented as a .NET decimal.
<code>TableMappings</code>	Inherited from <code>System.Data.Common.DataAdapter</code>
<a href="#">UpdateBatchSize</a>	Specifies a value that enables or disables batch processing support, and specifies the number of SQL statements that can be executed in a single round-trip to the database
<a href="#">UpdateCommand</a>	A SQL statement or stored procedure to update rows from the <code>DataSet</code> to an Oracle database

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataAdapter Class](#)
- [OracleDataAdapter Members](#)

## DeleteCommand

This property is a SQL statement or stored procedure to delete rows from an Oracle database.

**Declaration**

```
// C#
public OracleCommand DeleteCommand {get; set;}
```

### Property Value

An `OracleCommand` used during the `Update` call to delete rows from tables in the Oracle database, corresponding to the deleted rows in the `DataSet`.

### Remarks

Default = `null`

If there is primary key information in the `DataSet`, the `DeleteCommand` can be automatically generated using the `OracleCommandBuilder`, if no command is provided for this.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataAdapter Class](#)
- [OracleDataAdapter Members](#)

## IdentityInsert

When inserting `DataSet` data into the database, this property indicates whether the database generates the inserted row's identity column value or `DataSet` supplies this value.

### Declaration

```
// C#  
public bool IdentityInsert {get; set;}
```

### Property Value

When set to `true`, ODP.NET inserts `DataSet` identity column values into the database. When set to `false`, the database determines the inserted identity column values.

### Remarks

This property applies only to identity columns of type `GENERATED BY DEFAULT` and `GENERATED BY DEFAULT ON NULL`. Identity column of type `GENERATED ALWAYS` will ignore this property and will always use database generated values.

When set to `false`, the server will generate an identity value for the row. That generated identity value returns back to the client to update the `DataSet` value.

When this property is set to `true` for the `GENERATED BY DEFAULT` case and the application attempts to insert a `NULL` value into the database's identity column, the `NOT NULL` constraint is violated and an error occurs. ODP.NET will then allow the database to generate the identity column value and return the generated value to the `DataSet`.

The default value for this property is `false`.

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataAdapter Class](#)
- [OracleDataAdapter Members](#)
- [OracleIdentityType Enumeration](#)

## IdentityUpdate

When updating `DataSet` data into the database, this property indicates whether to replace the database's identity column values with values of the `DataSet` or leave the current values unchanged.

### Declaration

```
// C#  
public bool IdentityUpdate {get; set;}
```

### Property Value

When set to true, ODP.NET updates the database identity column values with the values of the `DataSet`. When set to false, the database identity columns are left unchanged.

### Remarks

This property applies only to identity columns of type `GENERATED BY DEFAULT` and `GENERATED BY DEFAULT ON NULL`. In the case of type `GENERATED ALWAYS`, this property will be ignored and the database will always retain its current identity values.

When set to false, the existing identity column value in the server is returned to the `DataSet`.

When this property is set to true for the `GENERATED BY DEFAULT` and `GENERATED BY DEFAULT ON NULL` cases and the application attempts to update the database's identity column with a `NULL` value, the `NOT NULL` constraint is violated and an error occurs. ODP.NET then does not update the identity column value and instead returns the existing identity column value of the database to the `DataSet`.

The default value for this property is `false`.

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataAdapter Class](#)
- [OracleDataAdapter Members](#)
- [OracleIdentityType Enumeration](#)

## InsertCommand

This property is a SQL statement or stored procedure to insert new rows into an Oracle database.

### Declaration

```
// C#  
public OracleCommand InsertCommand {get; set;}
```

### Property Value

An `OracleCommand` used during the `Update` call to insert rows into a table, corresponding to the inserted rows in the `DataSet`.

### Remarks

Default = null

If there is primary key information in the `DataSet`, the `InsertCommand` can be automatically generated using the `OracleCommandBuilder`, if no command is provided for this property.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataAdapter Class](#)
- [OracleDataAdapter Members](#)

## Requery

This property determines whether or not the `SelectCommand` is reexecuted on the next call to `Fill`.

### Declaration

```
// C#  
public Boolean Requery {get; set;}
```

### Property Value

Returns `true` if the `SelectCommand` is reexecuted on the next call to `Fill`; otherwise, returns `false`.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataAdapter Class](#)
- [OracleDataAdapter Members](#)
- ["OracleDataAdapter Requery Property"](#)

## ReturnProviderSpecificTypes

This property determines if the `Fill` method returns ODP.NET-specific values or .NET common language specification compliant values.

### Declaration

```
// C#  
public Boolean ReturnProviderSpecificTypes {get; set;}
```

### Property Value

A value that indicates whether or not the `Fill` method returns ODP.NET-specific values.

Starting with ODP.NET 12.1.0.2, when set to `true` and `LegacyEntireLOBFetch = 0` (default), BLOB and CLOB column values are represented in the `DataTable` as `OracleBlob` and `OracleClob`, respectively.

A value of `false` indicates that the `Fill` method returns .NET common language specification compliant values. The default is `false`.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataAdapter Class](#)
- [OracleDataAdapter Members](#)

## SafeMapping

This property creates a mapping between column names in the result set to .NET types that represent column values in the `DataSet`, to preserve the data.

### Declaration

```
// C#  
public Hashtable SafeMapping {get; set;}
```

**Property Value**

A hash table.

**Remarks**

Default = null

The `SafeMapping` property is used, when necessary, to preserve data in the following types:

- DATE
- `TimeStamp` (refers to all `TimeStamp` objects)
- INTERVAL DAY TO SECOND
- NUMBER

**Example**

See the example in "[OracleDataAdapter Safe Type Mapping](#)".

**See Also:**

- "[Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces](#)"
- [OracleDataAdapter Class](#)
- [OracleDataAdapter Members](#)
- "[OracleDataAdapter Safe Type Mapping](#)"

## SelectCommand

This property is a SQL statement or stored procedure that returns single or multiple result sets.

**Declaration**

```
// C#  
public OracleCommand SelectCommand {get; set;}
```

**Property Value**

An `OracleCommand` used during the `Fill` call to populate the selected rows to the `DataSet`.

**Remarks**

Default = null

If the `SelectCommand` does not return any rows, no tables are added to the dataset and no exception is raised.

If the `SELECT` statement selects from a `VIEW`, no key information is retrieved when a `FillSchema()` or a `Fill()` with `MissingSchemaAction.AddWithKey` is invoked.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataAdapter Class](#)
- [OracleDataAdapter Members](#)
- ["OracleDataAdapter Requery Property"](#)

## SuppressGetDecimalInvalidCastException

This property specifies whether to suppress the `InvalidCastException` and return a rounded-off 28 or 29 precision Oracle `NUMBER` value that can be represented as a .NET decimal.

### Declaration

```
// C#
public bool SuppressGetDecimalInvalidCastException { get; set; }
```

### Property Type

System.Boolean

### Remarks

Oracle `NUMBER` has a maximum of 38 precision. .NET Decimal has a maximum of 28 or 29 precision. When the `GetDecimal()` method is called for an Oracle `NUMBER` value that cannot be represented as a .NET Decimal, then ODP.NET throws an `InvalidCastException` because not all the precision can be preserved when converting the number to a .NET Decimal.

This behavior occurs when `SuppressGetDecimalInvalidCastException` is set to `false`. Its default value is `false`.

When `SuppressGetDecimalInvalidCastException` is set to `true`, then the resulting decimal will be rounded off to 28 or 29 precision so that it can fit as a .NET decimal without throwing an exception.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataAdapter Class](#)
- [OracleDataAdapter Members](#)

## UpdateBatchSize

This property specifies a value that enables or disables batch processing support, and specifies the number of SQL statements that can be executed in a single round-trip to the database.

### Declaration

```
// C#  
public virtual int UpdateBatchSize {get; set;}
```

### Property Value

An integer that returns the batch size.

### Exceptions

`ArgumentOutOfRangeException` - The value is set to a number < 0.

### Remarks

Update batches executed with large amounts of data may encounter an "PLS-00123: Program too large" error. To avoid this error, reduce the size of `UpdateBatchSize` to a smaller value.

For each row in the `DataSet` that has been modified, added, or deleted, one SQL statement will be executed on the database.

Values are as follows:

- Value = 0  
The data adapter executes all the SQL statements in a single database round-trip
- Value = 1 - Default value  
This value disables batch updating and SQL statements are executed one at a time.
- Value =  $n$  where  $n > 1$   
The data adapter updates  $n$  rows of data per database round-trip.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataAdapter Class](#)
- [OracleDataAdapter Members](#)
- ["Batch Processing"](#)

## UpdateCommand

This property is a SQL statement or stored procedure to update rows from the `DataSet` to an Oracle database.

### Declaration

```
// C#
public OracleCommand UpdateCommand {get; set;}
```

### Property Value

An `OracleCommand` used during the `Update` call to update rows in the Oracle database, corresponding to the updated rows in the `DataSet`.

### Remarks

Default = null

If there is primary key information in the `DataSet`, the `UpdateCommand` can be automatically generated using the `OracleCommandBuilder`, if no command is provided for this property.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataAdapter Class](#)
- [OracleDataAdapter Members](#)
- ["OracleDataAdapter Requery Property"](#)

## OracleDataAdapter Public Methods

`OracleDataAdapter` public methods are listed in [Table 7-72](#).

**Table 7-72 OracleDataAdapter Public Methods**

Public Method	Description
<code>CreateObjRef</code>	Inherited from <code>System.MarshalByRefObject</code>
<code>Dispose</code>	Inherited from <code>System.ComponentModel.Component</code>
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)
<code>Fill</code>	Adds or refreshes rows in the <code>DataSet</code> to match the data in the Oracle database (Overloaded)
<code>FillSchema</code>	Inherited from <code>System.Data.Common.DbDataAdapter</code>
<code>GetFillParameters</code>	Inherited from <code>System.Data.Common.DbDataAdapter</code>
<code>GetHashCode</code>	Inherited from <code>System.Object</code>
<code>GetLifetimeService</code>	Inherited from <code>System.MarshalByRefObject</code>

Table 7-72 (Cont.) OracleDataAdapter Public Methods

Public Method	Description
GetType	Inherited from <code>System.Object</code>
InitializeLifetimeService	Inherited from <code>System.MarshalByRefObject</code>
ToString	Inherited from <code>System.Object</code>
Update	Inherited from <code>System.Data.Common.DbDataAdapter</code>

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataAdapter Class](#)
- [OracleDataAdapter Members](#)

## Fill

Fill populates or refreshes the specified `DataTable` or `DataSet`.

### Overload List:

- [Fill\(DataTable, OracleRefCursor\)](#)  
This method adds or refreshes rows in the specified `DataTable` to match those in the provided `OracleRefCursor` object.
- [Fill\(DataSet, OracleRefCursor\)](#)  
This method adds or refreshes rows in the `DataSet` to match those in the provided `OracleRefCursor` object.
- [Fill\(DataSet, string, OracleRefCursor\)](#)  
This method adds or refreshes rows in the specified source table of the `DataSet` to match those in the provided `OracleRefCursor` object.
- [Fill\(DataSet, int, int, string, OracleRefCursor\)](#)  
This method adds or refreshes rows in a specified range in the `DataSet` to match rows in the provided `OracleRefCursor` object.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataAdapter Class](#)
- [OracleDataAdapter Members](#)

## Fill(DataTable, OracleRefCursor)

This method adds or refreshes rows in the specified `DataTable` to match those in the provided `OracleRefCursor` object.

### Declaration

```
// C#  
public int Fill(DataTable dataTable, OracleRefCursor refCursor);
```

### Parameters

- *dataTable*  
The `DataTable` object being populated.
- *refCursor*  
The `OracleRefCursor` that rows are being retrieved from.

### Return Value

The number of rows added to or refreshed in the `DataTable`.

### Exceptions

`ArgumentNullException` - The *dataTable* or *refCursor* parameter is null.

`InvalidOperationException` - The `OracleRefCursor` is already being used to fetch data.

`NotSupportedException` - The `SafeMapping` type is not supported.

### Remarks

No schema or key information is provided, even if the `Fill` method is called with `MissingSchemaAction` set to `MissingSchemaAction.AddWithKey`.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataAdapter Class](#)
- [OracleDataAdapter Members](#)
- ["OracleDataAdapter Requery Property"](#)

## Fill(DataSet, OracleRefCursor)

This method adds or refreshes rows in the `DataSet` to match those in the provided `OracleRefCursor` object.

### Declaration

```
// C#  
public int Fill(DataSet dataSet, OracleRefCursor refCursor);
```

### Parameters

- `dataSet`  
The `DataSet` object being populated.
- `refCursor`  
The `OracleRefCursor` that rows are being retrieved from.

### Return Value

Returns the number of rows added or refreshed in the `DataSet`.

### Exceptions

`ArgumentNullException` - The `dataSet` or `refCursor` parameter is null.

`InvalidOperationException` - The `OracleRefCursor` is already being used to fetch data.

`InvalidOperationException` - The `OracleRefCursor` is ready to fetch data.

`NotSupportedException` - The `SafeMapping` type is not supported.

### Remarks

If there is no `DataTable` to refresh, a new `DataTable` named `Table` is created and populated using the provided `OracleRefCursor` object.

No schema or key information is provided, even if the `Fill` method is called with `MissingSchemaAction` set to `MissingSchemaAction.AddWithKey`.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataAdapter Class](#)
- [OracleDataAdapter Members](#)
- ["OracleDataAdapter Requery Property"](#)

## Fill(DataSet, string, OracleRefCursor)

This method adds or refreshes rows in the specified source table of the `DataSet` to match those in the provided `OracleRefCursor` object.

### Declaration

```
// C#  
public int Fill(DataSet dataSet, string srcTable, OracleRefCursor  
    refCursor);
```

### Parameters

- `dataSet`  
The `DataSet` object being populated.
- `srcTable`  
The name of the source table used in the table mapping.
- `refCursor`  
The `OracleRefCursor` that rows are being retrieved from.

### Return Value

Returns the number of rows added or refreshed into the `DataSet`.

### Exceptions

`ArgumentNullException` - The `dataSet` or `refCursor` parameter is null.

`InvalidOperationException` - The `OracleRefCursor` is already being used to fetch data or the source table name is invalid.

`NotSupportedException` - The `SafeMapping` type is not supported.

### Remarks

No schema or key information is provided, even if the `Fill` method is called with `MissingSchemaAction` set to `MissingSchemaAction.AddWithKey`.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataAdapter Class](#)
- [OracleDataAdapter Members](#)
- ["OracleDataAdapter Requery Property"](#)

## Fill(DataSet, int, int, string, OracleRefCursor)

This method adds or refreshes rows in a specified range in the `DataSet` to match rows in the provided `OracleRefCursor` object.

### Declaration

```
// C#  
public int Fill(DataSet dataSet, int startRecord, int maxRecords,  
    string srcTable, OracleRefCursor refCursor);
```

### Parameters

- *dataSet*  
The `DataSet` object being populated.
- *startRecord*  
The record number to start with.
- *maxRecords*  
The maximum number of records to obtain.
- *srcTable*  
The name of the source table used in the table mapping.
- *refCursor*  
The `OracleRefCursor` that rows are being retrieved from.

### Return Value

This method returns the number of rows added or refreshed in the `DataSet`. This does not include rows affected by statements that do not return rows.

### Exceptions

`ArgumentNullException` - The `dataSet` or `refCursor` parameter is null.

`InvalidOperationException` - The `OracleRefCursor` is already being used to fetch data or the source table name is invalid.

`NotSupportedException` - The `SafeMapping` type is not supported.

## Remarks

No schema or key information is provided, even if the `Fill` method is called with `MissingSchemaAction` set to `MissingSchemaAction.AddWithKey`.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataAdapter Class](#)
- [OracleDataAdapter Members](#)
- ["OracleDataAdapter Requery Property"](#)

## OracleDataAdapter Events

`OracleDataAdapter` events are listed in [Table 7-73](#).

**Table 7-73 OracleDataAdapter Events**

Event Name	Description
<code>Disposed</code>	Inherited from <code>System.ComponentModel.Component</code>
<code>FillError</code>	Inherited from <code>System.Data.Common.DbDataAdapter</code>
<code>RowUpdated</code>	This event is raised when row(s) have been updated by the <code>Update()</code> method
<code>RowUpdating</code>	This event is raised when row data are about to be updated to the database

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataAdapter Class](#)
- [OracleDataAdapter Members](#)

## RowUpdated

This event is raised when row(s) have been updated by the `Update()` method.

### Declaration

```
// C#  
public event OracleRowUpdatedEventHandler RowUpdated;
```

## Event Data

The event handler receives an `OracleRowUpdatedEventArgs` object which exposes the following properties containing information about the event.

- `Command`  
The `OracleCommand` executed during the `Update`.
- `Errors` (inherited from `RowUpdatedEventArgs`)  
The exception, if any, is generated during the `Update`.
- `RecordsAffected` (inherited from `RowUpdatedEventArgs`)  
The number of rows modified, inserted, or deleted by the execution of the `Command`.
- `Row` (inherited from `RowUpdatedEventArgs`)  
The `DataRow` sent for `Update`.
- `StatementType` (inherited from `RowUpdatedEventArgs`)  
The type of SQL statement executed.
- `Status` (inherited from `RowUpdatedEventArgs`)  
The `UpdateStatus` of the `Command`.
- `TableMapping` (inherited from `RowUpdatedEventArgs`)  
The `DataTableMapping` used during the `Update`.

## Example

The following example shows how to use the `RowUpdating` and `RowUpdated` events.

```
// C#

using System;
using System.Data;
using Oracle.DataAccess.Client;

class RowUpdatedSample
{
    // Event handler for RowUpdating event
    protected static void OnRowUpdating(object sender,
                                       OracleRowUpdatingEventArgs e)
    {
        Console.WriteLine("Row updating....");
        Console.WriteLine("Event arguments:");
        Console.WriteLine("Command Text: " + e.Command.CommandText);
        Console.WriteLine("Command Type: " + e.StatementType);
        Console.WriteLine("Status: " + e.Status);
    }

    // Event handler for RowUpdated event
    protected static void OnRowUpdated(object sender,
                                       OracleRowUpdatedEventArgs e)
    {
        Console.WriteLine("Row updated....");
        Console.WriteLine("Event arguments:");
        Console.WriteLine("Command Text: " + e.Command.CommandText);
        Console.WriteLine("Command Type: " + e.StatementType);
    }
}
```

```
        Console.WriteLine("Status: " + e.Status);
    }

    static void Main()
    {
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        string cmdstr = "SELECT EMPNO, ENAME, SAL FROM EMP";

        // Create the adapter with the selectCommand txt and the
        // connection string
        OracleDataAdapter adapter = new OracleDataAdapter(cmdstr, constr);

        // Create the builder for the adapter to automatically generate
        // the Command when needed
        OracleCommandBuilder builder = new OracleCommandBuilder(adapter);

        // Create and fill the DataSet using the EMP
        DataSet dataset = new DataSet();
        adapter.Fill(dataset, "EMP");

        // Get the EMP table from the dataset
        DataTable table = dataset.Tables["EMP"];

        // Indicate DataColumn EMPNO is unique
        // This is required by the OracleCommandBuilder to update the EMP table
        table.Columns["EMPNO"].Unique = true;

        // Get the first row from the EMP table
        DataRow row = table.Rows[0];

        // Update the salary
        double sal = double.Parse(row["SAL"].ToString());
        row["SAL"] = sal + .01;

        // Set the event handlers for the RowUpdated and the RowUpdating event
        // the OnRowUpdating() method will be triggered before the update, and
        // the OnRowUpdated() method will be triggered after the update
        adapter.RowUpdating += new OracleRowUpdatingEventHandler(OnRowUpdating);
        adapter.RowUpdated += new OracleRowUpdatedEventHandler(OnRowUpdated);

        // Now update the EMP using the adapter
        // The OracleCommandBuilder will create the UpdateCommand for the
        // adapter to update the EMP table
        // The OnRowUpdating() and the OnRowUpdated() methods will be triggered
        adapter.Update(dataset, "EMP");
    }
}
```

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataAdapter Class](#)
- [OracleDataAdapter Members](#)
- ["OracleRowUpdatedEventHandler Delegate"](#)

## RowUpdating

This event is raised when row data are about to be updated to the database.

### Declaration

```
// C#  
public event OracleRowUpdatingEventHandler RowUpdating;
```

### Event Data

The event handler receives an `OracleRowUpdatingEventArgs` object which exposes the following properties containing information about the event.

- `Command`  
The `OracleCommand` executed during the `Update`.
- `Errors` (inherited from `RowUpdatingEventArgs`)  
The exception, if any, is generated during the `Update`.
- `Row` (inherited from `RowUpdatingEventArgs`)  
The `DataRow` sent for `Update`.
- `StatementType` (inherited from `RowUpdatingEventArgs`)  
The type of SQL statement executed.
- `Status` (inherited from `RowUpdatingEventArgs`)  
The `UpdateStatus` of the `Command`.
- `TableMapping` (inherited from `RowUpdatingEventArgs`)  
The `DataTableMapping` used during the `Update`.

### Example

The example for the `RowUpdated` event also shows how to use the `RowUpdating` event. See `RowUpdated` event "[Example](#)".



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataAdapter Class](#)
- [OracleDataAdapter Members](#)
- ["OracleRowUpdatingEventHandler Delegate"](#)

## OracleDatabase Class

An `OracleDatabase` object represents an Oracle Database instance.

## Class Inheritance

System.Object

Oracle.DataAccess.Client.OracleDatabase

## Declaration

```
// C#  
public sealed class OracleDatabase : IDisposable
```

## Requirements

Provider	ODP.NET, Unmanaged Driver
<b>Assembly</b>	Oracle.DataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client
<b>.NET Framework</b>	4.8

## Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

## Example

```
// C#  
  
using System;  
using Oracle.DataAccess.Client;  
  
namespace Startup  
{  
    class Test  
    {  
        static void Main()  
        {  
            OracleConnection con = null;  
            OracleDatabase db = null;  
            string constring = "dba privilege=sysdba;user id=scott;password=tiger;data  
source=oracle";  
  
            try  
            {  
                // Open a connection to see if the DB is up  
                con = new OracleConnection(constring);  
                con.Open();  
  
                Console.WriteLine("The Oracle database is already up.");  
            }  
            catch (OracleException ex)  
            {  
                // If the database is down, start up the DB  
                if (ex.Number == 1034)  
                {  
                    Console.WriteLine("The Oracle database is down.");  
  
                    // Create an instance of an OracleDatabase object
```

```
        db = new OracleDatabase(constring);

        // Start up the database
        db.Startup();

        Console.WriteLine("The Oracle database is now up.");

        // Executing Startup() is the same as the following:
        // db.Startup(OracleDBStartupMode.NoRestriction, null, true);
        // which is also the same as:
        // db.Startup(OracleDBStartupMode.NoRestriction, null, false);
        // db.ExecuteNonQuery("ALTER DATABASE MOUNT");
        // db.ExecuteNonQuery("ALTER DATABASE OPEN");

        // Dispose the OracleDatabase object
        db.Dispose();
    }
    else
    {
        Console.WriteLine("Error: " + ex.Message);
    }
}
finally
{
    // Dispose the OracleConnetion object
    con.Dispose();
}
}
}
```



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDatabase Members](#)
- [OracleDatabase Constructors](#)
- [OracleDatabase Properties](#)
- [OracleDatabase Public Methods](#)

## OracleDatabase Members

OracleDatabase members are listed in the following tables.

### OracleDatabase Constructors

The OracleDatabase constructor is listed in [Table 7-74](#).

**Table 7-74 OracleDatabase Constructors**

Constructor	Description
<a href="#">OracleDatabase Constructors</a>	Instantiates a new instance of <code>OracleDatabase</code> class

**OracleDatabase Properties**

The `OracleDatabase` properties are listed in [Table 7-75](#).

**Table 7-75 OracleDatabase Properties**

Property	Description
<a href="#">ServerVersion</a>	Specifies the database version number of the Oracle Database instance to which the connection is made

**OracleDatabase Public Methods**

The `OracleDatabase` public methods are listed in [Table 7-76](#).

**Table 7-76 OracleDatabase Public Methods**

Public Method	Description
<a href="#">Dispose</a>	Releases any resources or memory allocated by the object.
<a href="#">ExecuteNonQuery</a>	Executes the supplied non- <code>SELECT</code> statement against the database
<a href="#">Shutdown</a>	Shuts down the database (Overloaded)
<a href="#">Startup</a>	Starts up the database (Overloaded)

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDatabase Class](#)

## OracleDatabase Constructors

The `OracleDatabase` constructors instantiate a new instance of the `OracleDatabase` class.

**Overload List**

- [OracleDatabase Constructor\(string\)](#)

The `OracleDatabase` constructor instantiates a new instance of the `OracleDatabase` class using the supplied connection string.

- [OracleDatabase Constructor\(string, OracleCredential\)](#)

The `OracleDatabase` constructor instantiates a new instance of the `OracleDatabase` class using the supplied connection string and `OracleCredential` object .

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDatabase Class](#)
- [OracleDatabase Members](#)

## OracleDatabase Constructor(string)

The `OracleDatabase` constructor instantiates a new instance of the `OracleDatabase` class using the supplied connection string.

### Declaration

```
// C#  
public OracleDatabase(string connectionString);
```

### Parameters

- *connectionString*  
The connection information used to connect to the Oracle Database instance.

### Remarks

The *connectionString* follows the same format used by the `OracleConnection` object. However, the `OracleDatabase` constructor accepts only the `user id`, `password`, `data source`, and `dba privilege` connection string attributes. All other attribute values are ignored. The supplied *connectionString* must contain the `dba privilege` connection string attribute that is set to `SYSDBA`, `SYSASM`, `SYSOPER`, or another valid administrator privilege.

The `OracleDatabase` object creates a connection upon construction and remains connected throughout its lifetime. The connection is destroyed when the `OracleDatabase` object is disposed. This connection is not pooled to be used by another `OracleDatabase` object.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDatabase Class](#)
- [OracleDatabase Members](#)

## OracleDatabase Constructor(string, OracleCredential)

The `OracleDatabase` constructor instantiates a new instance of the `OracleDatabase` class using the supplied connection string and `OracleCredential` object.

### Declaration

```
// C#  
public OracleDatabase(string connectionString, OracleCredential orclCredential)
```

### Parameters

- `connectionString`  
connection string that does not contain any of user id, password, DBA Privilege, proxy user id, nor proxy password.
- `orclCredential`  
`OracleCredential` object containing user credentials. If this parameter is passed as null then `OracleConnection`'s behavior will be same as `OracleConnection` with normal connection string.

### Exceptions

`InvalidOperationException` is raised when non-null `OracleCredential` object is used with a connection string containing any of user id, password, DBA Privilege, proxy user id, or proxy password.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDatabase Class](#)
- [OracleDatabase Members](#)

## OracleDatabase Properties

The `OracleDatabase` properties are listed in [Table 7-77](#).

**Table 7-77 OracleDatabase Properties**

Property	Description
<a href="#">ServerVersion</a>	Specifies the database version number of the Oracle Database instance to which the connection is made

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDatabase Class](#)
- [OracleDatabase Members](#)

## ServerVersion

This property returns the database version number of the Oracle Database instance to which the connection is made.

### Declaration

```
Public string ServerVersion {get;}
```

### Property value

Returns the database version of the Oracle Database instance.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDatabase Class](#)
- [OracleDatabase Members](#)

## OracleDatabase Public Methods

The `OracleDatabase` public methods are listed in [Table 7-78](#).

**Table 7-78 OracleDatabase Public Methods**

Public Method	Description
<a href="#">Dispose</a>	Releases any resources or memory allocated by the object.
<a href="#">ExecuteNonQuery</a>	Executes the supplied non-SELECT statement against the database
<a href="#">Shutdown</a>	Shuts down the database (Overloaded)
<a href="#">Startup</a>	Starts up the database (Overloaded)

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDatabase Class](#)
- [OracleDatabase Members](#)

## Dispose

This method releases any resources or memory allocated by the object.

### Declaration

```
// C#  
public void Dispose();
```

### Implements

IDisposable

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDatabase Class](#)
- [OracleDatabase Members](#)

## ExecuteNonQuery

This method executes the supplied non-`SELECT` statement against the database.

### Declaration

```
// C#  
public void ExecuteNonQuery(string sql);
```

### Exceptions

`OracleException` - The command execution has failed.

### Remarks

This method is meant for execution of DDL statements such as `ALTER DATABASE` statements to `OPEN` and `MOUNT` the database, for example. This method should not be used to execute `SQL SELECT` statements. This method does not support any parameter binding.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDatabase Class](#)
- [OracleDatabase Members](#)

## Shutdown

`Shutdown` methods shut down a database instance.

### Overload List

- [Shutdown\(\)](#)  
This method shuts down the database.
- [Shutdown\(OracleDBShutdownMode, bool\)](#)  
This method shuts down the database using the specified mode.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDatabase Class](#)
- [OracleDatabase Members](#)
- ["OracleDBShutdownMode Enumeration"](#)

## Shutdown()

This method shuts down the database.

### Declaration

```
// C#  
public void Shutdown();
```

### Exceptions

`OracleException` - The database shutdown request has failed.

### Remarks

This method shuts down a database instance in the `OracleDBShutdownMode.Default` mode. New connections are refused, and the method waits for the existing connections to end.

 **Note:**

As the shutdown is effected using the `OracleDBShutdownMode.Default` mode, the shutdown request may remain pending if there are open connections other than the connection created by the `OracleDatabase` object.

After the connections have closed, the method closes the database, dismounts the database, and shuts down the instance using the `OracleDBShutdownMode.Final` mode.

This method does not throw exceptions for cases where the database has been already closed, dismounted, or shutdown appropriately. If other errors are encountered, then an exception is thrown.

Invoking this method against an Oracle Real Application Clusters (Oracle RAC) database shuts down only that database instance to which the `OracleDatabase` object is connected.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDatabase Class](#)
- [OracleDatabase Members](#)
- ["OracleDBShutdownMode Enumeration"](#)

## Shutdown(OracleDBShutdownMode, bool)

This method shuts down the database instance using the specified mode.

### Declaration

```
//C#  
public void Shutdown(OracleDBShutdownMode shutdownMode, bool  
bCloseDismountAndFinalize);
```

### Parameters

- *shutdownMode*  
A `OracleDBShutdownMode` enumeration value.
- *bCloseDismountAndFinalize*  
A `boolean` signifying whether the database is to be closed, dismounted, and finalized.

### Exceptions

`OracleException` - The database shutdown request has failed.

## Remarks

This method shuts down a database instance in the specified mode. If the *bCloseDismountAndFinalize* parameter is `true`, then the method also closes the database, dismounts the database, and shuts down the instance using the `OracleDBShutdownMode.Final` mode.

If the *bCloseDismountAndFinalize* parameter is `true`, then this method does not throw exceptions for cases where the database has been already closed, dismounted, or shutdown appropriately. If other errors are encountered, then an exception is thrown.

If the *bCloseDismountAndFinalize* parameter is `false`, then the application needs to explicitly close and dismount the database. The application can then reinvoke the method using the `OracleDBShutdownMode.Final` mode to properly shut down the database. For example, if `db` is an instance of the `OracleDatabase` class, then the application invokes the following:

1. `db.Shutdown(OracleDBShutdownMode.Default, false);`
2. `db.ExecuteNonQuery("ALTER DATABASE CLOSE NORMAL");`
3. `db.ExecuteNonQuery("ALTER DATABASE DISMOUNT");`
4. `db.Shutdown(OracleDBShutdownMode.Final);`

### Note:

- The `OracleDBShutdownMode.Final` enumeration value should not be used as the *shutdownMode* for the initial method invocation. The `OracleDBShutdownMode.Final` mode should be used only if the database is already closed and dismounted. Otherwise, the method might wait indefinitely.
- If the specified *shutdownMode* is `OracleDBShutdownMode.Final`, then the value of the *bCloseDismountAndFinalize* input parameter is ignored, as the database should have been closed and dismounted already.

If the specified *shutdownMode* is `OracleDBShutdownMode.Abort`, then the value of the *bCloseDismountAndFinalize* input parameter is ignored, as the `Abort` mode requires the database to be closed, dismounted, and finalized.

Invoking this method against an Oracle Real Application Clusters (Oracle RAC) database shuts down only that database instance to which the `OracleDatabase` object is connected.

## Example

```
using System;
using Oracle.DataAccess.Client;

namespace Shutdown
{
    class Test
    {
        static void Main()
```

```
{
  OracleConnection con = null;
  OracleDatabase db = null;
  string constring = "user id=scott;password=tiger;data source=oracle;" +
    "pooling=false;dba privilege=sysdba";

  try
  {
    // Open a connection to see if the DB is up;
    con = new OracleConnection(constring);
    con.Open();

    Console.WriteLine("The Oracle database is currently up.");

    // If open succeeds, we know that the database is up.
    // We have to dispose the connection so that we can
    // shutdown the database.
    con.Dispose();

    // Shutdown the database
    db = new OracleDatabase(constring);
    db.Shutdown();

    Console.WriteLine("The Oracle database is shut down.");

    // Executing Shutdown() above is the same as the following:
    // db.Shutdown(OracleDBShutdownMode.Default, false);
    // db.ExecuteNonQuery("ALTER DATABASE CLOSE NORMAL");
    // db.ExecuteNonQuery("ALTER DATABASE DISMOUNT");
    // db.Shutdown(OracleDBShutdownMode.Final);

    // Dispose the OracleDatabase object
    db.Dispose();
  }
  catch (OracleException ex)
  {
    Console.WriteLine("An error has occurred: {0}", ex.Message);
  }
}
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDatabase Class](#)
- [OracleDatabase Members](#)
- ["OracleDBShutdownMode Enumeration"](#)

## Startup

Startup methods enable a user with database administrator privileges to start a database instance.

### Overload List

- [Startup\(\)](#)  
This method starts a database instance using the server-side parameter file.
- [Startup\(OracleDBStartupMode, string, bool\)](#)  
This method starts a database instance using the client-side parameter file.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDatabase Class](#)
- [OracleDatabase Members](#)
- ["OracleDBStartupMode Enumeration"](#)

## Startup()

This method starts up the database.

### Declaration

```
// C#  
public void Startup();
```

### Exceptions

`OracleException` - The database startup request has failed.

### Remarks

This method starts a database instance in the `OracleDbStartupMode.Normal` mode using the server-side parameter file (`spfile`). After the database is successfully started, this method also executes the `ALTER DATABASE MOUNT` and `ALTER DATABASE OPEN` statements.

This method does not throw exceptions for cases where the database is already mounted, opened, or started appropriately. If other errors are encountered, then an exception is thrown.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDatabase Class](#)
- [OracleDatabase Members](#)
- ["OracleDBStartupMode Enumeration"](#)

## Startup(OracleDBStartupMode, string, bool)

This method starts up the database using the specified startup mode.

### Declaration

```
// C#  
public void Startup(OracleDbStartupMode startupMode, string pfile, bool bMountAndOpen);
```

### Parameters

- *startupMode*

An `OracleDBStartupMode` enumeration value.

- *pfile*

The location and name of the client-side parameter file. For example, "c:\\admin\\init.ora".

The name of the parameter file varies depending on the operating system. For example, it can be in mixed case or lowercase, or it can have a logical name or a variation of the name `init.ora`. The default location is usually `ORACLE_HOME/dbs` or `ORACLE_HOME/database`.

- *bMountAndOpen*

A `true/false` value signifying whether the database is to be mounted and opened.

### Exceptions

`OracleException` - The database startup request has failed.

### Remarks

This method starts a database instance in the specified mode using the specified client-side parameter file. After the database is successfully started, and if `bMountAndOpen` input parameter is `true`, this method also executes the `ALTER DATABASE MOUNT` and `ALTER DATABASE OPEN` statements.

If `bMountAndOpen` is `true`, then this method does not throw an exception for cases where the database is already mounted, opened, or started appropriately. If other errors are encountered, then an exception is thrown.

If `bMountAndOpen` is `false`, then the database must be mounted and opened explicitly by the application. For example, if `db` is an instance of the `OracleDatabase` class, then the application invokes the following:

1. `db.Startup(OracleDBStartupMode.NoRestriction, null, false);`
2. `db.ExecuteNonQuery("ALTER DATABASE MOUNT");`
3. `db.ExecuteNonQuery("ALTER DATABASE OPEN");`

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDatabase Class](#)
- [OracleDatabase Members](#)
- ["OracleDBStartupMode Enumeration"](#)

## OracleDataReader Class

An `OracleDataReader` object represents a forward-only, read-only, in-memory result set.

Unlike the `DataSet`, the `OracleDataReader` object stays connected and fetches one row at a time.

The following section contain related information:

- ["Obtaining LONG and LONG RAW Data"](#).
- ["Obtaining Data from an OracleDataReader Object"](#).

### Class Inheritance

`System.Object`

`System.MarshalByRefObject`

`System.Data.Common.DataReader`

`System.Data.Common.DbDataReader`

`Oracle.DataAccess.Client.OracleDataReader`

### Declaration

```
// C#
public sealed class OracleDataReader : DbDataReader, IEnumerable,
    IDataReader, IDisposable, IDataRecord
```

### Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	<code>Oracle.DataAccess.dll</code>	<code>Oracle.ManagedDataAccess.dll</code>	<code>Oracle.ManagedDataAccess.dll</code>

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Namespace</b>	Oracle.DataAccess .Client	Oracle.ManagedDat aAccess.Client	Oracle.ManagedDat aAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

### Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

### Remarks

An `OracleDataReader` instance is constructed by a call to the `ExecuteReader` method of the `OracleCommand` object. The only properties that can be accessed after the `DataReader` is closed or has been disposed, are `IsClosed` and `RecordsAffected`.

To minimize the number of open database cursors, `OracleDataReader` objects should be explicitly disposed.

### Example

The following `OracleDataReader` example retrieves the data from the `EMP` table:

```

/* Database Setup, if you have not done so yet.
connect scott/tiger@oracle
CREATE TABLE empInfo (
empno NUMBER(4) PRIMARY KEY,
empName VARCHAR2(20) NOT NULL,
hiredate DATE,
salary NUMBER(7,2),
jobDescription Clob,
byteCodes BLOB
);

Insert into empInfo(EMPNO,EMPNAME,JOBDESCRIPTION,byteCodes) values
(1,'KING','SOFTWARE ENGR', '5657');
Insert into empInfo(EMPNO,EMPNAME,JOBDESCRIPTION,byteCodes) values
(2,'SCOTT','MANAGER', '5960');
commit;

*/

// C#

using System;
using System.Data;
using Oracle.DataAccess.Client;

class OracleDataReaderSample
{
    static void Main()
    {
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);

```

```
con.Open();

string cmdstr = "SELECT * FROM EMPINFO";
OracleConnection connection = new OracleConnection(constr);
OracleCommand cmd = new OracleCommand(cmdstr, con);

OracleDataReader reader = cmd.ExecuteReader();

// Declare the variables to retrieve the data in EmpInfo
short empNo;
string empName;
DateTime hireDate;
double salary;
string jobDesc;
byte[] byteCodes = new byte[10];

// Read the next row until end of row
while (reader.Read())
{
    empNo = reader.GetInt16(0);
    Console.WriteLine("Employee number: " + empNo);
    empName = reader.GetString(1);
    Console.WriteLine("Employee name: " + empName);

    // The following columns can have NULL value, so it
    // is important to call IsDBNull before getting the column data
    if (!reader.IsDBNull(2))
    {
        hireDate = reader.GetDateTime(2);
        Console.WriteLine("Hire date: " + hireDate);
    }

    if (!reader.IsDBNull(3))
    {
        salary = reader.GetDouble(3);
        Console.WriteLine("Salary: " + salary);
    }

    if (!reader.IsDBNull(4))
    {
        jobDesc = reader.GetString(4);
        Console.WriteLine("Job Description: " + jobDesc);
    }

    if (!reader.IsDBNull(5))
    {
        long len = reader.GetBytes(5, 0, byteCodes, 0, 10);

        Console.Write("Byte codes: ");
        for (int i = 0; i < len; i++)
            Console.Write(byteCodes[i].ToString("x"));

        Console.WriteLine();
    }

    Console.WriteLine();
}

// Clean up
reader.Dispose();
con.Dispose();
```

```
}
}
```

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Members](#)
- [OracleDataReader Static Methods](#)
- [OracleDataReader Properties](#)
- [OracleDataReader Public Methods](#)

## OracleDataReader Members

`OracleDataReader` members are listed in the following tables.

### OracleDataReader Static Methods

The `OracleDataReader` static method is listed in [Table 7-79](#).

**Table 7-79 OracleDataReader Static Method**

Method	Description
<a href="#">Equals</a>	Inherited from <code>System.Object</code> (Overloaded)

### OracleDataReader Properties

`OracleDataReader` properties are listed in [Table 7-80](#).

**Table 7-80 OracleDataReader Properties**

Property	Description
<a href="#">Depth</a>	Gets a value indicating the depth of nesting for the current row
<a href="#">FetchSize</a>	Specifies the size of <code>OracleDataReader</code> 's internal cache
<a href="#">FieldCount</a>	Gets the number of columns in the result set
<a href="#">HasRows</a>	Indicates whether the <code>OracleDataReader</code> has one or more rows
<a href="#">HiddenFieldCount</a>	Gets the number of fields in the <code>OracleDataReader</code> that are hidden
<a href="#">IsClosed</a>	Indicates whether or not the data reader is closed
<a href="#">Item</a>	Gets the value of the column (Overloaded)
<a href="#">InitialLOBFetchSize</a>	Specifies the amount that the <code>OracleDataReader</code> initially fetches for LOB columns
<a href="#">InitialLONGFetchSize</a>	Specifies the amount that the <code>OracleDataReader</code> initially fetches for LONG and LONG RAW columns

**Table 7-80 (Cont.) OracleDataReader Properties**

Property	Description
<a href="#">RecordsAffected</a>	Gets the number of rows changed, inserted, or deleted by execution of the SQL statement
<a href="#">RowSize</a>	Gets the amount of memory the internal cache of the <code>OracleDataReader</code> needs to store one row of data.
<a href="#">SuppressGetDecimalInvalidCastException</a>	Specifies whether to suppress the <code>InvalidCastException</code> and return a rounded-off 28 precision value if the Oracle <code>NUMBER</code> value has more than 28 precision.
<a href="#">UseEdmMapping</a>	Indicates whether or not the <code>OracleDataReader</code> utilizes the Entity Data Model mapping configuration when returning values
<a href="#">VisibleFieldCount</a>	Gets the number of fields in the <code>OracleDataReader</code> that are not hidden

**OracleDataReader Public Methods**

`OracleDataReader` public methods are listed in [Table 7-81](#).

**Table 7-81 OracleDataReader Public Methods**

Public Method	Description
<a href="#">Close</a>	Closes the <code>OracleDataReader</code>
<a href="#">CreateObjRef</a>	Inherited from <code>System.MarshalByRefObject</code>
<a href="#">Dispose</a>	Releases any resources or memory allocated by the object
<a href="#">Equals</a>	Inherited from <code>System.Object</code> (Overloaded)
<a href="#">GetBoolean</a>	Returns the <code>bool</code> value of the specified numeric column
<a href="#">GetByte</a>	Returns the <code>byte</code> value of the specified column
<a href="#">GetBytes</a>	Populates the provided byte array with up to the maximum number of bytes, from the specified offset (in bytes) of the column
<a href="#">GetChar</a>	<i>Not Supported</i>
<a href="#">GetChars</a>	Populates the provided character array with up to the maximum number of characters, from the specified offset (in characters) of the column
<a href="#">GetData</a>	<i>Not Supported</i>
<a href="#">GetDataTypeName</a>	Returns the ODP.NET type name of the specified column
<a href="#">GetDateTime</a>	Returns the <code>DateTime</code> value of the specified column
<a href="#">GetDateTimeOffset</a>	Returns the <code>DateTimeOffset</code> value of the specified column
<a href="#">GetDecimal</a>	Returns the <code>decimal</code> value of the specified <code>NUMBER</code> column
<a href="#">GetDouble</a>	Returns the <code>double</code> value of the specified <code>NUMBER</code> column or <code>BINARY_DOUBLE</code> column
<a href="#">GetEnumerator</a>	Returns an <code>IEnumerator</code> that can be used to iterate through the collection
<a href="#">GetFieldType</a>	Returns the <code>Type</code> of the specified column

Table 7-81 (Cont.) OracleDataReader Public Methods

Public Method	Description
<a href="#">GetFloat</a>	Returns the float value of the specified NUMBER column or BINARY_FLOAT column
<a href="#">GetGuid</a>	Returns the Guid value of the specified binary data column
<code>GetHashCode</code>	Inherited from <code>System.Object</code>
<a href="#">GetInt16</a>	Returns the Int16 value of the specified NUMBER column
<a href="#">GetInt32</a>	Returns the Int32 value of the specified NUMBER column
<a href="#">GetInt64</a>	Returns the Int64 value of the specified NUMBER column
<code>GetLifetimeService</code>	Inherited by <code>System.MarshalByRefObject</code>
<a href="#">GetName</a>	Returns the name of the specified column
<a href="#">GetOracleBFile</a>	Returns an <code>OracleBFile</code> object of the specified BFILE column
<a href="#">GetOracleBinary</a>	Returns an <code>OracleBinary</code> structure of the specified column
<a href="#">GetOracleBlob</a>	Returns an <code>OracleBlob</code> object of the specified BLOB column
<a href="#">GetOracleBlobForUpdate</a>	Returns an updatable <code>OracleBlob</code> object of the specified BLOB column <i>Not Available in ODP.NET, Managed Driver and ODP.NET Core</i>
<a href="#">GetOracleClob</a>	Returns an <code>OracleClob</code> object of the specified CLOB column
<a href="#">GetOracleClobForUpdate</a>	Returns an updatable <code>OracleClob</code> object of the specified CLOB column <i>Not Available in ODP.NET, Managed Driver and ODP.NET Core</i>
<a href="#">GetOracleDate</a>	Returns an <code>OracleDate</code> structure of the specified DATE column
<a href="#">GetOracleDecimal</a>	Returns an <code>OracleDecimal</code> structure of the specified NUMBER column
<a href="#">GetOracleIntervalDS</a>	Returns an <code>OracleIntervalDS</code> structure of the specified INTERVAL DAY TO SECOND column
<a href="#">GetOracleIntervalYM</a>	Returns an <code>OracleIntervalYM</code> structure of the specified INTERVAL YEAR TO MONTH column
<a href="#">GetOracleRef</a>	Returns an <code>OracleRef</code> object of the specified REF column
<a href="#">GetOracleString</a>	Returns an <code>OracleString</code> structure of the specified column
<a href="#">GetOracleTimeStamp</a>	Returns an <code>OracleTimeStamp</code> structure of the Oracle TimeStamp column
<a href="#">GetOracleTimeStampLTZ</a>	Returns an <code>OracleTimeStampLTZ</code> structure of the specified Oracle TimeStamp WITH LOCAL TIME ZONE column

**Table 7-81 (Cont.) OracleDataReader Public Methods**

Public Method	Description
<a href="#">GetOracleTimeStampTZ</a>	Returns an <code>OracleTimeStampTZ</code> structure of the specified <code>OracleTimeStamp WITH TIME ZONE</code> column
<a href="#">GetOracleXmlType</a>	Returns an <code>OracleXmlType</code> object of the specified <code>XMLType</code> column
<a href="#">GetOracleValue</a>	Returns the specified column value as a ODP.NET type
<a href="#">GetOracleValues</a>	Gets all the column values as ODP.NET types
<a href="#">GetOrdinal</a>	Returns the 0-based ordinal (or index) of the specified column name
<a href="#">GetProviderSpecificFieldType</a>	Returns the provider-specific type of the specified column
<a href="#">GetProviderSpecificValue</a>	Returns an object that represents the underlying provider-specific value of the specified ordinal
<a href="#">GetProviderSpecificValues</a>	Returns an array of objects that represent the underlying provider-specific values
<a href="#">GetSchemaTable</a>	Returns a <code>DataTable</code> that describes the column metadata of the <code>OracleDataReader</code>
<a href="#">GetString</a>	Returns the string value of the specified column
<a href="#">GetTimeSpan</a>	Returns the <code>TimeSpan</code> value of the specified <code>INTERVAL DAY TO SECOND</code> column
<code>GetType</code>	Inherited from <code>System.Object</code> class
<a href="#">GetValue</a>	Returns the column value as a .NET type
<a href="#">GetValues</a>	Gets all the column values as .NET types
<a href="#">GetXmlReader</a>	Returns the value of an <code>XMLType</code> column as an instance of an <code>.NET XmlTextReader</code>
<a href="#">IsDBNull</a>	Indicates whether or not the column value is null
<a href="#">NextResult</a>	Advances the data reader to the next result set when reading the results
<a href="#">Read</a>	Reads the next row in the result set
<code>ToString</code>	Inherited from <code>System.Object</code>

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)

## OracleDataReader Static Methods

The `OracleDataReader` static method is listed in [Table 7-82](#).

**Table 7-82 OracleDataReader Static Method**

Method	Description
Equals	Inherited from <code>System.Object</code> (Overloaded)

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## OracleDataReader Properties

`OracleDataReader` properties are listed in [Table 7-83](#).

**Table 7-83 OracleDataReader Properties**

Property	Description
<a href="#">Depth</a>	Gets a value indicating the depth of nesting for the current row
<a href="#">FetchSize</a>	Specifies the size of <code>OracleDataReader</code> 's internal cache
<a href="#">FieldCount</a>	Gets the number of columns in the result set
<a href="#">HasRows</a>	Indicates whether the <code>OracleDataReader</code> has one or more rows
<a href="#">HiddenFieldCount</a>	Gets the number of fields in the <code>OracleDataReader</code> that are hidden
<a href="#">IsClosed</a>	Indicates whether or not the data reader is closed
<a href="#">Item</a>	Gets the value of the column (Overloaded)
<a href="#">InitialLOBFetchSize</a>	Specifies the amount that the <code>OracleDataReader</code> initially fetches for LOB columns
<a href="#">InitialLONGFetchSize</a>	Specifies the amount that the <code>OracleDataReader</code> initially fetches for LONG and LONG RAW columns
<a href="#">RecordsAffected</a>	Gets the number of rows changed, inserted, or deleted by execution of the SQL statement
<a href="#">RowSize</a>	Gets the amount of memory the internal cache of the <code>OracleDataReader</code> needs to store one row of data
<a href="#">SuppressGetDecimalInvalidCastException</a>	Specifies whether to suppress the <code>InvalidCastException</code> and return a rounded-off 28 precision value if the Oracle NUMBER value has more than 28 precision.
<a href="#">UseEdmMapping</a>	Indicates whether or not the <code>OracleDataReader</code> utilizes the Entity Data Model mapping configuration when returning values
<a href="#">VisibleFieldCount</a>	Gets the number of fields in the <code>OracleDataReader</code> that are not hidden

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## Depth

This property gets a value indicating the depth of nesting for the current row.

### Declaration

```
// C#  
public override int Depth {get;}
```

### Property Value

The depth of nesting for the current row.

### Implements

IDataReader

### Exceptions

InvalidOperationException - The reader is closed.

### Remarks

Default = 0

This property always returns zero because Oracle does not support nesting.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## FetchSize

This property specifies the size of `OracleDataReader`'s internal cache.

### Declaration

```
// C#  
public long FetchSize {get; set;}
```

### Property Value

A `long` that specifies the amount of memory (in bytes) that the `OracleDataReader` uses for its internal cache.

### Exceptions

`ArgumentException` - The `FetchSize` value specified is invalid.

### Remarks

Default = The `OracleCommand`'s `FetchSize` property value.

The `FetchSize` property is inherited by the `OracleDataReader` that is created by a command execution returning a result set. The `FetchSize` property on the `OracleDataReader` object determines the amount of data fetched into its internal cache for each database round-trip.

The `RowSize` and `FetchSize` properties handle UDT and `XMLType` data differently than other scalar data types. Because only a reference to the UDT and `XMLType` data is stored in the ODP.NET's internal cache, the `RowSize` property accounts for only the memory needed for the reference (which is very small) and not the actual size of the UDT and `XMLType` data. Thus, applications can inadvertently fetch a large number of UDT or `XMLType` instances from the database in a single database round-trip. This is because the actual size of UDT and `XMLType` data does not count against the `FetchSize`, and it would require numerous UDT and `XMLType` references to fill up the default cache size of 131072 bytes. Therefore, when fetching UDT or `XMLType` data, the `FetchSize` property must be appropriately configured to control the number of UDT and `XMLType` instances that are to be fetched, rather than the amount of the actual UDT and `XMLType` data to be fetched.

NOTE: For LOB and `LONG` data types, only the sizes specified in the `InitialLOBFetchSize` and `InitialLONGFetchSize` properties are accounted for by the `RowSize` property in addition to the metadata and reference information that is maintained by the cache for each LOB in the select list.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)
- `OracleDataReader` ["RowSize"](#)
- `OracleCommand` ["ExecuteReader\(\)"](#)
- `OracleCommand` ["RowSize"](#)

## FieldCount

This property returns the number of columns in the result set.

**Declaration**

```
// C#  
public override int FieldCount {get;}
```

**Property Value**

The number of columns in the result set if one exists, otherwise 0.

**Implements**

IDataRecord

**Exceptions**

InvalidOperationException - The reader is closed.

**Remarks**

Default = 0

This property has a value of 0 for queries that do not return result sets.

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## HasRows

This property indicates whether the `OracleDataReader` has one or more rows.

**Declaration**

```
// C#  
public override bool HasRows {get;}
```

**Return Value**

bool

**Remarks**

`HasRows` indicates whether or not the `OracleDataReader` has any rows.

The value of `HasRows` does not change based on the row position. For example, even if the application has read all the rows from the result set and the next `Read` method invocation will return `false`, the `HasRows` property still returns `true` since the result set was not empty to begin with.

Rows are fetched to determine the emptiness of the `OracleDataReader` when `HasRows` property is accessed for the first time after the creation of the `OracleDataReader` object.

### Example

```
// C#

using System;
using Oracle.DataAccess.Client;

class HasRowsSample
{
    static void Main()
    {
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();

        OracleCommand cmd = new OracleCommand(
            "select * from emp where empno = 9999", con);

        OracleDataReader reader = cmd.ExecuteReader();

        if (!reader.HasRows)
            Console.WriteLine("The result set is empty.");
        else
            Console.WriteLine("The result set is not empty.");

        con.Dispose();
    }
}
```

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)
- <http://msdn.microsoft.com/library> for detailed information about this Microsoft .NET Framework feature

## HiddenFieldCount

This property gets the number of fields in the `OracleDataReader` that are hidden.

### Declaration

```
// C#
public int HiddenFieldcount { get; }
```

### Property Value

The number of fields in the `OracleDataReader` that are hidden.

## Exceptions

InvalidOperationException - The reader is closed.

## Remarks

OracleDataReader.FieldCount and OracleDataReader.VisibleFieldCount return the visible field count.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)
- ["VisibleFieldCount"](#)
- ["FieldCount "](#)

## IsClosed

This property indicates whether or not the data reader is closed.

### Declaration

```
// C#  
public override bool IsClosed {get;}
```

### Property Value

If the OracleDataReader is in a closed state, returns true; otherwise, returns false.

### Implements

IDataReader

### Remarks

Default = true

IsClosed and RecordsAffected are the only two properties that are accessible after the OracleDataReader is closed.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## Item

This property gets the value of the column in .NET data type.

### Overload List:

- [Item \[index\]](#)  
This property gets the .NET `Value` of the column specified by the column index.
- [Item \[string\]](#)  
This property gets the .NET `Value` of the column specified by the column name.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## Item [index]

This property gets the .NET `Value` of the column specified by the column index.

### Declaration

```
// C#  
public override object this[int index] {get;}
```

### Parameters

- *index*  
The zero-based index of the column.

### Property Value

The .NET value of the specified column.

### Implements

`IDataRecord`

### Remarks

Default = Not Applicable

In C#, this property is the indexer for this class.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## Item [string]

This property gets the .NET `Value` of the column specified by the column name.

### Declaration

```
// C#  
public override object this[string columnName] {get;}
```

### Parameters

- *columnName*  
The name of the column.

### Property Value

The .NET `Value` of the specified column.

### Implements

`IDataRecord`

### Remarks

Default = Not Applicable

A case-sensitive search is made to locate the specified column by its name. If this fails, then a case-insensitive search is made.

In C#, this property is the indexer for this class.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## InitialLOBFetchSize

This property specifies the amount that the `OracleDataReader` initially fetches for LOB columns.

### Declaration

```
// C#  
public int InitialLOBFetchSize {get;}
```

### Property Value

The size of the chunk to retrieve.

### Exceptions

`InvalidOperationException` - The reader is closed.

### Remarks

The maximum value supported for `InitialLOBFetchSize` is 2 GB.

Default is the `OracleCommand.InitialLOBFetchSize`, from which this value is inherited.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)
- ["InitialLOBFetchSize"](#) for further information on `OracleCommand.InitialLOBFetchSize`
- ["Obtaining LOB Data"](#)

## InitialLONGFetchSize

This property specifies the amount that the `OracleDataReader` initially fetches for LONG and LONG RAW columns.

### Declaration

```
// C#  
public long InitialLONGFetchSize {get;}
```

### Property Value

The size of the chunk to retrieve. The default is 0.

### Exceptions

`InvalidOperationException` - The reader is closed.

### Remarks

The maximum value supported for `InitialLONGFetchSize` is 32767. If this property is set to a higher value, the provider resets it to 32767.

Default is `OracleCommand.InitialLONGFetchSize`, from which this value is inherited.

This property is read-only for the `OracleDataReader`.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)
- ["InitialLONGFetchSize"](#) for further information on `OracleCommand.InitialLONGFetchSize`
- ["Obtaining LONG and LONG RAW Data"](#)

## RecordsAffected

This property gets the number of rows changed, inserted, or deleted by execution of the SQL statement.

### Declaration

```
// C#  
public int RecordsAffected {get;}
```

### Property Value

The number of rows affected by execution of the SQL statement.

### Implements

`IDataReader`

## Remarks

Default = 0

The value of -1 is returned for `SELECT` statements.

`IsClosed` and `RecordsAffected` are the only two properties that are accessible after the `OracleDataReader` is closed.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## RowSize

This property gets the amount of memory the internal cache of the `OracleDataReader` needs to store one row of data.

### Declaration

```
// C#  
public long RowSize {get;}
```

### Property Value

A `long` that indicates the amount of memory (in bytes) that an `OracleDataReader` needs to store one row of data for the executed query.

### Remarks

The `RowSize` property is set to a nonzero value when the `OracleDataReader` object is created. This property can be used at design time or dynamically during runtime, to set the `FetchSize` property, based on the number of rows. For example, to enable the `OracleDataReader` object to fetch  $N$  rows for each database round-trip, the `OracleDataReader` `FetchSize` property can be set dynamically to  $\text{RowSize} * N$ . Note that for the `FetchSize` property to take effect appropriately, it must be set before the first invocation of `OracleDataReader.Read()` for the particular result set.

ODP.NET now supports values up to 32K for `VARCHAR2`, `NVARCHAR2` or `RAW` type columns in its calculation of `RowSize` value

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)
- ["FetchSize "](#)

## SuppressGetDecimalInvalidCastException

This property specifies whether to suppress the `InvalidCastException` and return a rounded-off 28 precision value if the Oracle `NUMBER` value has more than 28 precision.

### Declaration

```
// C#  
public bool SuppressGetDecimalInvalidCastException { get; set; }
```

### Property Type

`System.Boolean`

### Remarks

Oracle `NUMBER` has a maximum of 38 precision. `.NET Decimal` has a maximum of 28 or 29 precision. When the `GetDecimal()` method is called for an Oracle `NUMBER` value that cannot be represented as a `.NET Decimal`, then ODP.NET throws an `InvalidCastException` because not all the precision can be preserved when converting the number to a `.NET Decimal`.

This behavior occurs when `SuppressGetDecimalInvalidCastException` is set to `false`. Its default value is `false`.

When `SuppressGetDecimalInvalidCastException` is set to `true`, then the resulting decimal will be rounded off to 28 or 29 precision so that it can fit as a `.NET decimal` without throwing an exception.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## UseEdmMapping

This read-only property indicates whether or not the `OracleDataReader` utilizes the Entity Data Model mapping configuration when returning values.

### Declaration

```
// C#  
public bool UseEdmMapping {get;}
```

### Property Value

A `boolean` that indicates whether the `OracleDataReader` uses the Entity Data Model mapping configuration for returning values.

### Remarks

Default is `false`.

The value is inherited from the `OracleCommand` object.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)
- [OracleCommand Class](#)

## VisibleFieldCount

This property gets the number of fields in the `OracleDataReader` that are not hidden.

### Declaration

```
// C#  
public override int VisibleFieldcount { get; }
```

### Property Value

The number of fields that are not hidden.

### Exceptions

`InvalidOperationException` - The reader is closed.

### Remarks

If an application sets the `AddRowid` property on an `OracleCommand` object to `true`, then the application can access the `RowId` but it is not a visible field. If `RowId` is added in the select

statement list, then it is a visible field. `OracleDataReader.VisibleFieldCount` and `OracleDataReader.FieldCount` always have the same value.

### Example

```
// C#

using System;
using System.Data;
using System.Data.Common;
using Oracle.DataAccess.Client;

class VisibleFieldCountSample
{
    static void Main(string[] args)
    {
        string constr = "User Id=scott; Password=tiger; Data Source=oracle;";
        DbProviderFactory factory =
            DbProviderFactories.GetFactory("Oracle.DataAccess.Client");

        using (DbConnection conn = factory.CreateConnection())
        {
            conn.ConnectionString = constr;
            try
            {
                conn.Open();
                OracleCommand cmd = (OracleCommand)factory.CreateCommand();
                cmd.Connection = (OracleConnection)conn;

                //to gain access to ROWIDs of the table
                cmd.AddRowid = true;
                cmd.CommandText = "select empno, ename from emp;";

                OracleDataReader reader = cmd.ExecuteReader();

                int visFC = reader.VisibleFieldCount; //Results in 2
                int hidFC = reader.HiddenFieldCount; // Results in 1

                Console.WriteLine("Visible field count: " + visFC);
                Console.WriteLine("Hidden field count: " + hidFC);

                reader.Dispose();
                cmd.Dispose();
            }
            catch (Exception ex)
            {
                Console.WriteLine(ex.Message);
                Console.WriteLine(ex.StackTrace);
            }
        }
    }
}
```

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)
- ["VisibleFieldCount"](#)
- ["FieldCount "](#)

## OracleDataReader Public Methods

OracleDataReader public methods are listed in [Table 7-84](#).

**Table 7-84 OracleDataReader Public Methods**

Public Method	Description
<a href="#">Close</a>	Closes the OracleDataReader
CreateObjRef	Inherited from System.MarshalByRefObject
<a href="#">Dispose</a>	Releases any resources or memory allocated by the object
Equals	Inherited from System.Object (Overloaded)
<a href="#">GetBoolean</a>	Returns the bool value of the specified numeric column
<a href="#">GetByte</a>	Returns the byte value of the specified column
<a href="#">GetBytes</a>	Populates the provided byte array with up to the maximum number of bytes, from the specified offset (in bytes) of the column
<a href="#">GetChar</a>	<i>Not Supported</i>
<a href="#">GetChars</a>	Populates the provided character array with up to the maximum number of characters, from the specified offset (in characters) of the column
<a href="#">GetData</a>	<i>Not Supported</i>
<a href="#">GetDataTypeName</a>	Returns the ODP.NET type name of the specified column
<a href="#">GetDateTime</a>	Returns the DateTime value of the specified column
<a href="#">GetDateTimeOffset</a>	Returns the DateTimeOffset value of the specified column
<a href="#">GetDecimal</a>	Returns the decimal value of the specified NUMBER column
<a href="#">GetDouble</a>	Returns the double value of the specified NUMBER column or BINARY_DOUBLE column
<a href="#">GetEnumerator</a>	Returns an IEnumerator that can be used to iterate through the collection
<a href="#">GetFieldType</a>	Returns the Type of the specified column
<a href="#">GetFloat</a>	Returns the float value of the specified NUMBER column or BINARY_FLOAT column

Table 7-84 (Cont.) OracleDataReader Public Methods

Public Method	Description
<a href="#">GetGuid</a>	Returns the Guid value of the specified binary data column
GetHashCode	Inherited from System.Object
<a href="#">GetInt16</a>	Returns the Int16 value of the specified NUMBER column
<a href="#">GetInt32</a>	Returns the Int32 value of the specified NUMBER column
<a href="#">GetInt64</a>	Returns the Int64 value of the specified NUMBER column
GetLifetimeService	Inherited by System.MarshalByRefObject
<a href="#">GetName</a>	Returns the name of the specified column
<a href="#">GetOracleBFile</a>	Returns an OracleBFile object of the specified BFILE column
<a href="#">GetOracleBinary</a>	Returns an OracleBinary structure of the specified column
<a href="#">GetOracleBlob</a>	Returns an OracleBlob object of the specified BLOB column
<a href="#">GetOracleBlobForUpdate</a>	Returns an updatable OracleBlob object of the specified BLOB column <i>Not Available in ODP.NET, Managed Driver and ODP.NET Core</i>
<a href="#">GetOracleClob</a>	Returns an OracleClob object of the specified CLOB column
<a href="#">GetOracleClobForUpdate</a>	Returns an updatable OracleClob object of the specified CLOB column <i>Not Available in ODP.NET, Managed Driver and ODP.NET Core</i>
<a href="#">GetOracleDate</a>	Returns an OracleDate structure of the specified DATE column
<a href="#">GetOracleDecimal</a>	Returns an OracleDecimal structure of the specified NUMBER column
<a href="#">GetOracleIntervalDS</a>	Returns an OracleIntervalDS structure of the specified INTERVAL DAY TO SECOND column
<a href="#">GetOracleIntervalYM</a>	Returns an OracleIntervalYM structure of the specified INTERVAL YEAR TO MONTH column
<a href="#">GetOracleRef</a>	Returns an OracleRef object of the specified REF column
<a href="#">GetOracleString</a>	Returns an OracleString structure of the specified column
<a href="#">GetOracleTimeStamp</a>	Returns an OracleTimeStamp structure of the Oracle TimeStamp column
<a href="#">GetOracleTimeStampLTZ</a>	Returns an OracleTimeStampLTZ structure of the specified Oracle TimeStamp WITH LOCAL TIME ZONE column
<a href="#">GetOracleTimeStampTZ</a>	Returns an OracleTimeStampTZ structure of the specified Oracle TimeStamp WITH TIME ZONE column
<a href="#">GetOracleXmlType</a>	Returns an OracleXmlType object of the specified XMLType column
<a href="#">GetOracleValue</a>	Returns the specified column value as a ODP.NET type
<a href="#">GetOracleValues</a>	Gets all the column values as ODP.NET types
<a href="#">GetOrdinal</a>	Returns the 0-based ordinal (or index) of the specified column name
<a href="#">GetProviderSpecificFieldType</a>	Returns the provider-specific type of the specified column

Table 7-84 (Cont.) OracleDataReader Public Methods

Public Method	Description
<a href="#">GetProviderSpecificValue</a>	Returns an object that represents the underlying provider-specific value of the specified ordinal
<a href="#">GetProviderSpecificValues</a>	Returns an array of objects that represent the underlying provider-specific values
<a href="#">GetSchemaTable</a>	Returns a <code>DataTable</code> that describes the column metadata of the <code>OracleDataReader</code>
<a href="#">GetString</a>	Returns the string value of the specified column
<a href="#">GetTimeSpan</a>	Returns the <code>TimeSpan</code> value of the specified <code>INTERVAL DAY TO SECOND</code> column
<code>GetType</code>	Inherited from <code>System.Object</code> class
<a href="#">GetValue</a>	Returns the column value as a .NET type
<a href="#">GetValues</a>	Gets all the column values as .NET types
<a href="#">GetXmlReader</a>	Returns the value of an <code>XMLType</code> column as an instance of an .NET <code>XmlTextReader</code>
<a href="#">IsDBNull</a>	Indicates whether or not the column value is null
<a href="#">NextResult</a>	Advances the data reader to the next result set when reading the results
<a href="#">Read</a>	Reads the next row in the result set
<code>ToString</code>	Inherited from <code>System.Object</code>

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## Close

This method closes the `OracleDataReader`.

**Declaration**

```
// C#
public override void Close();
```

**Implements**

`IDataReader`

**Remarks**

The `Close` method frees all resources associated with the `OracleDataReader`.

**Example**

The code example for the `OracleDataReader` class includes the `Close` method. See [OracleDataReader Overview "Example"](#).

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## Dispose

This method releases any resources or memory allocated by the object.

**Declaration**

```
// C#  
public void Dispose();
```

**Implements**

`IDisposable`

**Remarks**

The `Dispose` method also closes the `OracleDataReader`.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetBoolean

This method returns the `bool` value of the specified numeric column.

### Declaration

```
// C#  
public override bool GetBoolean(int index);
```

### Parameters

- *index*  
The zero-based column index.

### Return Value

The bool value of the column.

### Implements

IDataRecord

### Exceptions

*InvalidOperationException* - The connection is closed, the reader is closed, *Read()* has not been called, or all rows have been read.

*IndexOutOfRangeException* - The column index is invalid.

*InvalidCastException* - The accessor method is invalid for this column type.

### Remarks

- This method can be called on any numeric database type column (*NUMBER*, *BINARY\_DOUBLE*, *BINARY\_FLOAT*, and *FLOAT*).
- *FALSE* is returned if column value is 0; *TRUE* otherwise.
- *IsDBNull* should be called to check for *NULL* values before calling this method.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetByte

This method returns the byte value of the specified column.

### Declaration

```
// C#  
public override byte GetByte(int index);
```

### Parameters

- *index*  
The zero-based column index.

### Return Value

The value of the column as a byte.

### Implements

IDataRecord

### Exceptions

*InvalidOperationException* - The connection is closed, the reader is closed, `Read()` has not been called, or all rows have been read.

*IndexOutOfRangeException* - The column index is invalid.

*InvalidCastException* - The accessor method is invalid for this column type or the column value is `NULL`.

### Remarks

`IsDBNull` should be called to check for `NULL` values before calling this method.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetBytes

This method populates the provided byte array with up to the maximum number of bytes, from the specified offset (in bytes) of the column.

### Declaration

```
// C#  
public override long GetBytes(int index, long fieldOffset, byte[] buffer,  
    int bufferOffset, int length);
```

### Parameters

- *index*  
The zero-based column index.
- *fieldOffset*  
The offset within the column from which reading begins (in bytes).

- *buffer*  
The byte array that the data is read into.
- *bufferOffset*  
The offset within the buffer to begin reading data into (in bytes).
- *length*  
The maximum number of bytes to read (in bytes).

### Return Value

The number of bytes read.

### Implements

IDataRecord

### Exceptions

*InvalidOperationException* - The connection is closed, the reader is closed, `Read()` has not been called, or all rows have been read.

*IndexOutOfRangeException* - The column index is invalid.

*InvalidCastException* - The accessor method is invalid for this column type or the column value is `NULL`.

### Remarks

This method returns the number of bytes read into the buffer. This may be less than the actual length of the field if the method has been called previously for the same column.

If a null reference is passed for `buffer`, the length of the field in bytes is returned.

`IsDBNull` should be called to check for `NULL` values before calling this method.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetChar

This method is not supported.

### Declaration

```
// C#  
public override long GetChar(int index);
```

### Parameters

- *index*  
The zero based column index.

### Implements

IDataRecord

### Exceptions

NotSupportedException - This property is not supported.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetChars

This method populates the provided character array with up to the maximum number of characters, from the specified offset (in characters) of the column.

### Declaration

```
// C#  
public override long GetChars(int index, long fieldOffset, char[] buffer,  
    int bufferOffset, int length);
```

### Parameters

- *index*  
The zero based column index.
- *fieldOffset*  
The index within the column from which to begin reading (in characters).
- *buffer*  
The character array that the data is read into.
- *bufferOffset*  
The index within the buffer to begin reading data into (in characters).
- *length*  
The maximum number of characters to read (in characters).

### Return Value

The number of characters read.

## Implements

IDataRecord

## Exceptions

`InvalidOperationException` - The connection is closed, the reader is closed, `Read()` has not been called, or all rows have been read.

`IndexOutOfRangeException` - The column index is invalid.

`InvalidCastException` - The accessor method is invalid for this column type or the column value is `NULL`.

## Remarks

This method returns the number of characters read into the buffer. This may be less than the actual length of the field, if the method has been called previously for the same column.

If a null reference is passed for buffer, the length of the field in characters is returned.

`IsDBNull` should be called to check for `NULL` values before calling this method.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetData

This method is not supported

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetDataTypeName

This method returns the ODP.NET type name of the specified column.

### Declaration

```
// C#  
public override string GetDataTypeName(int index);
```

### Parameters

- *index*  
The zero-based column index.

### Return Value

The name of the ODP.NET type of the column.

### Implements

IDataRecord

### Exceptions

*InvalidOperationException* - The reader is closed.

*IndexOutOfRangeException* - The column index is invalid.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetDateTime

This method returns the *DateTime* value of the specified column.

### Declaration

```
// C#  
public override DateTime GetDateTime(int index);
```

### Parameters

- *index*  
The zero-based column index.

### Return Value

The *DateTime* value of the column.

### Implements

IDataRecord

## Exceptions

`InvalidOperationException` - The connection is closed, the reader is closed, `Read()` has not been called, or all rows have been read.

`IndexOutOfRangeException` - The column index is invalid.

`InvalidCastException` - The accessor method is invalid for this column type or the column value is `NULL`.

## Remarks

`IsDBNull` should be called to check for `NULL` values before calling this method.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetDateTimeOffset

This method returns the `DateTimeOffset` value of a `TIMESTAMP WITH TIME ZONE` column. `DateTimeOffset` represents a point in time. It is generally expressed as a date and time relative to Coordinated Universal Time (UTC).

## Declaration

```
// C#  
public override DateTimeOffset GetDateTimeOffset(int index);
```

## Parameters

- *index*  
The zero-based column index.

## Return Value

The `DateTimeOffset` value of the column.

## Implements

`IDataRecord`

## Exceptions

`InvalidOperationException` - The connection is closed, the reader is closed, `Read()` has not been called, or all rows have been read.

`IndexOutOfRangeException` - The column index is invalid.

`InvalidCastException` - The accessor method is invalid for this column type or the column value is `NULL`.

#### Remarks

- This method can be called only on a `TIMESTAMP WITH TIME ZONE` column.
- `IsDBNull` should be called to check for `NULL` values before calling this method.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetDecimal

This method returns the decimal value of the specified `NUMBER` column.

#### Declaration

```
// C#  
public override decimal GetDecimal(int index);
```

#### Parameters

- `index`  
The zero-based column index.

#### Return Value

The decimal value of the column.

#### Implements

`IDataRecord`

#### Exceptions

`InvalidOperationException` - The connection is closed, the reader is closed, `Read()` has not been called, or all rows have been read.

`IndexOutOfRangeException` - The column index is invalid.

`InvalidCastException` - The accessor method is invalid for this column type or the column value is `NULL`.

#### Remarks

`IsDBNull` should be called to check for `NULL` values before calling this method.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetDouble

This method returns the `double` value of the specified `NUMBER` column or `BINARY_DOUBLE` column.

### Declaration

```
// C#  
public override double GetDouble(int index);
```

### Parameters

- *index*  
The zero-based column index.

### Return Value

The `double` value of the column.

### Implements

`IDataRecord`

### Exceptions

`InvalidOperationException` - The connection is closed, the reader is closed, `Read()` has not been called, or all rows have been read.

`IndexOutOfRangeException` - The column index is invalid.

`InvalidCastException` - The accessor method is invalid for this column type or the column value is `NULL`.

### Remarks

`IsDBNull` should be called to check for `NULL` values before calling this method.

`GetDouble` now supports retrieval of data from `BINARY_DOUBLE` columns.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetEnumerator

This method returns an `IEnumerator` that can be used to iterate through the collection (record set).

### Declaration

```
// C#  
public override IEnumerator GetEnumerator();
```

### Return Value

An `IEnumerator` that can be used to iterate through the collection (record set).

### Exceptions

`InvalidOperationException` - The reader is closed.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetFieldType

This method returns the `type` of the specified column.

### Declaration

```
// C#  
public override Type GetFieldType(int index);
```

### Parameters

- `index`  
The zero-based column index.

### Return Value

The `type` of the default .NET type of the column.

### Implements

`IDataRecord`

### Exceptions

`InvalidOperationException` - The reader is closed, or the specified column is a UDT but no registered custom type mapping exists for the UDT.

`IndexOutOfRangeException` - The column index is invalid.

### Remarks

`GetFieldType` returns a type that corresponds to the value that the application obtains after invoking the `GetValue` accessor or `Item` property on the `OracleDataReader`. For example, if the column is a string, this method returns a .NET Type object for a .NET string.

If the attribute is a UDT, this method may return either of the following:

- A .NET Type of the custom type if a custom type mapping exists for the Oracle object or collection.
- A .NET Type of string if the column is an Oracle `REF`.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetFloat

This method returns the `float` value of the specified `NUMBER` column or `BINARY_FLOAT` column.

### Declaration

```
// C#  
public override float GetFloat(int index);
```

### Parameters

- `index`  
The zero-based column index.

### Return Value

The `float` value of the column.

## Implements

IDataRecord

## Exceptions

`InvalidOperationException` - The connection is closed, the reader is closed, `Read()` has not been called, or all rows have been read.

`IndexOutOfRangeException` - The column index is invalid.

`InvalidCastException` - The accessor method is invalid for this column type or the column value is `NULL`.

## Remarks

`IsDBNull` should be called to check for `NULL` values before calling this method.

`GetFloat` now supports retrieval of data from `BINARY_FLOAT` columns.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetGuid

This method returns the `Guid` value of the specified binary data column. A GUID is a Globally Unique Identifier.

### Declaration

```
// C#  
public override Guid GetGuid(int index);
```

### Parameters

- *index*  
The zero-based column index.

### Return Value

The `Guid` value of the column.

### Implements

IDataRecord

## Exceptions

`InvalidOperationException` - The connection is closed, the reader is closed, `Read()` has not been called, or all rows have been read.

`IndexOutOfRangeException` - The column index is invalid.

`InvalidCastException` - The accessor method is invalid for this column type or the column value is `NULL`.

`System.ArgumentException` - Byte array for GUID must be exactly 16 bytes long.

## Remarks

- This method can be called on columns that contain binary data, such as `RAW` and `BLOB`.
- An exception will be thrown if the binary data of the column is not 16 bytes in length.
- `IsDBNull` should be called to check for `NULL` values before calling this method.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetInt16

This method returns the `Int16` value of the specified `NUMBER` column.

### Note:

`short` is equivalent to `Int16`.

## Declaration

```
// C#  
public override short GetInt16(int index);
```

## Parameters

- *index*  
The zero-based column index.

## Return Value

The `Int16` value of the column.

## Implements

IDataRecord

## Exceptions

`InvalidOperationException` - The connection is closed, the reader is closed, `Read()` has not been called, or all rows have been read.

`IndexOutOfRangeException` - The column index is invalid.

`InvalidCastException` - The accessor method is invalid for this column type or the column value is `NULL`.

## Remarks

`IsDBNull` should be called to check for `NULL` values before calling this method.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetInt32

This method returns the `Int32` value of the specified `NUMBER` column.



### Note:

`int` is equivalent to `Int32`.

## Declaration

```
// C#  
public override int GetInt32(int index);
```

## Parameters

- *index*  
The zero-based column index.

## Return Value

The `Int32` value of the column.

## Implements

IDataRecord

## Exceptions

`InvalidOperationException` - The connection is closed, the reader is closed, `Read()` has not been called, or all rows have been read.

`IndexOutOfRangeException` - The column index is invalid.

`InvalidCastException` - The accessor method is invalid for this column type or the column value is `NULL`.

## Remarks

`IsDBNull` should be called to check for `NULL` values before calling this method.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetInt64

This method returns the `Int64` value of the specified `NUMBER` column.

### Note:

`long` is equivalent to `Int64`.

## Declaration

```
// C#  
public override long GetInt64(int index);
```

## Parameters

- *index*  
The zero-based column index.

## Return Value

The `Int64` value of the column.

## Implements

IDataRecord

## Exceptions

`InvalidOperationException` - The connection is closed, the reader is closed, `Read()` has not been called, or all rows have been read.

`IndexOutOfRangeException` - The column index is invalid.

`InvalidCastException` - The accessor method is invalid for this column type or the column value is `NULL`.

## Remarks

`IsDBNull` should be called to check for `NULL` values before calling this method.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetName

This method returns the name of the specified column.

### Declaration

```
// C#  
public override string GetName(int index);
```

### Parameters

- *index*  
The zero-based column index.

### Return Value

The name of the column.

## Implements

IDataRecord

## Exceptions

`InvalidOperationException` - The reader is closed.

`IndexOutOfRangeException` - The column index is invalid.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetOracleBFile

This method returns an `OracleBFile` object of the specified `BFILE` column.

### Declaration

```
// C#  
public OracleBFile GetOracleBFile(int index);
```

### Parameters

- *index*  
The zero-based column index.

### Return Value

The `OracleBFile` value of the column.

### Exceptions

`InvalidOperationException` - The connection is closed, the reader is closed, `Read()` has not been called, or all rows have been read.

`IndexOutOfRangeException` - The column index is invalid.

`InvalidCastException` - The accessor method is invalid for this column type or the column value is `NULL`.

### Remarks

`IsDBNull` should be called to check for `NULL` values before calling this method.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetOracleBinary

This method returns an `OracleBinary` structure of the specified column.

### Declaration

```
// C#  
public OracleBinary GetOracleBinary(int index);
```

### Parameters

- *index*  
The zero-based column index.

### Return Value

The `OracleBinary` value of the column.

### Exceptions

`InvalidOperationException` - The connection is closed, the reader is closed, `Read()` has not been called, or all rows have been read.

`IndexOutOfRangeException` - The column index is invalid.

`InvalidCastException` - The accessor method is invalid for this column type or the column value is `NULL`.

### Remarks

`IsDBNull` should be called to check for `NULL` values before calling this method.

`GetOracleBinary` is used on the following Oracle types:

- BFILE
- BLOB
- LONG RAW
- RAW

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetOracleBlob

This method returns an `OracleBlob` object of the specified `BLOB` column.

## Declaration

```
// C#  
public OracleBlob GetOracleBlob(int index);
```

## Parameters

- *index*  
The zero-based column index.

## Return Value

The `OracleBlob` value of the column.

## Exceptions

`InvalidOperationException` - The connection is closed, the reader is closed, `Read()` has not been called, or all rows have been read.

`IndexOutOfRangeException` - The column index is invalid.

`InvalidCastException` - The accessor method is invalid for this column type or the column value is `NULL`.

## Remarks

`IsDBNull` should be called to check for `NULL` values before calling this method.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetOracleBlobForUpdate

`GetOracleBlobForUpdate` returns an updatable `OracleBlob` object of the specified BLOB column.

### Overload List:

- [GetOracleBlobForUpdate\(int\)](#)  
This method returns an updatable `OracleBlob` object of the specified BLOB column.
- [GetOracleBlobForUpdate\(int, int\)](#)  
This method returns an updatable `OracleBlob` object of the specified BLOB column using a `WAIT` clause.

## GetOracleBlobForUpdate(int)

This method returns an updatable `OracleBlob` object of the specified `BLOB` column.

### Declaration

```
// C#  
public OracleBlob GetOracleBlobForUpdate(int index);
```

### Parameters

- *index*  
The zero-based column index.

### Return Value

An updatable `OracleBlob` object.

### Exceptions

`InvalidOperationException` - The connection is closed, the reader is closed, `Read()` has not been called, or all rows have been read.

`IndexOutOfRangeException` - The column index is invalid.

`InvalidCastException` - The accessor method is invalid for this column type or the column value is `NULL`.

### Remarks

When the `OracleCommand`'s `ExecuteReader()` method is invoked, all the data fetched by the `OracleDataReader` is from a particular snapshot. Therefore, calling an accessor method on the same column always returns the same value. However, the `GetOracleBlobForUpdate()` method incurs a database round-trip to obtain a reference to the current `BLOB` data while also locking the row using the `FOR UPDATE` clause. This means that the `OracleBlob` obtained from `GetOracleBlob()` can have a different value than the `OracleBlob` obtained from `GetOracleBlobForUpdate()` since it is not obtained from the original snapshot.

The returned `OracleBlob` object can be used to safely update the `BLOB` because the `BLOB` column has been locked after a call to this method.

Invoking this method internally executes a `SELECT...FOR UPDATE` statement without a `WAIT` clause. Therefore, the statement can wait indefinitely until a lock is acquired for that row.

`IsDBNull` should be called to check for `NULL` values before calling this method.

### Example

The following example gets the `OracleBlob` object for update from the reader, updates the `OracleBlob` object, and then commits the transaction.

```
/* Database Setup, if you have not done so yet.  
connect scott/tiger@oracle  
CREATE TABLE empInfo (  
empno NUMBER(4) PRIMARY KEY,
```

```
empName VARCHAR2(20) NOT NULL,
hiredate DATE,
salary NUMBER(7,2),
jobDescription Clob,
byteCodes BLOB
);

Insert into empInfo(EMPNO,EMPNAME,JOBDESCRIPTION,byteCodes) values
(1,'KING','SOFTWARE ENGR', '5657');
Insert into empInfo(EMPNO,EMPNAME,JOBDESCRIPTION,byteCodes) values
(2,'SCOTT','MANAGER', '5960');
commit;

*/
// C#

using System;
using System.Data;
using Oracle.DataAccess.Client;
using Oracle.DataAccess.Types;

class GetOracleBlobForUpdateSample
{
    static void Main()
    {
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();

        // Get the ByteCodes for empno = 1
        string cmdstr = "SELECT BYTECODES, EMPNO FROM EMPINFO where EMPNO = 1";
        OracleCommand cmd = new OracleCommand(cmdstr, con);

        // Since we are going to update the OracleBlob object, we will
        //have to create a transaction
        OracleTransaction txn = con.BeginTransaction();

        // Get the reader
        OracleDataReader reader = cmd.ExecuteReader();

        // Declare the variables to retrieve the data in EmpInfo
        OracleBlob byteCodesBlob;

        // Read the first row
        reader.Read();
        if (!reader.IsDBNull(0))
        {
            byteCodesBlob = reader.GetOracleBlobForUpdate(0);

            // Close the reader
            reader.Close();

            // Update the ByteCodes object
            byte[] addedBytes = new byte[2] {0, 0};
            byteCodesBlob.Append(addedBytes, 0, addedBytes.Length);

            // Now commit the transaction
            txn.Commit();
            Console.WriteLine("Blob Column successfully updated");
        }
        else
    }
}
```

```
        reader.Dispose();

        // Close the connection
        con.Dispose();
    }
}
```

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)
- ["LOB Support"](#)

## GetOracleBlobForUpdate(int, int)

This method returns an updatable `OracleBlob` object of the specified BLOB column using a `WAIT` clause.

### Declaration

```
// C#
public OracleBlob GetOracleBlobForUpdate(int index, int wait);
```

### Parameters

- *index*  
The zero-based column index.
- *wait*  
The number of seconds the method waits to acquire a lock.

### Return Value

An updatable `OracleBlob` object.

### Exceptions

`InvalidOperationException` - The connection is closed, the reader is closed, `Read()` has not been called, or all rows have been read.

`IndexOutOfRangeException` - The column index is invalid.

`InvalidCastException` - The accessor method is invalid for this column type or the column value is `NULL`.

### Remarks

When the `OracleCommand`'s `ExecuteReader()` method is invoked, all the data fetched by the `OracleDataReader` is from a particular snapshot. Therefore, calling an accessor method on the same column always returns the same value. However, the

`GetOracleBlobForUpdate()` method incurs a database round-trip to obtain a reference to the current BLOB data while also locking the row using the `FOR UPDATE` clause. This means that the `OracleBlob` obtained from `GetOracleBlob()` can have a different value than the `OracleBlob` obtained from `GetOracleBlobForUpdate()` since it is not obtained from the original snapshot.

`IsDBNull` should be called to check for `NULL` values before calling this method.

The returned `OracleBlob` object can be used to safely update the BLOB because the BLOB column has been locked after a call to this method.

Invoking this method internally executes a `SELECT...FOR UPDATE` statement which locks the row.

Different `WAIT` clauses are appended to the statement, depending on the `wait` value. If the `wait` value is:

- 0  
"NOWAIT" is appended at the end of a `SELECT...FOR UPDATE` statement. The statement executes immediately whether the lock is acquired or not. If the lock is not acquired, an exception is thrown.
- *n*  
"WAIT *n*" is appended at the end of a `SELECT...FOR UPDATE` statement. The statement executes as soon as the lock is acquired. However, if the lock cannot be acquired by *n* seconds, this method call throws an exception.  
  
The `WAIT n` feature is only available for Oracle9i or later. For any version lower than Oracle9i, *n* is implicitly treated as -1 and nothing is appended at the end of a `SELECT...FOR UPDATE` statement.
- -1  
Nothing is appended at the end of the `SELECT...FOR UPDATE`. The statement execution waits indefinitely until a lock can be acquired.

### Example

The `GetOracleBlobForUpdate` methods are comparable. See "Example" for a code example demonstrating usage.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)
- ["LOB Support"](#)

## GetOracleClob

This method returns an `OracleClob` object of the specified CLOB column.

### Declaration

```
// C#  
public OracleClob GetOracleClob(int index);
```

### Parameters

- *index*  
The zero-based column index.

### Return Value

The `OracleClob` value of the column.

### Exceptions

`InvalidOperationException` - The connection is closed, the reader is closed, `Read()` has not been called, or all rows have been read.

`IndexOutOfRangeException` - The column index is invalid.

`InvalidCastException` - The accessor method is invalid for this column type or the column value is `NULL`.

### Remarks

`IsDBNull` should be called to check for `NULL` values before calling this method.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)
- ["LOB Support"](#)

## GetOracleClobForUpdate

`GetOracleClobForUpdate` returns an updatable `OracleClob` object of the specified CLOB column.

### Overload List:

- [GetOracleClobForUpdate\(int\)](#)  
This method returns an updatable `OracleClob` object of the specified CLOB column.
- [GetOracleClobForUpdate\(int, int\)](#)  
This method returns an updatable `OracleClob` object of the specified CLOB column using a `WAIT` clause.

## GetOracleClobForUpdate(int)

This method returns an updatable `OracleClob` object of the specified `CLOB` column.

### Declaration

```
// C#  
public OracleClob GetOracleClobForUpdate(int index);
```

### Parameters

- *index*  
The zero-based column index.

### Return Value

An updatable `OracleClob`.

### Exceptions

`InvalidOperationException` - The connection is closed, the reader is closed, `Read()` has not been called, or all rows have been read.

`IndexOutOfRangeException` - The column index is invalid.

`InvalidCastException` - The accessor method is invalid for this column type or the column value is `NULL`.

### Remarks

When the `OracleCommand`'s `ExecuteReader()` method is invoked, all the data fetched by the `OracleDataReader` is from a particular snapshot. Therefore, calling an accessor method on the same column always returns the same value. However, the `GetOracleClobForUpdate()` method incurs a database round-trip to obtain a reference to the current `CLOB` data while also locking the row using the `FOR UPDATE` clause. This means that the `OracleClob` obtained from `GetOracleClob()` can have a different value than the `OracleClob` obtained from `GetOracleClobForUpdate()` since it is not obtained from the original snapshot.

The returned `OracleClob` object can be used to safely update the `CLOB` because the `CLOB` column is locked after a call to this method.

Invoking this method internally executes a `SELECT . . . FOR UPDATE` statement without a `WAIT` clause. Therefore, the statement can wait indefinitely until a lock is acquired for that row.

`IsDBNull` should be called to check for `NULL` values before calling this method.

### Example

The following example gets the `OracleClob` object for update from the reader, updates the `OracleClob` object, and then commits the transaction.

```
/* Database Setup, if you have not done so yet.  
connect scott/tiger@oracle  
CREATE TABLE empInfo (  
empno NUMBER(4) PRIMARY KEY,  
empName VARCHAR2(20) NOT NULL,  
hiredate DATE,
```

```
salary NUMBER(7,2),
jobDescription Clob,
byteCodes BLOB
);

Insert into empInfo(EMPNO,EMPNAME,JOBDESCRIPTION,byteCodes) values
(1,'KING','SOFTWARE ENGR', '5657');
Insert into empInfo(EMPNO,EMPNAME,JOBDESCRIPTION,byteCodes) values
(2,'SCOTT','MANAGER', '5960');
commit;

*/
// C#

using System;
using System.Data;
using Oracle.DataAccess.Client;
using Oracle.DataAccess.Types;

class GetOracleClobForUpdateSample
{
    static void Main()
    {
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();

        // Get the job description for empno = 1
        string cmdStr = "SELECT JOBDESCRIPTION, EMPNO FROM EMPINFO where EMPNO = 1";
        OracleCommand cmd = new OracleCommand(cmdStr, con);

        // Since we are going to update the OracleClob object, we will
        // have to create a transaction
        OracleTransaction txn = con.BeginTransaction();

        // Get the reader
        OracleDataReader reader = cmd.ExecuteReader();

        // Declare the variables to retrieve the data in EmpInfo
        OracleClob jobDescClob;

        // Read the first row
        reader.Read();

        if (!reader.IsDBNull(0))
        {
            jobDescClob = reader.GetOracleClobForUpdate(0);

            // Close the reader
            reader.Close();

            // Update the job description Clob object
            char[] jobDesc = "-SALES".ToCharArray();
            jobDescClob.Append(jobDesc, 0, jobDesc.Length);

            // Now commit the transaction
            txn.Commit();
            Console.WriteLine("Clob Column successfully updated");
        }
        else
            reader.Close();
    }
}
```

```
// Close the connection
con.Close();
}
}
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)
- ["LOB Support"](#)

## GetOracleClobForUpdate(int, int)

This method returns an updatable `OracleClob` object of the specified CLOB column using a `WAIT` clause.

### Declaration

```
// C#
public OracleClob GetOracleClobForUpdate(int index, int wait);
```

### Parameters

- *index*  
The zero-based column index.
- *wait*  
The number of seconds the method waits to acquire a lock.

### Return Value

An updatable `OracleClob`.

### Exceptions

`InvalidOperationException` - The connection is closed, the reader is closed, `Read()` has not been called, or all rows have been read.

`IndexOutOfRangeException` - The column index is invalid.

`InvalidCastException` - The accessor method is invalid for this column type or the column value is `NULL`.

### Remarks

When the `OracleCommand`'s `ExecuteReader()` method is invoked, all the data fetched by the `OracleDataReader` is from a particular snapshot. Therefore, calling an accessor method on the same column always returns the same value. However, the `GetOracleClobForUpdate()` method incurs a database round-trip to obtain a reference to the current CLOB data while also

locking the row using the `FOR UPDATE` clause. This means that the `OracleClob` obtained from `GetOracleClob()` can have a different value than the `OracleClob` obtained from `GetOracleClobForUpdate()` since it is not obtained from the original snapshot.

Invoking this method internally executes a `SELECT...FOR UPDATE` statement which locks the row.

The returned `OracleClob` object can be used to safely update the `CLOB` because the `CLOB` column is locked after a call to this method.

Different `WAIT` clauses are appended to the statement, depending on the `wait` value. If the `wait` value is:

- 0  
"NOWAIT" is appended at the end of a `SELECT...FOR UPDATE` statement. The statement executes immediately whether the lock is acquired or not. If the lock is not acquired, an exception is thrown.
- *n*  
"WAIT *n*" is appended at the end of a `SELECT...FOR UPDATE` statement. The statement executes as soon as the lock is acquired. However, if the lock cannot be acquired by *n* seconds, this method call throws an exception.  
  
The `WAIT n` feature is only available for Oracle9i or later. For any version lower than Oracle9i, *n* is implicitly treated as -1 and nothing is appended at the end of a `SELECT...FOR UPDATE` statement.
- -1  
Nothing is appended at the end of the `SELECT...FOR UPDATE`. The statement execution waits indefinitely until a lock can be acquired.

`IsDBNull` should be called to check for `NULL` values before calling this method.

### Example

The `GetOracleClobForUpdate` methods are comparable. See "Example" for a code example demonstrating usage.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)
- ["LOB Support"](#)

## GetOracleDate

This method returns an `OracleDate` structure of the specified `DATE` column.

**Declaration**

```
// C#  
public OracleDate GetOracleDate(int index);
```

**Parameters**

- *index*  
The zero-based column index.

**Return Value**

The `OracleDate` value of the column.

**Exceptions**

`InvalidOperationException` - The connection is closed, the reader is closed, `Read()` has not been called, or all rows have been read.

`IndexOutOfRangeException` - The column index is invalid.

`InvalidCastException` - The accessor method is invalid for this column type or the column value is `NULL`.

**Remarks**

`IsDBNull` should be called to check for `NULL` values before calling this method.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)
- ["LOB Support"](#)

## GetOracleDecimal

This method returns an `OracleDecimal` structure of the specified `NUMBER` column.

**Declaration**

```
// C#  
public OracleDecimal GetOracleDecimal(int index);
```

**Parameters**

- *index*  
The zero-based column index.

### Return Value

The `OracleDecimal` value of the column.

### Exceptions

`InvalidOperationException` - The connection is closed, the reader is closed, `Read()` has not been called, or all rows have been read.

`IndexOutOfRangeException` - The column index is invalid.

`InvalidCastException` - The accessor method is invalid for this column type or the column value is `NULL`.

### Remarks

`IsDBNull` should be called to check for `NULL` values before calling this method.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetOracleIntervalDS

This method returns an `OracleIntervalDS` structure of the specified `INTERVAL DAY TO SECOND` column.

### Declaration

```
// C#  
public OracleIntervalDS GetOracleIntervalDS(int index);
```

### Parameters

- *index*  
The zero-based column index.

### Return Value

The `OracleIntervalDS` value of the column.

### Exceptions

`InvalidOperationException` - The connection is closed, the reader is closed, `Read()` has not been called, or all rows have been read.

`IndexOutOfRangeException` - The column index is invalid.

`InvalidCastException` - The accessor method is invalid for this column type or the column value is `NULL`.

### Remarks

`IsDBNull` should be called to check for `NULL` values before calling this method.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetOracleIntervalYM

This method returns an `OracleIntervalYM` structure of the specified `INTERVAL YEAR TO MONTH` column.

### Declaration

```
// C#  
public OracleIntervalYM GetOracleIntervalYM(int index);
```

### Parameters

- *index*  
The zero-based column index.

### Return Value

The `OracleIntervalYM` value of the column.

### Exceptions

`InvalidOperationException` - The connection is closed, the reader is closed, `Read()` has not been called, or all rows have been read.

`IndexOutOfRangeException` - The column index is invalid.

`InvalidCastException` - The accessor method is invalid for this column type or the column value is `NULL`.

### Remarks

`IsDBNull` should be called to check for `NULL` values before calling this method.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetOracleRef

This method returns an `OracleRef` object of the specified `REF` column.

### Declaration

```
// C#  
public OracleRef GetOracleRef(int index);
```

### Parameters

- *index*  
The zero-based column index.

### Return Value

The `OracleRef` object of the specified column.

### Exceptions

`InvalidOperationException` - The connection is closed, the reader is closed, the `Read` method has not been called, or all rows have been read.

`IndexOutOfRangeException` - The column index is invalid.

`InvalidCastException` - The accessor method is invalid for this column type.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetOracleString

This method returns an `OracleString` structure of the specified column.

### Declaration

```
// C#  
public OracleString GetOracleString(int index);
```

### Parameters

- *index*  
The zero-based column index.

### Return Value

The `OracleString` value of the column.

### Exceptions

`InvalidOperationException` - The connection is closed, the reader is closed, `Read()` has not been called, or all rows have been read.

`IndexOutOfRangeException` - The column index is invalid.

`InvalidCastException` - The accessor method is invalid for this column type or the column value is `NULL`.

### Remarks

If the column is an Oracle `REF` column, the string returned is a hexadecimal value that represents the `REF` in the database.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetOracleTimeStamp

This method returns an `OracleTimeStamp` structure of the Oracle `TimeStamp` column.

### Declaration

```
// C#  
public OracleTimeStamp GetOracleTimeStamp(int index);
```

### Parameters

- *index*  
The zero-based column index.

### Return Value

The `OracleTimeStamp` value of the column.

### Exceptions

`InvalidOperationException` - The connection is closed, the reader is closed, `Read()` has not been called, or all rows have been read.

`IndexOutOfRangeException` - The column index is invalid.

`InvalidCastException` - The accessor method is invalid for this column type or the column value is `NULL`.

### Remarks

`GetOracleTimeStamp` is used with the Oracle Type `TimeStamp`.

`IsDBNull` should be called to check for `NULL` values before calling this method.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetOracleTimeStampLTZ

This method returns an `OracleTimeStampLTZ` structure of the specified Oracle `TimeStamp WITH LOCAL TIME ZONE` column.

### Declaration

```
// C#  
public OracleTimeStampLTZ GetOracleTimeStampLTZ(int index);
```

### Parameters

- `index`  
The zero-based column index.

### Return Value

The `OracleTimeStampLTZ` value of the column.

### Exceptions

`InvalidOperationException` - The connection is closed, the reader is closed, `Read()` has not been called, or all rows have been read.

`IndexOutOfRangeException` - The column index is invalid.

`InvalidCastException` - The accessor method is invalid for this column type or the column value is `NULL`.

### Remarks

`GetOracleTimeStampLTZ` is used with the Oracle Type `TimeStamp with Local Time Zone` columns.

`IsDBNull` should be called to check for `NULL` values before calling this method.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetOracleTimeStampTZ

This method returns an `OracleTimeStampTZ` structure of the specified Oracle `TimeStamp WITH TIME ZONE` column.

### Declaration

```
// C#  
public OracleTimeStampTZ GetOracleTimeStampTZ(int index);
```

### Parameters

- *index*  
The zero-based column index.

### Return Value

The `OracleTimeStampTZ` value of the column.

### Exceptions

`InvalidOperationException` - The connection is closed, the reader is closed, `Read()` has not been called, or all rows have been read.

`IndexOutOfRangeException` - The column index is invalid.

`InvalidCastException` - The accessor method is invalid for this column type or the column value is `NULL`.

### Remarks

Used with the Oracle Type `TimeStamp with Local Time Zone` columns

`IsDBNull` should be called to check for `NULL` values before calling this method.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetOracleXmlType

This method returns an `OracleXmlType` object of the specified `XMLType` column.

### Declaration

```
// C#  
public OracleXmlType GetOracleXmlType(int index);
```

### Parameters

- *index*  
The zero-based column index.

### Return Value

The `OracleXmlType` value of the column.

### Exceptions

`InvalidCastException` - The accessor method is invalid for this column type or the column value is `NULL`.

### Remarks

`IsDBNull` should be called to check for `NULL` values before calling this method.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetOracleValue

This method returns the specified column value as an ODP.NET type.

### Declaration

```
// C#  
public object GetOracleValue(int index);
```

### Parameters

- *index*  
The zero-based column index.

### Return Value

The value of the column as an ODP.NET type.

### Exceptions

*InvalidOperationException* - The connection is closed, the reader is closed, *Read()* has not been called, or all rows have been read.

*IndexOutOfRangeException* - The column index is invalid.

### Remarks

If the column is an Oracle object or Oracle collection column and a custom type mapping exists, then a custom type is returned.

If the column is an Oracle REF column, then an *OracleRef* is returned.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetOracleValues

This method gets all the column values as ODP.NET types.

### Declaration

```
// C#  
public int GetOracleValues(object[] values);
```

### Parameters

- *values*  
An array of objects to hold the ODP.NET types as the column values.

### Return Value

The number of ODP.NET types in the *values* array.

### Exceptions

`InvalidOperationException` - The connection is closed, the reader is closed, `Read()` has not been called, or all rows have been read.

### Remarks

This method provides a way to retrieve all column values rather than retrieving each column value individually.

The number of column values retrieved is the minimum of the length of the `values` array and the number of columns in the result set.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)
- ["LOB Support"](#)

## GetOrdinal

This method returns the 0-based ordinal (or index) of the specified column name.

### Declaration

```
// C#  
public override int GetOrdinal(string name);
```

### Parameters

- `name`  
The specified column name.

### Return Value

The index of the column.

### Implements

`IDataRecord`

### Exceptions

`InvalidOperationException` - The reader is closed.

`IndexOutOfRangeException` - The column index is invalid.

## Remarks

A case-sensitive search is made to locate the specified column by its name. If this fails, then a case-insensitive search is made.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetProviderSpecificFieldType

This method returns the provider-specific type of the specified column.

### Declaration

```
// C#public override Type GetProviderSpecificFieldType(int index);
```

### Parameters

- *index*  
A zero-based column index.

### Return Value

The provider-specific type of the specified column. This is a member of the `Oracle.DataAccess.Types` namespace.

### Exceptions

`IndexOutOfRangeException` - The column index is invalid.

`InvalidOperationException` - The reader is closed, or the specified column is a UDT but no registered custom type mapping exists for the UDT.

### Remarks

`GetProviderSpecificFieldType` returns a type that corresponds to the value the application obtains after invoking the `GetProviderSpecificValue` accessor on the `OracleDataReader`. For example, if the column is a string, this method returns a .NET Type object for an `OracleString`.

If the attribute is a UDT, this method may return any of the following:

- A .NET Type of the custom type, if the column is an Oracle object or Oracle collection column and a custom type mapping exists.
- A .NET Type of `OracleRef` if the column is an Oracle REF.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetProviderSpecificValue

This method returns an object that represents the underlying provider-specific value of the specified ordinal.

### Declaration

```
// C#  
public override object GetProviderSpecificValue (int index);
```

### Parameters

*index*

A zero-based column index.

### Return Value

An `Object` that is a representation of the underlying provider-specific field type.

### Exceptions

`IndexOutOfRangeException` - The column index is invalid.

`InvalidOperationException` - The connection is closed, the reader is closed, `Read()` has not been called or all rows have been read.

### Remarks

If the column is an Oracle object or collection column, and a custom type mapping exists, a custom type is returned.

If the column is an Oracle `REF` column, an `OracleRef` is returned.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetProviderSpecificValues

This method returns an array of objects that represent the underlying provider-specific values.

### Declaration

```
// C#  
public override int GetProviderSpecificValues(object [ ] values);
```

### Parameters

- *values*  
An array of objects.

### Return Value

The number of `Object` instances in the array.

### Exceptions

`InvalidOperationException` - The reader is closed.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetSchemaTable

This method returns a `DataTable` that describes the column metadata of the `OracleDataReader`.

### Declaration

```
// C#  
public override DataTable GetSchemaTable();
```

### Return Value

A `DataTable` that contains the metadata of the result set.

### Implements

`IDataReader`

### Exceptions

`InvalidOperationException` - The connection is closed or the reader is closed.

**Remarks**

The `OracleDataReader.GetSchemaTable` method returns the `SchemaTable`.

**OracleDataReader SchemaTable**

The `OracleDataReader SchemaTable` is a `DataTable` that describes the column metadata of the `OracleDataReader`.

The value of `ColumnSize` can show value up to 32K depending on the definition of `VARCHAR2`, `NVARCHAR2`, or `RAW` type columns in the table definition.

The columns of the `SchemaTable` are in the order shown.

**Table 7-85 OracleDataReader SchemaTable**

Name	Name Type	Description
<code>ColumnName</code>	<code>System.String</code>	The name of the column.
<code>ColumnOrdinal</code>	<code>System.Int32</code>	The 0-based ordinal of the column.
<code>ColumnSize</code>	<code>System.Int64</code>	The maximum possible length of a value in the column. <code>ColumnSize</code> value is determined as follows: <ul style="list-style-type: none"> <li>• <code>CHAR</code> and <code>VARCHAR2</code> types: <ul style="list-style-type: none"> <li>in bytes - if <code>IsByteSemantic</code> boolean value is true</li> <li>in characters - if <code>IsByteSemantic</code> boolean value is false</li> </ul> </li> <li>• All other types: <ul style="list-style-type: none"> <li>in bytes</li> </ul> </li> </ul>
<code>NumericPrecision</code>	<code>System.Int16</code>	The maximum precision of the column, if the column is a numeric data type. This column has valid values for Oracle <code>NUMBER</code> , Oracle <code>INTERVAL YEAR TO MONTH</code> , and Oracle <code>INTERVAL DAY TO SECOND</code> columns. For all other columns, the value is null.
<code>NumericScale</code>	<code>System.Int16</code>	The scale of the column. This column has valid values for Oracle <code>NUMBER</code> , Oracle <code>INTERVAL DAY TO SECOND</code> , and the Oracle <code>TIMESTAMP</code> columns. For all other columns, the value is null.

Table 7-85 (Cont.) OracleDataReader SchemaTable

Name	Name Type	Description
IsUnique	System.Boolean	<p>Indicates whether or not the column is unique.</p> <p><code>true</code> if no two rows in the base table can have the same value in this column, where the base table is the table returned in <code>BaseTableName</code>.</p> <p><code>IsUnique</code> is guaranteed to be <code>true</code> if one of the following applies in descending order of priority:</p> <ul style="list-style-type: none"> <li>the column constitutes a base table primary key by itself and a <code>NOT NULL</code> constraint has been defined on the column</li> <li>there is a unique constraint or a unique index that applies only to this column and a <code>NOT NULL</code> constraint has been defined on the column</li> <li>the column is an explicitly selected <code>ROWID</code></li> </ul> <p><code>IsUnique</code> is <code>false</code> if the column can contain duplicate values in the base table.</p> <p>The default is <code>false</code>.</p> <p>The value of this property is the same for each occurrence of the base table column in the select list.</p>
IsKey	System.Boolean	<p>Indicates whether or not the column is a key column.</p> <p><code>true</code> if the column is one of a set of columns in the rowset that, taken together, uniquely identify the row. The set of columns with <code>IsKey</code> set to <code>true</code> must uniquely identify a row in the rowset. There is no requirement that this set of columns is a minimal set of columns.</p> <p>This set of columns can be generated from one of the following in descending order of priority:</p> <ul style="list-style-type: none"> <li>A base table primary key with the following condition: A <code>NOT NULL</code> constraint must be defined on the column or on all of the columns, in the case of a composite primary key.</li> <li>Any of the unique constraints or unique indexes with the following condition: A <code>NOT NULL</code> constraint must be defined on the column or on all of the columns, in the case of a composite unique constraint or composite unique index.</li> <li>A base table composite primary key with the following condition: A <code>NULL</code> constraint must be defined on at least one, but not all, of the columns.</li> <li>Any of the composite unique constraints or composite unique indexes with the following condition: A <code>NULL</code> constraint must be defined on at least one, but not all, of the columns.</li> </ul> <p>An explicitly selected <code>ROWID</code>. <code>false</code> if the column is not required to uniquely identify the row. The value of this property is the same for each occurrence of the base table column in the select list.</p>
IsRowID	System.Boolean	<code>true</code> if the column is a <code>ROWID</code> , otherwise <code>false</code> .
BaseColumnName	System.String	The name of the column in the database if an alias is used for the column.

Table 7-85 (Cont.) OracleDataReader SchemaTable

Name	Name Type	Description
BaseSchemaName	System.String	The name of the schema in the database that contains the column.
BaseTableName	System.String	The name of the table or view in the database that contains the column.
DataType	System.RuntimeType	Maps to the common language runtime type.
ProviderType	Oracle.DataAccess.Client.OracleDbType	The database column type (OracleDbType) of the column.
AllowDBNull	System.Boolean	true if null values are allowed, otherwise false.
IsAliased	System.Boolean	true if the column is an alias; otherwise false.
IsByteSemantic	System.Boolean	IsByteSemantic is: <ul style="list-style-type: none"> <li>• true if the ColumnSize value uses bytes semantics</li> <li>• false if ColumnSize uses character semantics</li> </ul> This value is always true when connected to a database version earlier than Oracle9i.
IsExpression	System.Boolean	true if the column is an expression; otherwise false.
IsHidden	System.Boolean	true if the column is hidden; otherwise false.
IsReadOnly	System.Boolean	true if the column is read-only; otherwise false.
IsLong	System.Boolean	true if the column is a LONG, LONG RAW, BLOB, CLOB, or BFILE; otherwise false.
UdtTypeName	System.String	The type name of the UDT.
IsIdentity	System.Boolean	true if the column is an identity column; otherwise false.
IsAutoIncrement	System.Boolean	true if the column assigns values to new rows in fixed increments; otherwise false. <i>Not Available in ODP.NET, Managed Driver and ODP.NET Core</i>
IdentityType	OracleIdentityType	An OracleIdentityType enumeration value that specifies how the identity column values are generated; otherwise DbNull.Value, if the column is not an identity column. <i>Not Available in ODP.NET, Managed Driver and ODP.NET Core</i>

### Example

This example creates and uses the SchemaTable from the reader.

```

/* Database Setup, if you have not done so yet.
connect scott/tiger@oracle
CREATE TABLE empInfo (
empno NUMBER(4) PRIMARY KEY,
empName VARCHAR2(20) NOT NULL,
hiredate DATE,
salary NUMBER(7,2),
jobDescription Clob,
byteCodes BLOB

```

```
);

Insert into empInfo(EMPNO,EMPNAME,JOBDESCRIPTION,byteCodes) values
(1,'KING','SOFTWARE ENGR', '5657');
Insert into empInfo(EMPNO,EMPNAME,JOBDESCRIPTION,byteCodes) values
(2,'SCOTT','MANAGER', '5960');
commit;

*/
// C#

using System;
using System.Data;
using Oracle.DataAccess.Client;
using Oracle.DataAccess.Types;

class GetSchemaTableSample
{
    static void Main()
    {
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();

        string cmdstr = "SELECT EMPNO,EMPNAME FROM EMPINFO where EMPNO = 1";
        OracleCommand cmd = new OracleCommand(cmdstr, con);

        //get the reader
        OracleDataReader reader = cmd.ExecuteReader();

        //get the schema table
        DataTable schemaTable = reader.GetSchemaTable();

        //retrieve the first column info.
        DataRow row = schemaTable.Rows[0];

        //print out the column info
        Console.WriteLine("Column name: " + row["COLUMNNAME"]);
        Console.WriteLine("Precision: " + row["NUMERICPRECISION"]);
        Console.WriteLine("Scale: " + row["NUMERICSCALE"]);
        reader.Close();

        // Close the connection
        con.Close();
    }
}
```

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetString

This method returns the `string` value of the specified column.

### Declaration

```
// C#  
public override string GetString(int index);
```

### Parameters

- `index`  
The zero-based column index.

### Return Value

The `string` value of the column.

### Implements

`IDataRecord`

### Exceptions

`InvalidOperationException` - The connection is closed, the reader is closed, `Read()` has not been called, or all rows have been read.

`IndexOutOfRangeException` - The column index is invalid.

`InvalidCastException` - The accessor method is invalid for this column type or the column value is `NULL`.

### Remarks

`GetString()` can be called on all character-based column data types. Starting with version 19.10, `GetString()` can be called on all non-binary data types, returning a string representation of the following additional types with the NLS format session setting honored:

- `NUMBER`
- `DATE`
- `TIMESTAMP`
- `TIMESTAMP LTZ`
- `TIMESTAMP TZ`
- `INTERVAL YEAR TO MONTH`
- `INTERVAL DAY TO SECOND`
- `BINARY_DOUBLE`
- `BINARY_FLOAT`
- `FLOAT`

Call the `IsDBNull` method to check for null values before calling this method.

If the column is an Oracle `REF` column, the string returned is a hexadecimal string that represents the `REF` in the database.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetTimeSpan

This method returns the `TimeSpan` value of the specified `INTERVAL DAY TO SECOND` column.

### Declaration

```
// C#  
public TimeSpan GetTimeSpan(int index);
```

### Parameters

- *index*  
The zero-based column index.

### Return Value

The `TimeSpan` value of the column.

### Implements

`IDataRecord`

### Exceptions

`InvalidOperationException` - The connection is closed, the reader is closed, `Read()` has not been called, or all rows have been read.

`IndexOutOfRangeException` - The column index is invalid.

`InvalidCastException` - The accessor method is invalid for this column type or the column value is `NULL`.

### Remarks

`IsDBNull` should be called to check for `NULL` values before calling this method.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetValue

This method returns the column value as a .NET type.

### Declaration

```
// C#  
public override object GetValue(int index);
```

### Parameters

- *index*  
The zero-based column index.

### Return Value

The value of the column as a .NET type.

### Implements

IDataRecord

### Exceptions

*InvalidOperationException* - The connection is closed, the reader is closed, `Read()` has not been called, all rows have been read, or no valid custom type mapping has been specified for the Oracle Object or Oracle Collection column.

*IndexOutOfRangeException* - The column index is invalid.

### Remarks

If the column is an Oracle Object or an Oracle Collection column, the .NET custom type corresponding to the custom type mapping is returned.

If the column is an Oracle `REF` column, a hexadecimal value is returned as a .NET string that represents the `REF` in the database.

If the UDT is `NULL`, `DBNull.Value` is returned

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetValues

This method gets all the column values as .NET types.

### Declaration

```
// C#  
public override int GetValues(object[ ] values);
```

### Parameters

- *values*  
An array of objects to hold the .NET types as the column values.

### Return Value

The number of objects in the *values* array.

### Implements

IDataRecord

### Exceptions

*InvalidOperationException* - The connection is closed, the reader is closed, `Read()` has not been called, or all rows have been read.

### Remarks

This method provides a way to retrieve all column values rather than retrieving each column value individually.

The number of column values retrieved is the minimum of the length of the values array and the number of columns in the result set.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## GetXmlReader

This method returns the contents of an `XMLType` column as an instance of an .NET `XmlTextReader` object.

### Declaration

```
// C#  
public XmlReader GetXmlReader(int index);
```

### Parameters

- `index`  
The zero-based column index.

### Return Value

A .NET `XmlTextReader`.

### Exceptions

`InvalidCastException` - The accessor method is invalid for this column type or the column value is `NULL`.

### Remarks

`IsDBNull` should be called to check for `NULL` values before calling this method.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## IsDBNull

This method indicates whether or not the column value is `NULL`.

### Declaration

```
// C#  
public override bool IsDBNull(int index);
```

### Parameters

- `index`  
The zero-based column index.

### Return Value

Returns `true` if the column is a `NULL` value; otherwise, returns `false`.

### Implements

`IDataRecord`

### Exceptions

`InvalidOperationException` - The reader is closed, `Read()` has not been called, or all rows have been read.

`IndexOutOfRangeException` - The column index is invalid.

### Remarks

This method should be called to check for `NULL` values before calling the other accessor methods.

### Example

The code example for the `OracleDataReader` class includes the `IsDBNull` method. See ["Example"](#).



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## NextResult

This method advances the data reader to the next result set.

### Declaration

```
// C#  
public override bool NextResult();
```

### Return Value

Returns `true` if another result set exists; otherwise, returns `false`.

### Implements

`IDataReader`

### Exceptions

`InvalidOperationException` - The connection is closed or the reader is closed.

## Remarks

`NextResult` is used when reading results from stored procedure execution that return more than one result set.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## Read

This method reads the next row in the result set.

### Declaration

```
// C#  
public override bool Read();
```

### Return Value

Returns `true` if another row exists; otherwise, returns `false`.

### Implements

`IDataReader`

### Exceptions

`InvalidOperationException` - The connection is closed or the reader is closed.

### Remarks

The initial position of the data reader is before the first row. Therefore, the `Read` method must be called to fetch the first row. The row that was just read is considered the *current row*. If the `OracleDataReader` has no more rows to read, it returns `false`.

### Example

The code example for the `OracleDataReader` class includes the `Read` method. See ["Example"](#).

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataReader Class](#)
- [OracleDataReader Members](#)

## OracleDataSourceCollection Class

An `OracleDataSourceCollection` supports adding and deleting network service name (i.e. TNS) entries for ODP.NET's use to connect to an Oracle database.

### Class Inheritance

`System.Object`

`Oracle.ManagedDataAccess.Client.OracleDataSourceCollection`

### Declaration

```
// C#
public sealed class OracleDataSourceCollection
```

### Requirements

Provider	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	<code>Oracle.ManagedDataAccess.dll</code>	<code>Oracle.ManagedDataAccess.dll</code>
<b>Namespace</b>	<code>Oracle.ManagedDataAccess.Client</code>	<code>Oracle.ManagedDataAccess.Client</code>
<b>.NET Framework</b>	4.8	-
<b>.NET (Core)</b>	-	See <a href="#">System Requirements</a>

### Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

### Example

```
using System;
using Oracle.ManagedDataAccess.Client;

namespace NetCoreApplication
{
    class DataSourcesExample
    {
        static void Main(string[] args)
        {
            // Example to configure Data Sources for the ODP.NET Core provider.
        }
    }
}
```

```
// Add data source through Add method on OracleDataSourceCollection
OracleConfiguration.OracleDataSources.Add("orcl1",
"(DESCRIPTION=(ADDRESS=(PROTOCOL=TCP) (HOST=host1) (PORT=1234))
(CONNECT_DATA=(SERVICE_NAME=oracle) (SERVER=dedicated)))");

// Add data source through indexer method on OracleDataSourceCollection
OracleConfiguration.OracleDataSources["orcl2"] =
"(DESCRIPTION=(ADDRESS=(PROTOCOL=TCP) (HOST=host1) (PORT=1234))
(CONNECT_DATA=(SERVICE_NAME=oracle) (SERVER=dedicated)))";

// Get number of data sources configured
int numDataSources = OracleConfiguration.OracleDataSources.Count;

// Get OracleDataSourceCollection object
OracleDataSourceCollection dsColl = OracleConfiguration.OracleDataSources;

// Add server through Add method on OracleDataSourceCollection
dsColl.Add("orcl3", "(DESCRIPTION=(ADDRESS=(PROTOCOL=TCP) (HOST=host3)
(PORT=1234)) (CONNECT_DATA=(SERVICE_NAME=oracle) (SERVER=dedicated)))");

// Add server through indexer method on OracleDataSourceCollection
dsColl["orcl4"] = "(DESCRIPTION=(ADDRESS=(PROTOCOL=TCP) (HOST=host4)
(PORT=1234)) (CONNECT_DATA=(SERVICE_NAME=oracle) (SERVER=dedicated)))";

// Remove a data source
OracleConfiguration.OracleDataSources.Remove("db2");

// Get number of data sources configured
numDataSources = OracleConfiguration.OracleDataSources.Count;

// Get value corresponding to a data source.
string dsVal = OracleConfiguration.OracleDataSources["db1"];

OracleConnection orclCon = null;

try
{
    // Open a test connection
    orclCon = new OracleConnection("user id=scott; password=tiger; data
source=orcl3");

    orclCon.Open();
    orclCon.Close();
}
catch (OracleException ex)
{
    Console.WriteLine(ex);
}
finally
{
    // Close the connection
    if (null != orclCon)
        orclCon.Close();
}
}
}
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataSourceCollection Members](#)
- [OracleDataSourceCollection Methods](#)
- [OracleDataSourceCollection Properties](#)

## OracleDataSourceCollection Members

`OracleDataSourceCollection` members are listed in the following tables.

### OracleDataSourceCollection Methods

`OracleDataSourceCollection` methods are listed in [Table 7-86](#).

**Table 7-86 OracleDataSourceCollection Methods**

Method	Description
<a href="#">Add</a>	Adds unique network service name (TNS) entries in the <code>OracleDataSourceCollection</code> using net service names and complete connect descriptors
<a href="#">Remove</a>	Removes network service name entries from an <code>OracleDataSourceCollection</code>

### OracleDataSourceCollection Properties

`OracleDataSourceCollection` properties are listed in [Table 7-87](#).

**Table 7-87 OracleDataSourceCollection Properties**

Property	Description
<a href="#">Count</a>	Returns the number of <code>OracleDataSourceCollection</code> elements
<a href="#">This</a>	Returns or sets the network service name entry with the specified network service name

## OracleDataSourceCollection Methods

`OracleDataSourceCollection` methods are listed in [Table 7-88](#).

**Table 7-88 OracleDataSourceCollection Methods**

Method	Description
<a href="#">Add</a>	Adds unique network service name (TNS) entries in the OracleDataSourceCollection using net service names and complete connect descriptors
<a href="#">Remove</a>	Removes network service name entries from an OracleDataSourceCollection

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataSourceCollection Class](#)
- [OracleDataSourceCollection Members](#)

## Add

This method adds unique network service name (TNS) entries in the OracleDataSourceCollection using net service names and complete connect descriptors.

### Declaration

```
// C#  
public void Add(string tnsName, string tnsDescriptor)
```

### Parameters

- tnsName
  - Type: System.String
  - Network service name used as the ODP.NET connection string Data Source name.
- tnsDescriptor
  - Type: System.String
  - The complete connect descriptor information for this specific net service name.

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataSourceCollection Class](#)
- [OracleDataSourceCollection Members](#)

## Remove

This method removes network service name entries from an `OracleDataSourceCollection`.

### Declaration

```
// C#
public void Remove(string tnsName)
```

### Parameter

tnsName

- **Type:** `System.String`
- Unique network service name to be removed from the collection.

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataSourceCollection Class](#)
- [OracleDataSourceCollection Members](#)

## OracleDataSourceCollection Properties

`OracleDataSourceCollection` properties are listed in [Table 7-89](#).

**Table 7-89 OracleDataSourceCollection Properties**

Property	Description
<a href="#">Count</a>	Returns the number of <code>OracleDataSourceCollection</code> elements
<a href="#">This</a>	Returns or sets the network service name entry with the specified network service name

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataSourceCollection Class](#)
- [OracleDataSourceCollection Members](#)

## Count

This is a read-only property that returns the number of `OracleDataSourceCollection` elements

### Declaration

```
// C#  
public int Count { get; }
```

### Property Value

Type: `System.Int32`

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataSourceCollection Class](#)
- [OracleDataSourceCollection Members](#)

## This

This property returns or sets the network service name entry with the specified network service name.

### Declaration

```
// C#  
public string this[string tnsName] { get; set; }
```

### Parameters

- `tnsName`
  - Type: `System.String`
  - Unique network service name to be added or updated
- `Value`
  - Type: `System.String`

- Connect descriptor to be added or updated.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataSourceCollection Class](#)
- [OracleDataSourceCollection Members](#)

## OracleDataSourceEnumerator Class

An `OracleDataSourceEnumerator` object allows applications to generically obtain a collection of data sources to connect to.

### Class Inheritance

`System.Object`

`System.DbDataSourceEnumerator`

`Oracle.DataAccess.Client.OracleDataSourceEnumerator`

### Declaration

```
// C#
public sealed class OracleDataSourceEnumerator : DbDataSourceEnumerator
```

### Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

### Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

### Example

```
// C#
using System;
using System.Data;
using System.Data.Common;
```

```

using Oracle.DataAccess.Client;

class DataSourceEnumSample
{
    static void Main()
    {
        string ProviderName = "Oracle.DataAccess.Client";

        DbProviderFactory factory = DbProviderFactories.GetFactory(ProviderName);

        if (factory.CanCreateDataSourceEnumerator)
        {
            DbDataSourceEnumerator dsenum = factory.CreateDataSourceEnumerator();
            DataTable dt = dsenum.GetDataSources();

            // Print the first column/row entry in the DataTable
            Console.WriteLine(dt.Columns[0] + " : " + dt.Rows[0][0]);
            Console.WriteLine(dt.Columns[1] + " : " + dt.Rows[0][1]);
            Console.WriteLine(dt.Columns[2] + " : " + dt.Rows[0][2]);
            Console.WriteLine(dt.Columns[3] + " : " + dt.Rows[0][3]);
            Console.WriteLine(dt.Columns[4] + " : " + dt.Rows[0][4]);
        }
        else
            Console.WriteLine("Data source enumeration is not supported by provider");
    }
}

```

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataSourceEnumerator Members](#)
- [OracleDataSourceEnumerator Constructor](#)
- [OracleDataSourceEnumerator Public Methods](#)

## OracleDataSourceEnumerator Members

OracleDataSourceEnumerator members are listed in the following tables.

### OracleDataSourceEnumerator Constructor

OracleDataSourceEnumerator Public Methods are listed in [Table 7-90](#).

**Table 7-90 OracleDataSourceEnumerator Method**

Method	Description
<a href="#">OracleDataSourceEnumerator Constructor</a>	Instantiates a new instance of the OracleDataSourceEnumerator class

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataSourceEnumerator Class](#)

### OracleDataSourceEnumerator Public Methods

OracleDataSourceEnumerator Public Methods are listed in [Table 7-91](#).

**Table 7-91 OracleDataSourceEnumerator Method**

Method	Description
<a href="#">GetDataSources</a>	Returns a DataTable object with information on all the TNS alias entries in the <code>tnsnames.ora</code> file and entries retrieved from the LDAP servers configured in <code>ldap.ora</code> if LDAP Naming is enabled

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataSourceEnumerator Class](#)

## OracleDataSourceEnumerator Constructor

OracleDataSourceEnumerator constructor creates new instances of an OracleDataSourceEnumerator class.

### Declaration

```
// C#  
public OracleDataSourceEnumerator();
```

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataSourceEnumerator Class](#)
- [OracleDataSourceEnumerator Members](#)

## OracleDataSourceEnumerator Public Methods

The `OracleDataSourceEnumerator` static method is listed in [Table 7-92](#).

**Table 7-92 OracleDataSourceEnumerator Method**

Method	Description
<a href="#">GetDataSources</a>	Returns a <code>DataTable</code> object with information on all the TNS alias entries in the <code>tnsnames.ora</code> file

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataSourceEnumerator Class](#)
- [OracleDataSourceEnumerator Members](#)

## GetDataSources

This method returns a `DataTable` object with information on all the .NET configuration file ODP.NET data sources, TNS alias entries in the `tnsnames.ora` file, and entries retrieved from the LDAP servers configured in `ldap.ora` if LDAP naming is enabled.

### Declaration

```
// C#  
public override DataTable GetDataSources();
```

### Return Value

A `DataTable` object.

### Remarks

This method returns a `DataTable` object for each ODP.NET data source in the .NET configuration file, TNS alias entry that exists in the `tnsnames.ora` file, and each entry retrieved from the LDAP servers. If there are no ODP.NET data sources in the .NET configuration file, a `tnsnames.ora` file is not found, nor LDAP Naming is configured, then the returned `DataTable` object will be empty.

This method in ODP.NET, Managed Driver can fetch all the data source aliases from an LDAP server, such as Oracle Internet Directory or Microsoft Active Directory. This method in ODP.NET, Unmanaged Driver does not support retrieving data source aliases from an LDAP server.

When Oracle Internet Directory (OID) is used for the TNS naming repository, there is a limit of 1000 TNS entries retrieved.

The following columns are returned for each row, but only the `InstanceName` column is populated.

- `InstanceName` (type: `System.String`)
- `ServerName` (type: `System.String`)
- `ServiceName` (type: `System.String`)
- `Protocol` (type: `System.String`)
- `Port` (type: `System.String`)

If the TNS and/or LDAP information changes for existing pooled connections, then calling `GetDataSources` will not return these changes unless the pools have been cleared.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataSourceEnumerator Class](#)
- [OracleDataSourceEnumerator Members](#)

## OracleError Class

The `OracleError` class represents an error reported by Oracle.

### Class Inheritance

`System.Object`

`Oracle.DataAccess.Client.OracleError`

### Declaration

```
// C#
public sealed class OracleError
```

### Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	<code>Oracle.DataAccess.dll</code>	<code>Oracle.ManagedDataAccess.dll</code>	<code>Oracle.ManagedDataAccess.dll</code>
<b>Namespace</b>	<code>Oracle.DataAccess.Client</code>	<code>Oracle.ManagedDataAccess.Client</code>	<code>Oracle.ManagedDataAccess.Client</code>
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

## Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

## Remarks

The `OracleError` class represents a warning or an error reported by Oracle.

If there are multiple errors, ODP.NET only returns the first error message on the stack.

## Example

```
// C#

using System;
using System.Data;
using Oracle.DataAccess.Client;

class OracleErrorsSample
{
    static void Main()
    {
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();

        // Create an OracleCommand object using the connection object
        OracleCommand cmd = con.CreateCommand();

        try
        {
            cmd.CommandText = "insert into notable values (99, 'MyText')";
            cmd.ExecuteNonQuery();
        }
        catch (OracleException ex)
        {
            Console.WriteLine("Record is not inserted into the database table.");

            foreach (OracleError error in ex.Errors)
            {
                Console.WriteLine("Error Message: " + error.Message);
                Console.WriteLine("Error Source: " + error.Source);
            }
        }
    }
}
```

 **See Also:**

- "Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"
- OracleError Members
- OracleError Static Methods
- OracleError Properties
- OracleError Methods

## OracleError Members

OracleError members are listed in the following tables.

### OracleError Static Methods

The OracleError static method is listed in [Table 7-93](#).

**Table 7-93 OracleError Static Method**

Method	Description
Equals	Inherited from System.Object (Overloaded)

### OracleError Properties

OracleError properties are listed in [Table 7-94](#).

**Table 7-94 OracleError Properties**

Property	Description
<a href="#">ArrayBindIndex</a>	Specifies the row number of errors that occurred during the Array Bind execution
<a href="#">DataSource</a>	Specifies the Oracle service name (TNS name) that identifies the Oracle database
<a href="#">Message</a>	Specifies the message describing the error
<a href="#">Number</a>	Specifies the Oracle error number
<a href="#">Procedure</a>	Specifies the stored procedure that causes the error
<a href="#">Source</a>	Specifies the name of the data provider that generates the error

### OracleError Methods

OracleError methods are listed in [Table 7-95](#).

**Table 7-95 OracleError Methods**

Method	Description
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)
<code>GetHashCode</code>	Inherited from <code>System.Object</code>
<code>GetType</code>	Inherited from <code>System.Object</code>
<a href="#">ToString</a>	Returns a string representation of the <code>OracleError</code>

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleError Class](#)

## OracleError Static Methods

The `OracleError` static method is listed in [Table 7-96](#).

**Table 7-96 OracleError Static Method**

Method	Description
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleError Class](#)
- [OracleError Members](#)

## OracleError Properties

`OracleError` properties are listed in [Table 7-97](#).

**Table 7-97 OracleError Properties**

Property	Description
<a href="#">ArrayBindIndex</a>	Specifies the row number of errors that occurred during the Array Bind execution

Table 7-97 (Cont.) OracleError Properties

Property	Description
<a href="#">DataSource</a>	Specifies the Oracle service name (TNS name) that identifies the Oracle database
<a href="#">Message</a>	Specifies the message describing the error
<a href="#">Number</a>	Specifies the Oracle error number
<a href="#">Procedure</a>	Specifies the stored procedure that causes the error
<a href="#">Source</a>	Specifies the name of the data provider that generates the error

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleError Class](#)
- [OracleError Members](#)

## ArrayBindIndex

This property specifies the row number of errors that occurred during the Array Bind execution.

### Declaration

```
// C#  
public int ArrayBindIndex {get;}
```

### Property Value

An `int` value that specifies the row number for errors that occurred during the Array Bind execution.

### Remarks

Default = 0.

This property is used for Array Bind operations only.

`ArrayBindIndex` represents the zero-based row number at which the error occurred during an Array Bind operation. For example, if an array bind execution causes two errors on the 2nd and 4th operations, two `OracleError` objects appear in the `OracleErrorCollection` with the `ArrayBindIndex` property values 2 and 4 respectively.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleError Class](#)
- [OracleError Members](#)
- ["Array Binding"](#)

## DataSource

This property specifies the Oracle service name (TNS name) that identifies the Oracle database.

### Declaration

```
// C#  
public string DataSource {get;}
```

### Property Value

A string.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleError Class](#)
- [OracleError Members](#)

## Message

This property specifies the message describing the error.

### Declaration

```
// C#  
public string Message {get;}
```

### Property Value

A string.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleError Class](#)
- [OracleError Members](#)

## Number

This property specifies the Oracle `error` number.

### Declaration

```
// C#  
public int Number {get;}
```

### Property Value

An `int`.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleError Class](#)
- [OracleError Members](#)

## Procedure

This property specifies the stored procedure that causes the `error`.

### Declaration

```
// C#  
public string Procedure {get;}
```

### Property Value

The stored procedure name.

### Remarks

Represents the stored procedure which creates this `OracleError` object.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleError Class](#)
- [OracleError Members](#)

## Source

This property specifies the name of the data provider that generates the `error`.

### Declaration

```
// C#  
public string Source {get;}
```

### Property Value

A string.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleError Class](#)
- [OracleError Members](#)

## OracleError Methods

`OracleError` methods are listed in [Table 7-98](#).

**Table 7-98 OracleError Methods**

Method	Description
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)
<code>GetHashCode</code>	Inherited from <code>System.Object</code>
<code>GetType</code>	Inherited from <code>System.Object</code>
<a href="#">ToString</a>	Returns a string representation of the <code>OracleError</code>

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleError Class](#)
- [OracleError Members](#)

## ToString

Overrides `Object`

This method returns a string representation of the `OracleError`.

### Declaration

```
// C#  
public override string ToString();
```

### Return Value

Returns a string with the format `Ora- error number: Class.Method name error message stack trace information`.

### Example

ORA-24333: zero iteration count

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleError Class](#)
- [OracleError Members](#)

## OracleErrorCollection Class

An `OracleErrorCollection` class represents a collection of all errors that are thrown by the Oracle Data Provider for .NET.

### Class Inheritance

`System.Object`

`System.ArrayList`

`Oracle.DataAccess.Client.OracleErrorCollection`

## Declaration

```
// C#
public sealed class OracleErrorCollection : ArrayList
```

## Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

## Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

## Remarks

A simple `ArrayList` that holds a list of `OracleErrors`.

If there are multiple errors, ODP.NET only returns the first error message on the stack.

## Example

```
// C#

using System;
using System.Data;
using Oracle.DataAccess.Client;

class OracleErrorCollectionSample
{
    static void Main()
    {
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();

        // Create an OracleCommand object using the connection object
        OracleCommand cmd = con.CreateCommand();

        try
        {
            cmd.CommandText = "insert into notable values (99, 'MyText')";
            cmd.ExecuteNonQuery();
        }
        catch (OracleException ex)
        {
            Console.WriteLine("Record is not inserted into the database table.");

            foreach (OracleError error in ex.Errors)
```

```

    {
        Console.WriteLine("Error Message: " + error.Message);
        Console.WriteLine("Error Source: " + error.Source);
    }
}
}
}

```

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleErrorCollection Members](#)
- [OracleErrorCollection Static Methods](#)
- [OracleErrorCollection Properties](#)
- [OracleErrorCollection Public Methods](#)

## OracleErrorCollection Members

OracleErrorCollection members are listed in the following tables.

### OracleErrorCollection Static Methods

OracleErrorCollection static methods are listed in [Table 7-99](#).

**Table 7-99 OracleErrorCollection Static Methods**

Method	Description
Equals	Inherited from System.Object (Overloaded)

### OracleErrorCollection Properties

OracleErrorCollection properties are listed in [Table 7-100](#).

**Table 7-100 OracleErrorCollection Properties**

Property	Description
Capacity	Inherited from System.Collections.ArrayList
Count	Inherited from System.Collections.ArrayList
IsReadOnly	Inherited from System.Collections.ArrayList
IsSynchronized	Inherited from System.Collections.ArrayList
Item	Inherited from System.Collections.ArrayList

### OracleErrorCollection Public Methods

OracleErrorCollection public methods are listed in [Table 7-101](#).

**Table 7-101 OracleErrorCollection Public Methods**

Public Method	Description
CopyTo	Inherited from <code>System.Collections.ArrayList</code>
Equals	Inherited from <code>System.Object</code> (Overloaded)
GetHashCode	Inherited from <code>System.Object</code>
GetType	Inherited from <code>System.Object</code>
ToString	Inherited from <code>System.Object</code>



**See Also:**

- "Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"
- [OracleErrorCollection Class](#)

## OracleErrorCollection Static Methods

The `OracleErrorCollection` static method is listed in [Table 7-102](#).

**Table 7-102 OracleErrorCollection Static Method**

Method	Description
Equals	Inherited from <code>System.Object</code> (Overloaded)



**See Also:**

- "Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"
- [OracleErrorCollection Class](#)
- [OracleErrorCollection Members](#)

## OracleErrorCollection Properties

`OracleErrorCollection` properties are listed in [Table 7-103](#).

**Table 7-103 OracleErrorCollection Properties**

Property	Description
Capacity	Inherited from <code>System.Collections.ArrayList</code>

**Table 7-103 (Cont.) OracleErrorCollection Properties**

Property	Description
Count	Inherited from <code>System.Collections.ArrayList</code>
IsReadOnly	Inherited from <code>System.Collections.ArrayList</code>
IsSynchronized	Inherited from <code>System.Collections.ArrayList</code>
Item	Inherited from <code>System.Collections.ArrayList</code>

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleErrorCollection Class](#)
- [OracleErrorCollection Members](#)

## OracleErrorCollection Public Methods

`OracleErrorCollection` public methods are listed in [Table 7-104](#).

**Table 7-104 OracleErrorCollection Public Methods**

Public Method	Description
<code>CopyTo</code>	Inherited from <code>System.Collections.ArrayList</code>
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)
<code>GetHashCode</code>	Inherited from <code>System.Object</code>
<code>GetType</code>	Inherited from <code>System.Object</code>
<code>ToString</code>	Inherited from <code>System.Object</code>

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleErrorCollection Class](#)
- [OracleErrorCollection Members](#)

# OracleException Class

The `OracleException` class represents an exception that is thrown when the Oracle Data Provider for .NET encounters an error. Each `OracleException` object contains at least one `OracleError` object in the `Error` property that describes the error or warning.

## Class Inheritance

```
System.Object
  System.Exception
    System.SystemException
      System.Runtime.InteropServices.ExternalException
        System.Data.Common.DbException
          Oracle.DataAccess.Client.OracleException
```

## Declaration

```
// C#
public sealed class OracleException : SystemException
```

## Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

## Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

## Remarks

If there are multiple errors, ODP.NET only returns the first error message on the stack.

## Example

```
// C#

using System;
using System.Data;
using Oracle.DataAccess.Client;

class OracleExceptionSample
{
```

```
static void Main()
{
    string constr = "User Id=scott;Password=tiger;Data Source=oracle";
    OracleConnection con = new OracleConnection(constr);
    con.Open();

    // Create an OracleCommand object using the connection object
    OracleCommand cmd = con.CreateCommand();

    try
    {
        cmd.CommandText = "insert into notable values (99, 'MyText')";
        cmd.ExecuteNonQuery();
    }
    catch (OracleException ex)
    {
        Console.WriteLine("Record is not inserted into the database table.");
        Console.WriteLine("Exception Message: " + ex.Message);
        Console.WriteLine("Exception Source: " + ex.Source);
    }
}
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleException Members](#)
- [OracleException Methods](#)
- [OracleException Static Methods](#)
- [OracleException Static Methods](#)
- [OracleException Properties](#)
- [OracleException Methods](#)

## OracleException Members

OracleException members are listed in the following tables.

### OracleException Static Methods

The OracleException static method is listed in [Table 7-105](#).

**Table 7-105 OracleException Static Method**

Method	Description
Equals	Inherited from System.Object (Overloaded)

## OracleException Properties

OracleException properties are listed in [Table 7-106](#).

**Table 7-106 OracleException Properties**

Property	Description
<a href="#">DataSource</a>	Specifies the TNS name that contains the information for connecting to an Oracle instance
<a href="#">Errors</a>	Specifies a collection of one or more <code>OracleError</code> objects that contain information about exceptions generated by the Oracle database
<code>HelpLink</code>	Inherited from <code>System.Exception</code>
<code>InnerException</code>	Inherited from <code>System.Exception</code>
<a href="#">IsRecoverable</a>	Specifies whether the current operation producing this exception can succeed if retried
<a href="#">Message</a>	Specifies the error messages that occur in the exception
<a href="#">Number</a>	Specifies the Oracle error number
<a href="#">OracleLogicalTransaction</a>	Returns an <code>OracleLogicalTransaction</code> object for a recoverable error when using Transaction Guard
<a href="#">Procedure</a>	Specifies the stored procedure that cause the exception
<a href="#">Source</a>	Specifies the name of the data provider that generates the error
<code>StackTrace</code>	Inherited from <code>System.Exception</code>
<code>TargetSite</code>	Inherited from <code>System.Exception</code>

## OracleException Methods

OracleException methods are listed in [Table 7-107](#).

**Table 7-107 OracleException Methods**

Method	Description
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)
<code>GetBaseException</code>	Inherited from <code>System.Exception</code>
<code>GetHashCode</code>	Inherited from <code>System.Object</code>
<a href="#">GetObjectData</a>	Sets the serializable <code>info</code> object with information about the exception
<code>GetType</code>	Inherited from <code>System.Object</code>
<a href="#">ToString</a>	Returns the fully qualified name of this exception

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleException Class](#)

## OracleException Static Methods

The `OracleException` static method is listed in [Table 7-108](#).

**Table 7-108 OracleException Static Method**

Method	Description
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleException Class](#)
- [OracleException Members](#)

## OracleException Properties

`OracleException` properties are listed in [Table 7-109](#).

**Table 7-109 OracleException Properties**

Property	Description
<code>DataSource</code>	Specifies the TNS name that contains the information for connecting to an Oracle instance
<code>Errors</code>	Specifies a collection of one or more <code>OracleError</code> objects that contain information about exceptions generated by the Oracle database
<code>HelpLink</code>	Inherited from <code>System.Exception</code>
<code>InnerException</code>	Inherited from <code>System.Exception</code>
<code>IsRecoverable</code>	Specifies whether the current operation producing this exception can succeed if retried
<code>Message</code>	Specifies the error messages that occur in the exception
<code>Number</code>	Specifies the Oracle error number
<code>OracleLogicalTransaction</code>	Returns an <code>OracleLogicalTransaction</code> object for a recoverable error when using Transaction Guard

Table 7-109 (Cont.) OracleException Properties

Property	Description
<a href="#">Procedure</a>	Specifies the stored procedure that cause the exception
<a href="#">Source</a>	Specifies the name of the data provider that generates the error
StackTrace	Inherited from System.Exception
TargetSite	Inherited from System.Exception

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleException Class](#)
- [OracleException Members](#)

## DataSource

This property specifies the TNS name that contains the information for connecting to an Oracle instance.

### Declaration

```
// C#  
public string DataSource {get;}
```

### Property Value

The TNS name containing the connect information.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleException Class](#)
- [OracleException Members](#)

## Errors

This property specifies a collection of one or more `OracleError` objects that contain information about exceptions generated by the Oracle database.

**Declaration**

```
// C#  
public OracleErrorCollection Errors {get;}
```

**Property Value**

An `OracleErrorCollection`.

**Remarks**

The `Errors` property contains at least one instance of `OracleError` objects.

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleException Class](#)
- [OracleException Members](#)

## IsRecoverable

This property specifies whether the current operation producing this exception can succeed if retried.

**Declaration**

```
// C#  
public bool IsRecoverable {get;}
```

**Property Value**

A `bool`.

**Remarks**

When a database outage occurs, such as during a network failure, the session becomes unavailable and the client receives an error code. The client can have difficulty determining whether the in-flight operation committed or needs to be resubmitted. Oracle automatically determines whether an in-flight database operation can be recovered or not using the `IsRecoverable` property. If `IsRecoverable` returns true after an outage, then the application can retrieve the current operation status and complete the transaction. If `IsRecoverable` returns false, then the application can rollback the current operation and resubmit the transaction.

This property is often used in conjunction with Transaction Guard.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleException Class](#)
- [OracleException Members](#)
- [Using Transaction Guard to Prevent Logical Corruption](#)

## Message

Overrides `Exception`

This property specifies the error messages that occur in the exception.

### Declaration

```
// C#  
public override string Message {get;}
```

### Property Value

A `string`.

### Remarks

`Message` is a concatenation of all errors in the `Errors` collection. Each error message is concatenated and is followed by a carriage return, except the last one.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleException Class](#)
- [OracleException Members](#)

## Number

This property specifies the Oracle error number.

### Declaration

```
// C#  
public int Number {get;}
```

### Property Value

The error number.

## Remarks

This error number can be the topmost level of error generated by Oracle and can be a provider-specific error number.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleException Class](#)
- [OracleException Members](#)

## OracleLogicalTransaction

This property will returns an `OracleLogicalTransaction` object for a recoverable error when using Transaction Guard.

### Declaration

```
// C#  
public OracleLogicalTransaction OracleLogicalTransaction {get;}
```

### Property Value

An `OracleLogicalTransaction`.

### Remarks

`OracleLogicalTransaction` is non-null when both of the following conditions are met:

- Transaction Guard is enabled on the service
- The exception is a recoverable error

`OracleLogicalTransaction` can be used to determine the transaction outcome by looking at the two properties that it exposes: `Committed` and `UserCallCompleted`. If the outcome is not known, then `Committed` and `UserCallCompleted` will be set to null.

If the outcome of a recoverable error could not be determined by ODP.NET and the connection have not participated in a distributed transaction, then the `OracleLogicalTransactionId` property of the `OracleLogicalTransaction` object will be non-null and it can be used to determine the outcome by having the application explicitly call the `OracleLogicalTransaction.GetOutcome` static method, if the database/service is up.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleException Class](#)
- [OracleException Members](#)
- [OracleLogicalTransaction Class](#)

## Procedure

This property specifies the stored procedure that caused the exception.

### Declaration

```
// C#  
public string Procedure {get;}
```

### Property Value

The stored procedure name.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleException Class](#)
- [OracleException Members](#)

## Source

Overrides [Exception](#)

This property specifies the name of the data provider that generates the error.

### Declaration

```
// C#  
public override string Source {get;}
```

### Property Value

The name of the data provider.

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleException Class](#)
- [OracleException Members](#)

## OracleException Methods

OracleException methods are listed in [Table 7-110](#).

**Table 7-110 OracleException Methods**

Method	Description
Equals	Inherited from System.Object (Overloaded)
GetBaseException	Inherited from System.Exception
GetHashCode	Inherited from System.Object
<a href="#">GetObjectData</a>	Sets the serializable info object with information about the exception
GetType	Inherited from System.Object
<a href="#">ToString</a>	Returns the fully qualified name of this exception

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleException Class](#)
- [OracleException Members](#)

## GetObjectData

Overrides `Exception`

This method sets the serializable `info` object with information about the exception.

### Declaration

```
// C#
public override void GetObjectData(SerializationInfo info, StreamingContext
    context);
```

### Parameters

- `info`

A `SerializationInfo` object.

- `context`

A `StreamingContext` object.

### Remarks

The information includes `DataSource`, `Message`, `Number`, `Procedure`, `Source`, and `StackTrace`.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleException Class](#)
- [OracleException Members](#)

## ToString

Overrides `Exception`

This method returns the fully qualified name of this exception, the `error` message in the `Message` property, the `InnerException.ToString()` message, and the stack trace.

### Declaration

```
// C#  
public override string ToString();
```

### Return Value

The string representation of the exception.

### Example

```
// C#  
  
using System;  
using Oracle.DataAccess.Client;  
  
class ToStringSample  
{  
    static void Main()  
    {  
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";  
        OracleConnection con = new OracleConnection(constr);  
        con.Open();  
  
        // Create an OracleCommand object using the connection object  
        OracleCommand cmd = con.CreateCommand();  
  
        try  
        {  
            cmd.CommandText = "insert into notable values (99, 'MyText')";  
        }  
    }  
}
```

```

        cmd.ExecuteNonQuery(); // This will throw an exception
    }
    catch (OracleException ex)
    {
        Console.WriteLine("Record is not inserted into the database table.");
        Console.WriteLine("ex.ToString() : " + ex.ToString());
    }
}
}
}

```



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleException Class](#)
- [OracleException Members](#)

## OracleInfoMessageEventArgs Class

The `OracleInfoMessageEventArgs` class provides event data for the `OracleConnection.InfoMessage` event. When any warning occurs in the database, the `OracleConnection.InfoMessage` event is triggered along with the `OracleInfoMessageEventArgs` object that stores the event data.

### Class Inheritance

System.Object

System.EventArgs

Oracle.DataAccess.Client.OracleInfoMessageEventArgs

### Declaration

```
// C#
public sealed class OracleInfoMessageEventArgs
```

### Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

## Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

## Example

```
// C#

using System;
using System.Data;
using Oracle.DataAccess.Client;
using Oracle.DataAccess.Types;

class InfoMessageSample
{
    public static void WarningHandler(object src,
        OracleInfoMessageEventArgs args)
    {
        Console.WriteLine("Source object is: " + src.GetType().Name);
        Console.WriteLine("InfoMessageEventArgs.Message is " + args.Message);
        Console.WriteLine("InfoMessageEventArgs.Source is " + args.Source);
    }
    static void Main()
    {
        OracleConnection con = new OracleConnection("User Id=scott;" +
            "Password=tiger;Data Source=oracle;");

        con.Open();

        OracleCommand cmd = con.CreateCommand();

        //Register to the InfoMessageHandler
        cmd.Connection.InfoMessage +=
            new OracleInfoMessageEventHandler(WarningHandler);

        cmd.CommandText =
            "create or replace procedure SelectWithNoInto( " +
            "  empname in VARCHAR2) AS " +
            "BEGIN " +
            "  select * from emp where ename = empname; " +
            "END SelectWithNoInto;";

        // Execute the statement that produces a warning
        cmd.ExecuteNonQuery();

        // Clean up
        cmd.Dispose();
        con.Dispose();
    }
}
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleInfoMessageEventArgs Members](#)
- [OracleInfoMessageEventArgs Static Methods](#)
- [OracleInfoMessageEventArgs Properties](#)
- [OracleInfoMessageEventArgs Public Methods](#)
- ["OracleConnection Class"](#)

## OracleInfoMessageEventArgs Members

`OracleInfoMessageEventArgs` members are listed in the following tables.

### OracleInfoMessageEventArgs Static Methods

The `OracleInfoMessageEventArgs` static methods is listed in [Table 7-111](#).

**Table 7-111 OracleInfoMessageEventArgs Static Method**

Method	Description
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)

### OracleInfoMessageEventArgs Properties

The `OracleInfoMessageEventArgs` properties are listed in [Table 7-112](#).

**Table 7-112 OracleInfoMessageEventArgs Properties**

Property	Description
<a href="#">Errors</a>	Specifies the collection of errors generated by the data source
<a href="#">Message</a>	Specifies the error text generated by the data source
<a href="#">Source</a>	Specifies the name of the object that generated the error

### OracleInfoMessageEventArgs Public Methods

The `OracleInfoMessageEventArgs` methods are listed in [Table 7-113](#).

**Table 7-113 OracleInfoMessageEventArgs Public Methods**

Method	Description
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)
<code>GetHashCode</code>	Inherited from <code>System.Object</code>
<code>GetType</code>	Inherited from <code>System.Object</code>

**Table 7-113 (Cont.) OracleInfoMessageEventArgs Public Methods**

Method	Description
<a href="#">ToString</a>	Returns the string representation of the current instance

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleInfoMessageEventArgs Class](#)

## OracleInfoMessageEventArgs Static Methods

The `OracleInfoMessageEventArgs` static method is listed in [Table 7-114](#).

**Table 7-114 OracleInfoMessageEventArgs Static Method**

Method	Description
<a href="#">Equals</a>	Inherited from <code>System.Object</code> (Overloaded)

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleInfoMessageEventArgs Class](#)
- [OracleInfoMessageEventArgs Members](#)

## OracleInfoMessageEventArgs Properties

The `OracleInfoMessageEventArgs` properties are listed in [Table 7-115](#).

**Table 7-115 OracleInfoMessageEventArgs Properties**

Property	Description
<a href="#">Errors</a>	Specifies the collection of errors generated by the data source
<a href="#">Message</a>	Specifies the error text generated by the data source
<a href="#">Source</a>	Specifies the name of the object that generated the error

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleInfoMessageEventArgs Class](#)
- [OracleInfoMessageEventArgs Members](#)

## Errors

This property specifies the collection of errors generated by the data source.

### Declaration

```
// C#  
public OracleErrorCollection Errors {get;}
```

### Property Value

The collection of errors.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleInfoMessageEventArgs Class](#)
- [OracleInfoMessageEventArgs Members](#)

## Message

This property specifies the error text generated by the data source.

### Declaration

```
// C#  
public string Message {get;}
```

### Property Value

The error text.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleInfoMessageEventArgs Class](#)
- [OracleInfoMessageEventArgs Members](#)

## Source

This property specifies the name of the object that generated the error.

### Declaration

```
// C#
public string Source {get;}
```

### Property Value

The object that generated the error.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleInfoMessageEventArgs Class](#)
- [OracleInfoMessageEventArgs Members](#)

## OracleInfoMessageEventArgs Public Methods

The `OracleInfoMessageEventArgs` methods are listed in [Table 7-116](#).

**Table 7-116 OracleInfoMessageEventArgs Public Methods**

Method	Description
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)
<code>GetHashCode</code>	Inherited from <code>System.Object</code>
<code>GetType</code>	Inherited from <code>System.Object</code>
<a href="#">ToString</a>	Returns the string representation of the current instance

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleInfoMessageEventArgs Class](#)
- [OracleInfoMessageEventArgs Members](#)

## ToString

Overrides `Object`

This method returns the string representation of the current instance.

### Declaration

```
// C#  
public override string ToString();
```

### Return Value

Returns the `OracleInfoMessageEventArgs` value in a string representation.

### Remarks

If the current instance has a null value, the returned string is null.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleInfoMessageEventArgs Class](#)
- [OracleInfoMessageEventArgs Members](#)

## OracleInfoMessageEventHandler Delegate

The `OracleInfoMessageEventHandler` represents the signature of the method that handles the `OracleConnection.InfoMessage` event.

### Declaration

```
// C#  
public delegate void OracleInfoMessageEventHandler(object sender,  
    OracleInfoMessageEventArgs eventArgs);
```

## Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

## Parameters

- *sender*  
The source of the event.
- *eventArgs*  
The `OracleInfoMessageEventArgs` object that contains the event data.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- ["InfoMessage"](#)

# OracleLogicalTransaction Class

The `OracleLogicalTransaction` class provides detailed information about the logical transaction status. Applications can conclusively determine the outcome of the running transaction during the last database outage, then act accordingly to commit, complete, or rollback the transaction.

## Class Inheritance

`System.Object`

`System.MarshalByRefObject`

`Oracle.DataAccess.Client.OracleLogicalTransaction`

## Declaration

```
// C#
public sealed class OracleLogicalTransaction
```

## Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

## Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleLogicalTransaction Members](#)
- [OracleLogicalTransaction Public Read-Only Properties](#)
- [OracleLogicalTransaction Methods](#)

## OracleLogicalTransaction Members

OracleLogicalTransaction members are listed in the following tables.

### OracleLogicalTransaction Public Read-Only Properties

OracleLoigcalTransaction public read-only properties are listed in [Table 7-117](#)

**Table 7-117 OracleLogicalTransaction Public Read-Only Properties**

Property	Description
<a href="#">Committed</a>	Specifies if the transaction was committed or not
<a href="#">ConnectionString</a>	Specifies a subset of the connection string used for the transaction running during the last database outage
<a href="#">LogicalTransactionId</a>	The logical transaction id is used to determine the commit outcome of the last transaction open in a database session following an outage.
<a href="#">UserCallCompleted</a>	Specifies if the transaction completed and that the information returned may be incomplete and/or not all expected work was completed

## OracleLogicalTransaction Methods

OracleLoigcalTransaction methods are listed in [Table 7-118](#)

**Table 7-118 OracleLogicalTransaction Methods**

Property	Description
<a href="#">Dispose</a>	This method releases any resources or memory allocated by the object
<a href="#">GetOutcome</a>	This method retrieves the transaction outcome from the database server. The method will determine whether the transaction committed and completed or not.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleLogicalTransaction Class](#)

## OracleLogicalTransaction Public Read-Only Properties

OracleLoigcalTransaction public read-only properties are listed in [Table 7-119](#)

**Table 7-119 OracleLogicalTransaction Public Read-Only Properties**

Property	Description
<a href="#">Committed</a>	Specifies if the transaction was committed or not
<a href="#">ConnectionString</a>	Specifies a subset of the connection string used for the transaction running during the last database outage
<a href="#">LogicalTransactionId</a>	The logical transaction id is used to determine the commit outcome of the last transaction open in a database session following an outage.
<a href="#">UserCallCompleted</a>	Specifies if the transaction completed and that the information returned may be incomplete and/or not all expected work was completed

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleLogicalTransaction Class](#)
- [OracleLogicalTransaction Members](#)

## Committed

This property specifies if the transaction was committed or not.

### Declaration

```
// C#
public bool? Committed {get;}
```

### Property Value

bool.

### Remarks

If `GetOutcome()` is not called, the this property holds a null value.

Once `GetOutcome()` is called, then this property will hold either `true` or `false`.

In some cases, `OracleLogicalTransaction.GetOutcome` will be called implicitly and populate this property with a non-null value automatically.

[Table 7-120](#) describes the possible outcomes of the `Committed` and `UserCallCompleted` properties.

**Table 7-120 Outcome of OracleLogicalTransaction Committed and UserCallCompleted Properties**

Committed Value	UserCallCompleted Value	Outcome
false	false	The call did not execute the commit.
true	true	The call did execute the commit and there was no additional information to return and no more work to do if that call was a PL/SQL procedure.
true	false	The transaction is committed, but the information returned may be incomplete and/or not all expected work was completed. Examples of incomplete information or incomplete work done include: the number of rows modified when using autocommit or commit on success, parameter and function results when calling PL/SQL procedures, or PL/SQL procedures with more work to do after the commit. In order to function correctly, .NET applications that use data returned from the commit must check the <code>UserCallCompleted</code> value.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleLogicalTransaction Class](#)
- [OracleLogicalTransaction Members](#)

## ConnectionString

This property specifies a subset of the connection string used for the transaction running during the last database outage.

### Declaration

```
// C#  
public string ConnectionString {get;}
```

### Property Value

The data source as a string.

### Remarks

This connection string can be useful if the outcome is not known at the time the exception is thrown due to a service that is down. In such a scenario, use the connection string from this property along with the `LogicalTransactionId` to determine the outcome of the logical transaction by invoking the static `GetOutcome()` method, once the database or service is back up.

The string returned by this property will contain only the following attributes: `User Id`, `Proxy user Id` (if not null/empty), `Data Source`, and `Pooling` (which will be set to `false`).

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleLogicalTransaction Class](#)
- [OracleLogicalTransaction Members](#)

## LogicalTransactionId

The logical transaction id is used to determine the commit outcome of the last transaction open in a database session following an outage.

### Declaration

```
// C#  
public byte LogicalTransactionId {get;}
```

### Property Value

byte[]

### Remarks

This logical transaction id can be useful if the outcome is not known at the time the exception is thrown due to a service that is down. In such a scenario, use the `byte[]` returned from this property (along with the `ConnectionString`) to determine the outcome of the logical transaction by invoking the static `GetOutcome()` method, once the database or service is back up.

This property will return a non-null value *only* when the outcome is not known. For example when database or service is down, then the outcome is not known.

`LogicalTransactionId` property will return `null` if the connection has participated in a distributed transaction.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleLogicalTransaction Class](#)
- [OracleLogicalTransaction Members](#)

## UserCallCompleted

This property specifies if the transaction completed and that the information returned may be incomplete and/or not all expected work was completed.

### Declaration

```
// C#  
public bool? UserCallCompleted {get;}
```

### Property Value

bool

### Remarks

If `GetOutcome()` is not called, then this property holds a `null` value.

Once `GetOutcome()` is called, then this property will hold either `true` or `false`.

In some cases, [GetOutcome](#) will be called implicitly and populate this property with a non-null value automatically

Table 7-120 describes the possible outcomes of the `Committed` and `UserCallCompleted` properties.



#### See Also:

- "Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"
- OracleLogicalTransaction Class
- OracleLogicalTransaction Members

## OracleLogicalTransaction Methods

OracleLoigcalTransaction methods are listed in Table 7-121

**Table 7-121 OracleLogicalTransaction Methods**

Property	Description
<a href="#">Dispose</a>	This method releases any resources or memory allocated by the object
<a href="#">GetOutcome</a>	This method retrieves the transaction outcome from the database server. The method will determine whether the transaction committed and completed or not.

## Dispose

This method releases any resources or memory allocated by the object

### Declaration

```
// C#
public void Dispose();
```

### Implements

IDisposable

### Remarks

The `Dispose` method also closes the `OracleLogicalTransaction` object.



#### See Also:

- "Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"
- OracleLogicalTransaction Class
- OracleLogicalTransaction Members

## GetOutcome

The `GetOutcome` method retrieves the transaction outcome from the database server. The method will determine whether the transaction committed and completed or not.

### Overload List:

- `GetOutcome(string constring, byte[] ltxid, out bool? bCommitted, out bool? bUserCallCompleted)`

The application can use this static method to determine the outcome if the outcome was not known when the exception was raised.

The application will need to obtain the connection string and logical transaction id from the `OracleException.OracleLogicalTransaction` object before calling this method.

The supplied connection string will be used to establish a connection to the database to determine the outcome of the provided logical transaction id.

ODP.NET implicitly calls `GetOutcome` under the following conditions:

- Transaction Guard is enabled on the service
- `OracleException` is raised
- The exception is a recoverable error

When all of the above is true, then the `OracleException.OracleLogicalTransaction` property will be non-null.

If a connection is involved in a distributed transaction, then `GetOutcome` is *not* called implicitly and the `OracleException.OracleLogicalTransaction.LogicalTransactionId` property returns null.

### Note:

Once one server round-trip is incurred for the `GetOutcome()` invocation, the PL/SQL `ForceOutcome` is never invoked again against the server for a given `OracleLogicalTransaction` object.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleLogicalTransaction Class](#)
- [OracleLogicalTransaction Members](#)

# OracleOnsServerCollection Class

The `OracleOnsServerCollection` class supports adding to and deleting from a collection of logical servers with their corresponding list of nodes where the Oracle Notification Service (ONS) daemons are talking to their remote clients.

In case of remote configuration, the application has to specify the `<host>:<port>` values for every potential database that it can connect to. The `<host>:<port>` value pairs represent the ports on the different nodes.

## Class Inheritance

`System.Object`

`Oracle.ManagedDataAccess.Client.OracleOnsServerCollection`

## Declaration

```
// C#
public static class OracleOnsServerCollection
```

## Requirements

Provider	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	<code>Oracle.ManagedDataAccess.dll</code>	<code>Oracle.ManagedDataAccess.dll</code>
<b>Namespace</b>	<code>Oracle.ManagedDataAccess.Client</code>	<code>Oracle.ManagedDataAccess.Client</code>
<b>.NET Framework</b>	4.8	-
<b>.NET (Core)</b>	-	See <a href="#">System Requirements</a>

## Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

## Example

```
using System;
using Oracle.ManagedDataAccess.Client;

namespace NetCoreApplication
{
    class OnsServersExample
    {
        static void Main(string[] args)
        {
            // Example to configure ONS Servers for the ODP.NET Core provider.

            // Add server through Add method on OracleOnsServerCollection
            OracleConfiguration.OracleOnsServers.Add("db1", "nodeList=host1:port1,
            host2:port2, host3:port3");

            // Add server through indexer method on OracleOnsServerCollection
            OracleConfiguration.OracleOnsServers["db2"] = "nodeList=m1:p1, m2:p2";
        }
    }
}
```

```
// Get number of servers configured
int numServers = OracleConfiguration.OracleOnsServers.Count;

// Get OracleOnsServerCollection object
OracleOnsServerCollection serverColl = OracleConfiguration.OracleOnsServers;

// Add server through Add method on OracleOnsServerCollection
serverColl.Add("db3", "nodeList=host1:port1, host2:port2, host3:port3");

// Add server through indexer method on OracleOnsServerCollection
serverColl["db4"] = "nodeList=m1:p1, m2:p2";

// Remove a server
OracleConfiguration.OracleOnsServers.Remove("db2");

// Get number of servers configured
numServers = OracleConfiguration.OracleOnsServers.Count;

// Get value corresponding to a server.
string serverVal = OracleConfiguration.OracleOnsServers["db1"];

OracleConnection orclCon = null;

try
{
    // Open a test connection
    orclCon = new OracleConnection("user id=scott; password=tiger; data
source=oracle");

    orclCon.Open();
    orclCon.Close();
}
catch (OracleException ex)
{
    Console.WriteLine(ex);
}
finally
{
    // Close the connection
    if (null != orclCon)
        orclCon.Close();
}
}
```

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleOnsServerCollection Members](#)
- [OracleOnsServerCollection Methods](#)
- [OracleOnsServerCollection Properties](#)

## OracleOnsServerCollection Members

OracleOnsServerCollection members are listed in the following tables.

### OracleOnsServerCollection Methods

OracleOnsServerCollection methods are listed in [Table 7-122](#).

**Table 7-122 OracleOnsServerCollection Methods**

Method	Description
<a href="#">Add</a>	Adds unique entries in the OracleOnsServerCollection using logical server names and it's corresponding list of nodes
<a href="#">Remove</a>	Removes an entry from an OracleOnsServerCollection

### OracleOnsServerCollection Properties

OracleOnsServerCollection properties are listed in [Table 7-123](#).

**Table 7-123 OracleOnsServerCollection Properties**

Property	Description
<a href="#">Count</a>	Returns the number of OracleOnsServerCollection elements
<a href="#">This</a>	Returns or sets the an entry for a unique logical server name, which is to be associated with a list of nodes

## OracleOnsServerCollection Methods

OracleOnsServerCollection methods are listed in [Table 7-124](#).

**Table 7-124 OracleOnsServerCollection Methods**

Method	Description
<a href="#">Add</a>	Adds unique entries in the OracleOnsServerCollection using logical server names and it's corresponding list of nodes
<a href="#">Remove</a>	Removes an entry from an OracleOnsServerCollection

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleOnsServerCollection Class](#)
- [OracleOnsServerCollection Members](#)

## Add

This method adds unique entries in the `OracleOnsServerCollection` using logical server names and it's corresponding list of nodes.

### Declaration

```
// C#  
public void Add(string serverName, string nodeList)
```

### Parameters

- `serverName`
  - Type: `System.String`
  - A unique logical name for a list of nodes to be added
- `nodeList`
  - Type: `System.String`
  - Node names and remote ports for the list of nodes that ODP.NET shares ONS communication with using the following example format: `nodeList=racnode1:4200, racnode2:4200`

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleOnsServerCollection Class](#)
- [OracleOnsServerCollection Members](#)

## Remove

This method removes an entry from an `OracleOnsServerCollection`.

### Declaration

```
// C#  
public void Remove(string serverName)
```

### Parameters

serverName

- **Type:** System.String
- A unique logical name for a list of nodes to be removed

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleOnsServerCollection Class](#)
- [OracleOnsServerCollection Members](#)

## OracleOnsServerCollection Properties

OracleOnsServerCollection properties are listed in [Table 7-125](#).

**Table 7-125 OracleOnsServerCollection Properties**

Property	Description
<a href="#">Count</a>	Returns the number of OracleOnsServerCollection elements
<a href="#">This</a>	Returns or sets the an entry for a unique logical server name, which is to be associated with a list of nodes

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDataSourceCollection Class](#)
- [OracleDataSourceCollection Members](#)

### Count

This is a read-only property that returns the number of OracleOnsServerCollection elements.

#### Declaration

```
// C#
public int Count { get; }
```

### Property Value

Type: System.Int32

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleOnsServerCollection Class](#)
- [OracleOnsServerCollection Members](#)

## This

This property returns or sets the an entry for a unique logical server name, which is to be associated with a list of nodes.

### Declaration

```
// C#  
public string this[string serverName] { get; set; }
```

### Parameters

- serverName
  - Type: System.String
  - Unique logical server name to be added or updated
- Value
  - Type: System.String
  - Node names and remote ports for the list of nodes that ODP.NET shares ONS communication with using the following example format: `nodeList=racnode1:4200, racnode2:4200`

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleOnsServerCollection Class](#)
- [OracleOnsServerCollection Members](#)

## OracleParameter Class

An `OracleParameter` object represents a parameter for an `OracleCommand` or a `DataSet` column.

## Class Inheritance

System.Object

System.MarshalByRefObject

System.Data.Common.DbParameter

Oracle.DataAccess.Client.OracleParameter

## Declaration

```
// C#
public sealed class OracleParameter : DbParameter, IDisposable, ICloneable
```

## Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

## Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

## Exceptions

ArgumentException - The type binding is invalid.

## Example

```
// C#

using System;
using System.Data;
using Oracle.DataAccess.Client;
using Oracle.DataAccess.Types;

class OracleParameterSample
{
    static void Main()
    {
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();

        OracleParameter[] prm = new OracleParameter[3];

        // Create OracleParameter objects through OracleParameterCollection
        OracleCommand cmd = con.CreateCommand();
```

```

cmd.CommandText = "select max(empno) from emp";
int maxno = int.Parse(cmd.ExecuteScalar().ToString());

prm[0] = cmd.Parameters.Add("paramEmpno", OracleDbType.Decimal,
    maxno + 10, ParameterDirection.Input);
prm[1] = cmd.Parameters.Add("paramEname", OracleDbType.Varchar2,
    "Client", ParameterDirection.Input);
prm[2] = cmd.Parameters.Add("paramDeptNo", OracleDbType.Decimal,
    10, ParameterDirection.Input);
cmd.CommandText =
    "insert into emp(empno, ename, deptno) values(:1, :2, :3)";
cmd.ExecuteNonQuery();

Console.WriteLine("Record for employee id {0} has been inserted.",
    maxno + 10);
}
}

```

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Members](#)
- [OracleParameter Constructors](#)
- [OracleParameter Static Methods](#)
- [OracleParameter Properties](#)
- [OracleParameter Public Methods](#)

## OracleParameter Members

`OracleParameter` members are listed in the following tables.

### OracleParameter Constructors

`OracleParameter` constructors are listed in [Table 7-126](#).

**Table 7-126 OracleParameter Constructors**

Constructor	Description
<a href="#">OracleParameter Constructors</a>	Instantiates a new instance of <code>OracleParameter</code> class (Overloaded)

### OracleParameter Static Methods

`OracleParameter` static methods are listed in [Table 7-127](#).

**Table 7-127 OracleParameter Static Methods**

Method	Description
Equals	Inherited from <code>System.Object</code> (Overloaded)

**OracleParameter Properties**

`OracleParameter` properties are listed in [Table 7-128](#).

**Table 7-128 OracleParameter Properties**

Property	Description
<a href="#">ArrayBindSize</a>	Specifies the input or output size of elements in <code>Value</code> property of a parameter before or after an Array Bind or PL/SQL Associative Array Bind execution
<a href="#">ArrayBindStatus</a>	Specifies the input or output status of elements in <code>Value</code> property of a parameter before or after an Array Bind or PL/SQL Associative Array Bind execution
<a href="#">CollectionType</a>	Specifies whether or not the <code>OracleParameter</code> represents a collection, and if so, specifies the collection type
<a href="#">DbType</a>	Specifies the data type of the parameter using the <code>Data.DbType</code> enumeration type
<a href="#">Direction</a>	Specifies whether the parameter is input-only, output-only, bi-directional, or a stored function return value parameter
<a href="#">IsNullable</a>	Not supported
<a href="#">Offset</a>	Specifies the offset to the <code>Value</code> property or offset to the elements in the <code>Value</code> property
<a href="#">OracleDbType</a>	Specifies the Oracle data type
<a href="#">OracleDbTypeEx</a>	Specifies the Oracle data type to bind the parameter as, but returns a .NET type as output
<a href="#">ParameterName</a>	Specifies the name of the parameter
<a href="#">Precision</a>	Specifies the maximum number of digits used to represent the <code>Value</code> property
<a href="#">Scale</a>	Specifies the number of decimal places to which <code>Value</code> property is resolved
<a href="#">Size</a>	Specifies the maximum size, in bytes or characters, of the data transmitted to or from the database. For PL/SQL Associative Array Bind, <code>Size</code> specifies the maximum number of elements in PL/SQL Associative Array
<a href="#">SourceColumn</a>	Specifies the name of the <code>DataTable Column</code> of the <code>DataSet</code>
<a href="#">SourceColumnNullMapping</a>	Specifies a value which indicates whether the source column is nullable
<a href="#">SourceVersion</a>	Specifies the <code>DataRowVersion</code> value to use when loading the <code>Value</code> property of the parameter
<a href="#">Status</a>	Indicates the status of the execution related to the data in the <code>Value</code> property

**Table 7-128 (Cont.) OracleParameter Properties**

Property	Description
<a href="#">UdtTypeName</a>	Specifies the Oracle user-defined type name if the parameter is a user-defined data type
<a href="#">Value</a>	Specifies the value of the <code>Parameter</code>

**OracleParameter Public Methods**

`OracleParameter` public methods are listed in [Table 7-129](#).

**Table 7-129 OracleParameter Public Methods**

Public Method	Description
<a href="#">Clone</a>	Creates a shallow copy of an <code>OracleParameter</code> object
<code>CreateObjRef</code>	Inherited from <code>System.MarshalByRefObject</code>
<a href="#">Dispose</a>	Releases allocated resources
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)
<code>GetHashCode</code>	Inherited from <code>System.Object</code>
<code>GetLifetimeService</code>	Inherited from <code>System.MarshalByRefObject</code>
<code>GetType</code>	Inherited from <code>System.Object</code>
<code>InitializeLifetimeService</code>	Inherited from <code>System.MarshalByRefObject</code>
<a href="#">ResetDbType</a>	Resets the type associated with the parameter so that it can infer its type from the value passed in the parameter
<a href="#">ResetOracleDbType</a>	Resets the type associated with the parameter so that it can infer its type from the value passed in the parameter
<a href="#">ToString</a>	Returns the string representation of the current instance

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Class](#)

## OracleParameter Constructors

`OracleParameter` constructors instantiate new instances of the `OracleParameter` class.

**Overload List:**

- [OracleParameter\(\)](#)  
This constructor instantiates a new instance of `OracleParameter` class.
- [OracleParameter\(string, OracleDbType\)](#)

This constructor instantiates a new instance of `OracleParameter` class using the supplied parameter name and Oracle data type.

- [OracleParameter\(string, object\)](#)

This constructor instantiates a new instance of the `OracleParameter` class using the supplied parameter name and parameter value.

- [OracleParameter\(string, OracleDbType, ParameterDirection\)](#)

This constructor instantiates a new instance of the `OracleParameter` class using the supplied parameter name, data type, and parameter direction.

- [OracleParameter\(string, OracleDbType, object, ParameterDirection\)](#)

This constructor instantiates a new instance of the `OracleParameter` class using the supplied parameter name, data type, value, and direction.

- [OracleParameter\(string, OracleDbType, int\)](#)

This constructor instantiates a new instance of the `OracleParameter` class using the supplied parameter name, data type, and size.

- [OracleParameter\(string, OracleDbType, int, string\)](#)

This constructor instantiates a new instance of the `OracleParameter` class using the supplied parameter name, data type, size, and source column.

- [OracleParameter\(string, OracleDbType, int, ParameterDirection, bool, byte, byte, string, DataRowVersion, object\)](#)

This constructor instantiates a new instance of the `OracleParameter` class using the supplied parameter name, data type, size, direction, null indicator, precision, scale, source column, source version and parameter value.

- [OracleParameter\(string, OracleDbType, int, object, ParameterDirection\)](#)

This constructor instantiates a new instance of the `OracleParameter` class using the supplied parameter name, data type, size, value, and direction.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Class](#)
- [OracleParameter Members](#)

## OracleParameter()

This constructor instantiates a new instance of `OracleParameter` class.

### Declaration

```
// C#  
public OracleParameter();
```

**Remarks****Default Values:**

- DbType - String
- ParameterDirection - Input
- isNullable - true
- offset - 0
- OracleDbType - Varchar2
- ParameterAlias - Empty string
- ParameterName - Empty string
- Precision - 0
- Size - 0
- SourceColumn - Empty string
- SourceVersion - Current
- ArrayBindStatus - Success
- Value - null

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Class](#)
- [OracleParameter Members](#)
- ["OracleParameterStatus Enumeration"](#)
- ["OracleParameterCollection Class"](#)

## OracleParameter(string, OracleDbType)

This constructor instantiates a new instance of `OracleParameter` class using the supplied parameter name and Oracle data type.

**Declaration**

```
// C#  
public OracleParameter(string parameterName, OracleDbType oraType);
```

**Parameters**

- *parameterName*  
The parameter name.
- *oraType*

The data type of the `OracleParameter`.

### Remarks

Changing the `DbType` implicitly changes the `OracleDbType`.

Unless explicitly set in the constructor, all the properties have the default values.

### Default Values:

- `DbType` - String
- `ParameterDirection` - Input
- `isNullable` - true
- `offset` - 0
- `OracleDbType` - Varchar2
- `ParameterAlias` - Empty string
- `ParameterName` - Empty string
- `Precision` - 0
- `Size` - 0
- `SourceColumn` - Empty string
- `SourceVersion` - Current
- `ArrayBindStatus` - Success
- `Value` - null



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Class](#)
- [OracleParameter Members](#)
- ["OracleParameterStatus Enumeration"](#)
- ["OracleParameterCollection Class"](#)

## OracleParameter(string, object)

This constructor instantiates a new instance of the `OracleParameter` class using the supplied parameter name and parameter value.

### Declaration

```
// C#  
public OracleParameter(string parameterName, object obj);
```

## Parameters

- `parameterName`  
The parameter name.
- `obj`  
The value of the `OracleParameter`.

## Remarks

Unless explicitly set in the constructor, all the properties have the default values.

## Default Values:

- `DbType` - String
- `ParameterDirection` - Input
- `isNullable` - true
- `offset` - 0
- `OracleDbType` - Varchar2
- `ParameterAlias` - Empty string
- `ParameterName` - Empty string
- `Precision` - 0
- `Size` - 0
- `SourceColumn` - Empty string
- `SourceVersion` - Current
- `ArrayBindStatus` - Success
- `Value` - null



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Class](#)
- [OracleParameter Members](#)
- ["OracleParameterStatus Enumeration"](#)
- ["OracleParameterCollection Class"](#)

## OracleParameter(string, OracleDbType, ParameterDirection)

This constructor instantiates a new instance of the `OracleParameter` class using the supplied parameter name, data type, and parameter direction.

## Declaration

```
// C#  
public OracleParameter(string parameterName, OracleDbType type,  
    ParameterDirection direction);
```

## Parameters

- *parameterName*  
The parameter name.
- *type*  
The data type of the OracleParameter.
- *direction*  
The direction of the OracleParameter.

## Remarks

Unless explicitly set in the constructor, all the properties have the default values.

### Default Values:

- DbType - String
- ParameterDirection - Input
- isNullable - true
- offset - 0
- OracleDbType - Varchar2
- ParameterAlias - Empty string
- ParameterName - Empty string
- Precision - 0
- Size - 0
- SourceColumn - Empty string
- SourceVersion - Current
- ArrayBindStatus - Success
- Value - null

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Class](#)
- [OracleParameter Members](#)
- ["OracleParameterStatus Enumeration"](#)
- ["OracleParameterCollection Class"](#)

## OracleParameter(string, OracleDbType, object, ParameterDirection)

This constructor instantiates a new instance of the `OracleParameter` class using the supplied parameter name, data type, value, and direction.

### Declaration

```
// C#  
public OracleParameter(string parameterName, OracleDbType type, object obj,  
    ParameterDirection direction);
```

### Parameters

- *parameterName*  
The parameter name.
- *type*  
The data type of the `OracleParameter`.
- *obj*  
The value of the `OracleParameter`.
- *direction*  
The `ParameterDirection` value.

### Remarks

Changing the `DbType` implicitly changes the `OracleDbType`.

Unless explicitly set in the constructor, all the properties have the default values.

### Default Values:

- `DbType` - `String`
- `ParameterDirection` - `Input`
- `isNullable` - `true`
- `offset` - `0`
- `OracleDbType` - `Varchar2`
- `ParameterAlias` - `Empty string`

- `ParameterName` - Empty string
- `Precision` - 0
- `Size` - 0
- `SourceColumn` - Empty string
- `SourceVersion` - Current
- `ArrayBindStatus` - Success
- `Value` - null

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Class](#)
- [OracleParameter Members](#)
- ["OracleParameterStatus Enumeration"](#)
- ["OracleParameterCollection Class"](#)

## OracleParameter(string, OracleDbType, int)

This constructor instantiates a new instance of the `OracleParameter` class using the supplied parameter name, data type, and size.

### Declaration

```
// C#  
public OracleParameter(string parameterName, OracleDbType type,  
    int size);
```

### Parameters

- `parameterName`  
The parameter name.
- `type`  
The data type of the `OracleParameter`.
- `size`  
The size of the `OracleParameter` value.

### Remarks

Unless explicitly set in the constructor, all the properties have the default values.

### Default Values:

- `DbType` - String
- `ParameterDirection` - Input

- `isNullable` - true
- `offset` - 0
- `OracleDbType` - Varchar2
- `ParameterAlias` - Empty string
- `ParameterName` - Empty string
- `Precision` - 0
- `Size` - 0
- `SourceColumn` - Empty string
- `SourceVersion` - Current
- `ArrayBindStatus` - Success
- `Value` - null

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Class](#)
- [OracleParameter Members](#)
- ["OracleParameterStatus Enumeration"](#)
- ["OracleParameterCollection Class"](#)

## OracleParameter(string, OracleDbType, int, string)

This constructor instantiates a new instance of the `OracleParameter` class using the supplied parameter name, data type, size, and source column.

### Declaration

```
// C#
public OracleParameter(string parameterName, OracleDbType type, int size,
    string srcColumn);
```

### Parameters

- `parameterName`  
The parameter name.
- `type`  
The data type of the `OracleParameter`.
- `size`  
The size of the `OracleParameter` value.
- `srcColumn`

The name of the source column.

### Remarks

Unless explicitly set in the constructor, all the properties have the default values.

### Default Values:

- DbType - String
- ParameterDirection - Input
- isNullable - true
- offset - 0
- OracleDbType - Varchar2
- ParameterAlias - Empty string
- ParameterName - Empty string
- Precision - 0
- Size - 0
- SourceColumn - Empty string
- SourceVersion - Current
- ArrayBindStatus - Success
- Value - null

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Class](#)
- [OracleParameter Members](#)
- ["OracleParameterStatus Enumeration"](#)

OracleParameter(string, OracleDbType, int, ParameterDirection, bool, byte, byte, string, DataRowVersion, object)

This constructor instantiates a new instance of the `OracleParameter` class using the supplied parameter name, data type, size, direction, null indicator, precision, scale, source column, source version and parameter value.

### Declaration

```
// C#
public OracleParameter(string parameterName, OracleDbType oraType,
    int size, ParameterDirection direction, bool isNullable, byte
    precision, byte scale, string srcColumn, DataRowVersion srcVersion,
    object obj);
```

## Parameters

- *parameterName*  
The parameter name.
- *oraType*  
The data type of the OracleParameter.
- *size*  
The size of the OracleParameter value.
- *direction*  
The ParameterDirection value.
- *isNullable*  
An indicator that specifies if the parameter value can be null.
- *precision*  
The precision of the parameter value.
- *scale*  
The scale of the parameter value.
- *srcColumn*  
The name of the source column.
- *srcVersion*  
The DataRowVersion value.
- *obj*  
The parameter value.

## Exceptions

ArgumentException - The supplied value does not belong to the type of Value property in any of the OracleTypes.

## Remarks

Unless explicitly set in the constructor, all the properties have the default values.

### Default Values:

- DbType - String
- ParameterDirection - Input
- isNullable - true
- offset - 0
- OracleDbType - Varchar2
- ParameterAlias - Empty string
- ParameterName - Empty string

- Precision - 0
- Size - 0
- SourceColumn - Empty string
- SourceVersion - Current
- ArrayBindStatus - Success
- Value - null

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Class](#)
- [OracleParameter Members](#)
- ["OracleParameterStatus Enumeration"](#)

## OracleParameter(string, OracleDbType, int, object, ParameterDirection)

This constructor instantiates a new instance of the `OracleParameter` class using the supplied parameter name, data type, size, value, and direction.

### Declaration

```
// C#  
public OracleParameter(string parameterName, OracleDbType type, int size,  
    object obj, ParameterDirection direction);
```

### Parameters

- *parameterName*  
The parameter name.
- *type*  
The data type of the `OracleParameter`.
- *size*  
The size of the `OracleParameter` value.
- *obj*  
The value of the `OracleParameter`.
- *direction*  
The `ParameterDirection` value.

### Remarks

Changing the `DbType` implicitly changes the `OracleDbType`.

Unless explicitly set in the constructor, all the properties have the default values.

**Default Values:**

- DbType - String
- ParameterDirection - Input
- isNullable - true
- offset - 0
- OracleDbType - Varchar2
- ParameterAlias - Empty string
- ParameterName - Empty string
- Precision - 0
- Size - 0
- SourceColumn - Empty string
- SourceVersion - Current
- ArrayBindStatus - Success
- Value - null

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Class](#)
- [OracleParameter Members](#)
- ["OracleParameterStatus Enumeration"](#)
- ["OracleParameterCollection Class"](#)

## OracleParameter Static Methods

The `OracleParameter` static method is listed in [Table 7-130](#).

**Table 7-130 OracleParameter Static Method**

Method	Description
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Class](#)
- [OracleParameter Members](#)

## OracleParameter Properties

OracleParameter properties are listed in [Table 7-131](#).

**Table 7-131 OracleParameter Properties**

Property	Description
<a href="#">ArrayBindSize</a>	Specifies the input or output size of elements in <code>Value</code> property of a parameter before or after an Array Bind or PL/SQL Associative Array Bind execution
<a href="#">ArrayBindStatus</a>	Specifies the input or output status of elements in <code>Value</code> property of a parameter before or after an Array Bind or PL/SQL Associative Array Bind execution
<a href="#">CollectionType</a>	Specifies whether or not the <code>OracleParameter</code> represents a collection, and if so, specifies the collection type
<a href="#">DbType</a>	Specifies the data type of the parameter using the <code>Data.DbType</code> enumeration type
<a href="#">Direction</a>	Specifies whether the parameter is input-only, output-only, bi-directional, or a stored function return value parameter
<a href="#">IsNullable</a>	Not supported
<a href="#">Offset</a>	Specifies the offset to the <code>Value</code> property or offset to the elements in the <code>Value</code> property
<a href="#">OracleDbType</a>	Specifies the Oracle data type
<a href="#">OracleDbTypeEx</a>	Specifies the Oracle data type to bind the parameter as, but returns a .NET type as output
<a href="#">ParameterName</a>	Specifies the name of the parameter
<a href="#">Precision</a>	Specifies the maximum number of digits used to represent the <code>Value</code> property
<a href="#">Scale</a>	Specifies the number of decimal places to which <code>Value</code> property is resolved
<a href="#">Size</a>	Specifies the maximum size, in bytes or characters, of the data transmitted to or from the database. For PL/SQL Associative Array Bind, <code>Size</code> specifies the maximum number of elements in PL/SQL Associative Array
<a href="#">SourceColumn</a>	Specifies the name of the <code>DataTable Column</code> of the <code>DataSet</code>
<a href="#">SourceColumnNullMapping</a>	Specifies a value which indicates whether the source column is nullable

Table 7-131 (Cont.) OracleParameter Properties

Property	Description
<a href="#">SourceVersion</a>	Specifies the <code>DataRowVersion</code> value to use when loading the <code>Value</code> property of the parameter
<a href="#">Status</a>	Indicates the status of the execution related to the data in the <code>Value</code> property
<a href="#">UdtTypeName</a>	Specifies the Oracle user-defined type name if the parameter is a user-defined data type
<a href="#">Value</a>	Specifies the value of the <code>Parameter</code>

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Class](#)
- [OracleParameter Members](#)

## ArrayBindSize

This property specifies the maximum size, in bytes or characters, of the data for each array element transmitted to or from the database. This property is used for Array Bind or PL/SQL Associative Array execution.

### Declaration

```
// C#  
public int[] ArrayBindSize {get; set; }
```

### Property Value

An array of `int` values specifying the size.

### Remarks

Default = `null`.

This property is only used for variable size element types for an Array Bind or PL/SQL Associative Array. For fixed size element types, this property is ignored.

Each element in the `ArrayBindSize` corresponds to the bind size of an element in the `Value` property. Before execution, `ArrayBindSize` specifies the maximum size of each element to be bound in the `Value` property. After execution, it contains the size of each element returned in the `Value` property.

For binding a PL/SQL Associative Array, whose elements are of a variable-length element type, as an `InputOutput`, `Out`, or `ReturnValue` parameter, this property must be set properly. The number of elements in `ArrayBindSize` must be equal to the value specified in the `OracleParameter.Size` property.

**Example**

```
// C#

using System;
using System.Data;
using Oracle.DataAccess.Client;

class ArrayBindSizeSample
{
    static void Main()
    {
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();

        OracleParameter[] prm = new OracleParameter[3];

        // Create OracleParameter objects through OracleParameterCollection
        OracleCommand cmd = con.CreateCommand();

        cmd.CommandText = "select max(empno) from emp";
        int maxno = int.Parse(cmd.ExecuteScalar().ToString());

        // Set the ArrayBindCount for Array Binding
        cmd.ArrayBindCount = 2;

        prm[0] = cmd.Parameters.Add("paramEmpno", OracleDbType.Decimal,
            new int[2] {maxno + 10, maxno + 11}, ParameterDirection.Input);
        prm[1] = cmd.Parameters.Add("paramEname", OracleDbType.Varchar2,
            new string[2] {"Client1xxx", "Client2xxx"}, ParameterDirection.Input);
        prm[2] = cmd.Parameters.Add("paramDeptNo", OracleDbType.Decimal,
            new int[2] {10, 10}, ParameterDirection.Input);

        // Set the ArrayBindSize for prm[1]
        // These sizes indicate the maximum size of the elements in Value property
        prm[1].ArrayBindSize = new int[2];
        prm[1].ArrayBindSize[0] = 7; // Set ename = "Client1"
        prm[1].ArrayBindSize[1] = 7; // Set ename = "Client2"

        cmd.CommandText =
            "insert into emp(empno, ename, deptno) values(:1, :2, :3)";

        cmd.ExecuteNonQuery();

        Console.WriteLine("Record for employee id {0} has been inserted.",
            maxno + 10);
        Console.WriteLine("Record for employee id {0} has been inserted.",
            maxno + 11);

        prm[0].Dispose();
        prm[1].Dispose();
        prm[2].Dispose();
        cmd.Dispose();

        con.Close();
        con.Dispose();
    }
}
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Class](#)
- [OracleParameter Members](#)
- ["ArrayBindCount "](#)
- ["Size " and "Value " for more information on binding Associative Arrays](#)
- ["ArrayBindStatus "](#)

## ArrayBindStatus

This property specifies the input or output status of each element in the `Value` property before or after an Array Bind or PL/SQL Associative Array execution.

### Declaration

```
// C#  
public OracleParameterStatus[] ArrayBindStatus { get; set; }
```

### Property Value

An array of `OracleParameterStatus` enumerated values.

### Exceptions

`ArgumentOutOfRangeException` - The `Status` value specified is invalid.

### Remarks

Default = null.

`ArrayBindStatus` is used for Array Bind and PL/SQL Associative Array execution only.

Before execution, `ArrayBindStatus` indicates the bind status of each element in the `Value` property. After execution, it contains the execution status of each element in the `Value` property.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Class](#)
- [OracleParameter Members](#)
- ["ArrayBindCount "](#)
- ["OracleParameterStatus Enumeration"](#)
- ["Value "](#) for more information on binding Associative Arrays
- ["ArrayBindSize "](#)

## CollectionType

This property specifies whether or not the `OracleParameter` represents a collection, and if so, specifies the collection type.

### Declaration

```
// C#  
public OracleCollectionType CollectionType { get; set; }
```

### Property Value

An `OracleCollectionType` enumerated value.

### Exceptions

`ArgumentException` - The `OracleCollectionType` value specified is invalid.

### Remarks

Default = `OracleCollectionType.None`. If `OracleParameter` is used to bind a PL/SQL Associative Array, then `CollectionType` must be set to `OracleCollectionType.PLSQLAssociativeArray`.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Class](#)
- [OracleParameter Members](#)

## DbType

This property specifies the data type of the parameter using the `Data.DbType` enumeration type.

### Declaration

```
// C#  
public override DbType DbType {get; set; }
```

### Property Value

A `DbType` enumerated value.

### Implements

`IDataParameter`

### Exceptions

`ArgumentException` - The `DbType` value specified is invalid.

### Remarks

Default = `DbType.String`

`DbType` is the data type of each element in the array if the `OracleParameter` object is used for Array Bind or PL/SQL Associative Array Bind execution.

Due to the link between `DbType` and `OracleDbType` properties, if the `DbType` property is set, the `OracleDbType` property is inferred from `DbType`.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Class](#)
- [OracleParameter Members](#)
- ["Inference of OracleDbType from DbType"](#)
- ["CollectionType"](#)

## Direction

This property specifies whether the parameter is input-only, output-only, bi-directional, or a stored function return value parameter.

### Declaration

```
// C#  
public override ParameterDirection Direction { get; set; }
```

### Property Value

A `ParameterDirection` enumerated value.

### Implements

IDataParameter

### Exceptions

ArgumentOutOfRangeException - The ParameterDirection value specified is invalid.

### Remarks

Default = ParameterDirection.Input

Possible values: Input, InputOutput, Output, and ReturnValue.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Class](#)
- [OracleParameter Members](#)

## IsNull

This property is not supported.

### Declaration

```
// C#  
public override bool IsNull { get; set; }
```

### Implements

IDataParameter

### Property Value

This property is not supported.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Class](#)
- [OracleParameter Members](#)

## Offset

This property specifies the offset to the Value property.

## Declaration

```
// C#  
public int Offset { get; set; }
```

## Property Value

An `int` that specifies the offset.

## Exceptions

`ArgumentOutOfRangeException` - The `Offset` value specified is invalid.

## Remarks

Default = 0

For `Array Bind` and `PL/SQL Associative Array Bind`, `Offset` applies to every element in the `Value` property.

The `Offset` property is used for binary and string data types. The `Offset` property represents the number of bytes for binary types and the number of characters for strings. The count for strings does not include the terminating character if a `null` is referenced. The `Offset` property is used by parameters of the following types:

- `OracleDbType.BFile`
- `OracleDbType.Blob`
- `OracleDbType.LongRaw`
- `OracleDbType.Raw`
- `OracleDbType.Char`
- `OracleDbType.Clob`
- `OracleDbType.NClob`
- `OracleDbType.NChar`
- `OracleDbType.NVarchar2`
- `OracleDbType.Varchar2`



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Class](#)
- [OracleParameter Members](#)

## OracleDbType

This property specifies the Oracle data type.

### Declaration

```
// C#  
public OracleDbType OracleDbType { get; set; }
```

### Property Value

An `OracleDbType` enumerated value.

### Remarks

Default = `OracleDbType.Varchar2`

If the `OracleParameter` object is used for Array Bind or PL/SQL Associative Array Bind execution, `OracleDbType` is the data type of each element in the array.

The `OracleDbType` property and `DbType` property are linked. Therefore, setting the `OracleDbType` property changes the `DbType` property to a supporting `DbType`.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Class](#)
- [OracleParameter Members](#)
- ["OracleDbType Enumeration"](#)
- ["Inference of DbType from OracleDbType"](#)
- ["CollectionType"](#)

## OracleDbTypeEx

This property specifies the Oracle data type to bind the parameter as, but returns a .NET type as output.

### Declaration

```
// C#  
public OracleDbType OracleDbTypeEx { get; set; }
```

### Property Value

An `OracleDbType` enumerated value.

### Remarks

This property is used by applications that need to bind a parameter value as an Oracle type, but need a .NET type back for output. This property should be used with an output or input/output parameter. For an input parameter, using `OracleDbTypeEx` has the same affect as using `OracleDbType`. The .NET type that is returned for the output is the .NET type that the Oracle type closely maps to.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Class](#)
- [OracleParameter Members](#)
- ["OracleDbType Enumeration"](#)
- ["OracleDbType "](#)
- ["Inference of DbType from OracleDbType"](#)
- ["CollectionType"](#)

## ParameterName

This property specifies the name of the parameter.

### Declaration

```
// C#  
public override string ParameterName { get; set; }
```

### Property Value

String

### Implements

IDataParameter

### Remarks

Default = null

Oracle supports ParameterName up to 30 characters.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Class](#)
- [OracleParameter Members](#)

## Precision

This property specifies the maximum number of digits used to represent the Value property.

### Declaration

```
// C#  
Public byte Precision { get; set; }
```

### Property Value

byte

### Remarks

Default = 0

The `Precision` property is used by parameters of type `OracleDbType.Decimal`.

Oracle supports `Precision` range from 0 to 38.

For `Array Bind` and `PL/SQL Associative Array Bind`, `Precision` applies to each element in the `Value` property.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Class](#)
- [OracleParameter Members](#)
- ["Value "](#)

## Scale

This property specifies the number of decimal places to which `Value` property is resolved.

### Declaration

```
// C#  
public byte Scale { get; set; }
```

### Property Value

byte

### Remarks

Default = 0.

`Scale` is used by parameters of type `OracleDbType.Decimal`.

Oracle supports `Scale` between -84 and 127.

For `Array Bind` and `PL/SQL Associative Array Bind`, `Scale` applies to each element in the `Value` property.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Class](#)
- [OracleParameter Members](#)
- ["Value "](#)

## Size

This property specifies the maximum size, in bytes or characters, of the data transmitted to or from the database.

### Declaration

```
// C#  
public override int Size { get; set;}
```

### Property Value

int

### Exceptions

`ArgumentOutOfRangeException` - The `Size` value specified is invalid.

`InvalidOperationException` - The `Size = 0` when the `OracleParameter` object is used to bind a PL/SQL Associative Array.

### Remarks

If `Size` is not explicitly set, it is inferred from the actual size of the specified parameter value when binding only for input parameters. Output parameters must have their size defined explicitly.

The default value is 0.

Before execution, this property specifies the maximum size to be bound in the `Value` property. After execution, it contains the size of the type in the `Value` property.

`Size` is used for parameters of the following types:

- `OracleDbType.Blob`
- `OracleDbType.Char`
- `OracleDbType.Clob`
- `OracleDbType.LongRaw`
- `OracleDbType.NChar`
- `OracleDbType.NClob`
- `OracleDbType.NVarchar2`

- `OracleDbType.Raw`
- `OracleDbType.Varchar2`

For the preceding types, the `Size` property describes the maximum amount of data transmitted to or from the database. For character data, `Size` is in number of characters and for binary data, it is in number of bytes.

For fixed length data types, the value of `Size` is ignored.

If the `Size` is not explicitly set, it is inferred from the actual size of the specified parameter value when binding.

 **Note:**

`Size` does not include the null terminating character for the string data.

If the `OracleParameter` object is used to bind a PL/SQL Associative Array, `Size` specifies the maximum number of elements in the PL/SQL Associative Array. Before the execution, this property specifies the maximum number of elements in the PL/SQL Associative Array. After the execution, it specifies the current number of elements returned in the PL/SQL Associative Array. For `Output` and `InputOutput` parameters and return values, `Size` specifies the maximum number of elements in the PL/SQL Associative Array.

ODP.NET does not support binding an empty PL/SQL Associative Array. Therefore, `Size` cannot be set to 0 when the `OracleParameter` object is used to bind a PL/SQL Associative Array.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Class](#)
- [OracleParameter Members](#)
- ["OracleDbType Enumeration"](#)
- ["CollectionType"](#)
- ["ArrayBindSize "](#)
- ["ArrayBindStatus "](#)
- ["Value "](#)

## SourceColumn

This property specifies the name of the `DataTable` Column of the `DataSet`.

**Declaration**

```
// C#  
public override string SourceColumn { get; set; }
```

**Property Value**

A string.

**Implements**

IDataParameter

**Remarks**

Default = empty string

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Class](#)
- [OracleParameter Members](#)

## SourceColumnNullMapping

This property specifies a value which indicates whether the source column is nullable.

**Declaration**

```
// C#  
public bool SourceColumnNullMapping { get; set; }
```

**Property Value**

Returns `true` if the source column can be nullified; otherwise, returns `false`.

**Remarks**

The default value is `false`.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Class](#)
- [OracleParameter Members](#)

## SourceVersion

This property specifies the `DataRowVersion` value to use when loading the `Value` property of the parameter.

### Declaration

```
// C#  
public override DataRowVersion SourceVersion { get; set; }
```

### Property Value

`DataRowVersion`

### Implements

`IDataParameter`

### Exceptions

`ArgumentOutOfRangeException` - The `DataRowVersion` value specified is invalid.

### Remarks

Default = `DataRowVersion.Current`

`SourceVersion` is used by the `OracleDataAdapter.UpdateCommand()` during the `OracleDataAdapter.Update` to determine whether the original or current value is used for a parameter value. This allows primary keys to be updated. This property is ignored by the `OracleDataAdapter.InsertCommand()` and the `OracleDataAdapter.DeleteCommand()`.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Class](#)
- [OracleParameter Members](#)

## Status

This property indicates the status of the execution related to the data in the `Value` property.

### Declaration

```
// C#  
public OracleParameterStatus Status { get; set; }
```

### Property Value

An `OracleParameterStatus` enumerated value.

## Exceptions

`ArgumentOutOfRangeException` - The `Status` value specified is invalid.

## Remarks

Default = `OracleParameterStatus.Success`

Before execution, this property indicates the bind status related to the `Value` property. After execution, it returns the status of the execution.

`Status` indicates if:

- A `NULL` is fetched from a column.
- Truncation has occurred during the fetch; then `Value` was not big enough to hold the data.
- A `NULL` is to be inserted into a database column; then `Value` is ignored, and a `NULL` is inserted into a database column.

This property is ignored for `Array Bind` and `PL/SQL Associative Array Bind`. Instead, `ArrayBindStatus` property is used.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Class](#)
- [OracleParameter Members](#)
- ["OracleParameterStatus Enumeration"](#)
- ["ArrayBindStatus "](#)

## UdtTypeName

This property specifies the Oracle user-defined type name if the parameter is a user-defined data type.

### Declaration

```
// C#  
public string UdtTypeName {get; set;}
```

### Property Value

Name of the Oracle UDT.

### Remarks

The `UdtTypeName` property corresponds to the user-defined type name of the parameter. This property must always be specified if the parameter is a user-defined type. Note that when a custom object is provided as an input parameter value, it is converted to the Oracle UDT that is specified by the custom type mapping on the connection used to execute the

command. The Oracle UDT specified by the custom type mapping and by the `OracleParameter.UdtTypeName` property differs if the application binds a custom object that represents a subtype of the parameter type.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Class](#)
- [OracleParameter Members](#)

## Value

This property specifies the value of the `Parameter`.

### Declaration

```
// C#  
public override object Value { get; set; }
```

### Property Value

An object.

### Implements

`IDataParameter`

### Exceptions

`ArgumentException` - The `Value` property specified is invalid.

`InvalidArgumentException`- The `Value` property specified is invalid.

### Remarks

Default = `null`

If the `OracleParameter` object is used for Array Bind or PL/SQL Associative Array, `Value` is an array of parameter values.

The `Value` property can be overwritten by `OracleDataAdapter.Update()`.

The provider attempts to convert any type of value if it supports the `IConvertible` interface. Conversion errors occur if the specified type is not compatible with the value.

When sending a `null` parameter value to the database, the user must specify `DBNull`, not `null`. The `null` value in the system is an empty object that has no value. `DBNull` is used to represent `null` values. The user can also specify a `null` value by setting `Status` to `OracleParameterStatus.NullValue`. In this case, the provider sends a `null` value to the database.

If neither `OracleDbType` nor `DbType` are set, their values can be inferred by `Value`. Please see the following for related information:

- Tables in section "[Inference of DbType and OracleDbType from Value](#)"
- "[ArrayBindCount](#) "
- "[ArrayBindSize](#) "
- "[ArrayBindStatus](#) "
- "[OracleDbType Enumeration](#)"

For input parameters the value is:

- Bound to the `OracleCommand` that is sent to the database.
- Converted to the data type specified in `OracleDbType` or `DbType` when the provider sends the data to the database.

For output parameters the value is:

- Set on completion of the `OracleCommand` (true for return value parameters also).
- Set to the data from the database, to the data type specified in `OracleDbType` or `DbType`.

When array binding is used with:

- Input parameter - `Value` should be set to an array of values. `OracleCommand.ArrayBindCount` should be set to a value that is greater than zero to indicate the number of elements to be bound.  
  
The number of elements in the array should be equal to the `OracleCommand.ArrayBindCount` property; otherwise, their minimum value is used to bind the elements in the array.
- Output parameter - `OracleCommand.ArrayBindCount` should be set to a value that is greater than zero to indicate the number of elements to be retrieved (for `SELECT` statements).

When PL/SQL Associative Array binding is used with:

- Input parameter – `Value` should be set to an array of values. `CollectionType` should be set to `OracleCollection.PLSQLAssociativeArray`. `Size` should be set to specify the possible maximum number of array elements in the PL/SQL Associative Array. If `Size` is smaller than the number of elements in `Value`, then `Size` specifies the number of elements in the `Value` property to be bound.
- Output parameter - `CollectionType` should be set to `OracleCollection.PLSQLAssociativeArray`. `Size` should be set to specify the maximum number of array elements in PL/SQL Associative Array.

Each parameter should have a value. To bind a parameter with a null value, set `Value` to `DBNull.Value`, or set `Status` to `OracleParameterStatus.NullInsert`.

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Class](#)
- [OracleParameter Members](#)
- ["ArrayBindCount "](#)
- ["OracleParameterStatus Enumeration"](#)

## OracleParameter Public Methods

OracleParameter public methods are listed in [Table 7-132](#).

**Table 7-132 OracleParameter Public Methods**

Public Method	Description
<a href="#">Clone</a>	Creates a shallow copy of an OracleParameter object
CreateObjRef	Inherited from System.MarshalByRefObject
<a href="#">Dispose</a>	Releases allocated resources
Equals	Inherited from System.Object (Overloaded)
GetHashCode	Inherited from System.Object
GetLifetimeService	Inherited from System.MarshalByRefObject
GetType	Inherited from System.Object
InitializeLifetimeService	Inherited from System.MarshalByRefObject
<a href="#">ResetDbType</a>	Resets the type associated with the parameter so that it can infer its type from the value passed in the parameter
<a href="#">ResetOracleDbType</a>	Resets the type associated with the parameter so that it can infer its type from the value passed in the parameter
<a href="#">ToString</a>	Returns the string representation of the current instance

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Class](#)
- [OracleParameter Members](#)

## Clone

This method creates a shallow copy of an `OracleParameter` object.

### Declaration

```
// C#  
public object Clone();
```

### Return Value

An `OracleParameter` object.

### Implements

`ICloneable`

### Remarks

The cloned object has the same property values as that of the object being cloned.

### Example

```
// C#  
  
using System;  
using System.Data;  
using Oracle.DataAccess.Client;  
  
class CloneSample  
{  
    static void Main()  
    {  
        OracleParameter prm1 = new OracleParameter();  
  
        // Prints "prm1.ParameterName = "  
        Console.WriteLine("prm1.ParameterName = " + prm1.ParameterName);  
  
        // Set the ParameterName before cloning  
        prm1.ParameterName = "MyParam";  
  
        // Clone the OracleParameter  
        OracleParameter prm2 = (OracleParameter) prm1.Clone();  
  
        // Prints "prm2.ParameterName = MyParam"  
        Console.WriteLine("prm2.ParameterName = " + prm2.ParameterName);  
  
        prm1.Dispose();  
        prm2.Dispose();  
    }  
}
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Class](#)
- [OracleParameter Members](#)

## Dispose

This method releases resources allocated for an `OracleParameter` object.

### Declaration

```
// C#  
public void Dispose();
```

### Implements

`IDisposable`

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Class](#)
- [OracleParameter Members](#)

## ResetDbType

This method resets the type associated with the parameter so that it can infer its type from the value passed in the parameter.

### Declaration

```
// C#  
public override void ResetDbType();
```

### Remarks

If an application does not set the `DbType` or `OracleDbType` properties of an `OracleParameter` object, then these values are inferred from the value set by the application to that `OracleParameter` object. Calling `ResetDbType` method resets these properties so that `OracleParameter` can again infer its type from the value passed into the `OracleParameter`. Calling this method affects both the `DbType` and `OracleDbType` properties of the `OracleParameter` object.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Class](#)
- [OracleParameter Members](#)

## ResetOracleDbType

This method resets the type associated with the parameter so that it can infer its type from the value passed in the parameter.

### Declaration

```
// C#  
public override void ResetOracleDbType();
```

### Remarks

If an application does not set the `DbType` or `OracleDbType` properties of an `OracleParameter` object, then these values are inferred from the value set by the application to that `OracleParameter` object. Calling the `ResetOracleDbType` method resets these properties so that `OracleParameter` can again infer its type from the value passed into the `OracleParameter`. Calling this method affects both the `DbType` and `OracleDbType` properties of the `OracleParameter` object.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Class](#)
- [OracleParameter Members](#)

## ToString

Overrides `Object`

This method returns the string representation of the current instance.

### Declaration

```
// C#  
public override string ToString();
```

### Return Value

Returns the `OracleParameter` value in a string representation.

**Remarks**

If the current instance has a null value, the returned string is null.

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameter Class](#)
- [OracleParameter Members](#)

## OracleParameterCollection Class

An `OracleParameterCollection` class represents a collection of all parameters relevant to an `OracleCommand` object and their mappings to `DataSet` columns.

**Class Inheritance**

`System.Object`

`System.MarshalByRefObject`

`System.Data.Common.DbParameterCollection`

`Oracle.DataAccess.Client.OracleParameterCollection`

**Declaration**

```
// C#
public sealed class OracleParameterCollection : DbParameterCollection,
    IDataParameterCollection, IList, ICollection, IEnumerable
```

**Requirements**

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

**Thread Safety**

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

## Remarks

The position of an `OracleParameter` added into the `OracleParameterCollection` is the binding position in the SQL statement. Position is 0-based and is used only for positional binding. If named binding is used, the position of an `OracleParameter` in the `OracleParameterCollection` is ignored.

## Example

```
// C#

using System;
using System.Data;
using Oracle.DataAccess.Client;

class OracleParameterCollectionSample
{
    static void Main()
    {
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();

        OracleParameter[] prm = new OracleParameter[3];

        // Create OracleParameter objects through OracleParameterCollection
        OracleCommand cmd = con.CreateCommand();

        cmd.CommandText = "select max(empno) from emp";
        int maxno = int.Parse(cmd.ExecuteScalar().ToString());

        prm[0] = cmd.Parameters.Add("paramEmpno", OracleDbType.Decimal,
            maxno + 10, ParameterDirection.Input);
        prm[1] = cmd.Parameters.Add("paramEname", OracleDbType.Varchar2,
            "Client", ParameterDirection.Input);
        prm[2] = cmd.Parameters.Add("paramDeptNo", OracleDbType.Decimal,
            10, ParameterDirection.Input);
        cmd.CommandText =
            "insert into emp(empno, ename, deptno) values (:1, :2, :3)";
        cmd.ExecuteNonQuery();

        Console.WriteLine("Record for employee id {0} has been inserted.",
            maxno + 10);

        // Remove all parameters from OracleParameterCollection
        cmd.Parameters.Clear();

        prm[0].Dispose();
        prm[1].Dispose();
        prm[2].Dispose();
        cmd.Dispose();

        con.Close();
        con.Dispose();
    }
}
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Members](#)
- [OracleParameterCollection Static Methods](#)
- [OracleParameterCollection Properties](#)
- [OracleParameterCollection Public Methods](#)

## OracleParameterCollection Members

OracleParameterCollection members are listed in the following tables.

### OracleParameterCollection Static Methods

OracleParameterCollection static methods are listed in [Table 7-133](#).

**Table 7-133 OracleParameterCollection Static Methods**

Method	Description
Equals	Inherited from System.Object (Overloaded)

### OracleParameterCollection Properties

OracleParameterCollection properties are listed in [Table 7-134](#).

**Table 7-134 OracleParameterCollection Properties**

Property	Description
Count	Specifies the number of OracleParameters in the collection
Item	Gets and sets the OracleParameter object (Overloaded)
IsFixedSize	Gets a value that indicates whether the OracleParameterCollection has a fixed size
IsReadOnly	Gets a value that indicates whether the OracleParameterCollection is read-only
IsSynchronized	Gets a value that indicates whether the OracleParameterCollection is synchronized.
SyncRoot	Gets an object that can be used to synchronize access to the OracleParameterCollection

### OracleParameterCollection Public Methods

OracleParameterCollection public methods are listed in [Table 7-135](#).

**Table 7-135 OracleParameterCollection Public Methods**

Public Method	Description
<a href="#">Add</a>	Adds objects to the collection (Overloaded)
<a href="#">AddRange</a>	Adds elements to the end of the <code>OracleParameterCollection</code>
<a href="#">Clear</a>	Removes all the <code>OracleParameter</code> objects from the collection
<a href="#">Contains</a>	Indicates whether or not objects exist in the collection (Overloaded)
<a href="#">CopyTo</a>	Copies <code>OracleParameter</code> objects from the collection, starting with the supplied index to the supplied array
<code>CreateObjRef</code>	Inherited from <code>System.MarshalByRefObject</code>
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)
<a href="#">GetEnumerator</a>	Returns an enumerator that iterates through the <code>OracleParameterCollection</code>
<code>GetHashCode</code>	Inherited from <code>System.Object</code>
<code>GetLifetimeService</code>	Inherited from <code>System.MarshalByRefObject</code>
<code>GetType</code>	Inherited from <code>System.Object</code>
<code>InitializeLifetimeService</code>	Inherited from <code>System.MarshalByRefObject</code>
<a href="#">IndexOf</a>	Returns the index of the objects in the collection (Overloaded)
<a href="#">Insert</a>	Inserts the supplied <code>OracleParameter</code> to the collection at the specified index
<a href="#">Remove</a>	Removes objects from the collection
<a href="#">RemoveAt</a>	Removes objects from the collection by location (Overloaded)
<code>ToString</code>	Inherited from <code>System.Object</code>

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Class](#)

## OracleParameterCollection Static Methods

The `OracleParameterCollection` static method is listed in [Table 7-136](#).

**Table 7-136 OracleParameterCollection Static Method**

Method	Description
Equals	Inherited from <code>System.Object</code> (Overloaded)

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Class](#)
- [OracleParameterCollection Members](#)

## OracleParameterCollection Properties

OracleParameterCollection properties are listed in [Table 7-137](#).

**Table 7-137 OracleParameterCollection Properties**

Property	Description
<a href="#">Count</a>	Specifies the number of <code>OracleParameters</code> in the collection
<a href="#">Item</a>	Gets and sets the <code>OracleParameter</code> object (Overloaded)
<a href="#">IsFixedSize</a>	Gets a value that indicates whether the <code>OracleParameterCollection</code> has a fixed size
<a href="#">IsReadOnly</a>	Gets a value that indicates whether the <code>OracleParameterCollection</code> is read-only
<a href="#">IsSynchronized</a>	Gets a value that indicates whether the <code>OracleParameterCollection</code> is synchronized.
<a href="#">SyncRoot</a>	Gets an object that can be used to synchronize access to the <code>OracleParameterCollection</code>

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Class](#)
- [OracleParameterCollection Members](#)

## Count

This property specifies the number of `OracleParameter` objects in the collection.

### Declaration

```
// C#  
public override int Count {get;}
```

### Property Value

The number of `OracleParameter` objects.

### Implements

`ICollection`

### Remarks

Default = 0

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Class](#)
- [OracleParameterCollection Members](#)

## Item

`Item` gets and sets the `OracleParameter` object.

### Overload List:

- [Item\[int\]](#)  
This property gets and sets the `OracleParameter` object at the index specified by the supplied `parameterIndex`.
- [Item\[string\]](#)  
This property gets and sets the `OracleParameter` object using the parameter name specified by the supplied `parameterName`.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Class](#)
- [OracleParameterCollection Members](#)

## Item[int]

This property gets and sets the `OracleParameter` object at the index specified by the supplied `parameterIndex`.

### Declaration

```
// C#  
public object Item[int parameterIndex] {get; set;}
```

### Property Value

An object.

### Implements

`IList`

### Exceptions

`IndexOutOfRangeException` - The supplied index does not exist.

### Remarks

The `OracleParameterCollection` class is a zero-based index.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Class](#)
- [OracleParameterCollection Members](#)

## Item[string]

This property gets and sets the `OracleParameter` object using the parameter name specified by the supplied `parameterName`.

### Declaration

```
// C#  
public OracleParameter Item[string parameterName] {get; set;};
```

### Property Value

An OracleParameter.

### Implements

IDataParameterCollection

### Exceptions

IndexOutOfRangeException - The supplied parameter name does not exist.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Class](#)
- [OracleParameterCollection Members](#)

## IsFixedSize

IsFixedSize gets a value that indicates whether the OracleParameterCollection has a fixed size.

### Declaration

```
// C#  
public override bool IsFixedSize { get; };
```

### Property Value

Returns true if the OracleParameterCollection has a fixed size; otherwise false.

### Implements

IList



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Class](#)
- [OracleParameterCollection Members](#)

## IsReadOnly

IsReadOnly gets a value that indicates whether the OracleParameterCollection is read-only.

### Declaration

```
// C#  
public override bool IsReadOnly { get; };
```

### Property Value

Returns true if the OracleParameterCollection is read only; otherwise false.

### Implements

IList



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Class](#)
- [OracleParameterCollection Members](#)

## IsSynchronized

IsSynchronized gets a value that indicates whether the OracleParameterCollection is synchronized.

### Declaration

```
// C#  
public override bool IsSynchronized { get; };
```

### Property Value

Returns true if the OracleParameterCollection is synchronized; otherwise false.

### Implements

ICollection



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Class](#)
- [OracleParameterCollection Members](#)

## SyncRoot

`SyncRoot` gets an object that can be used to synchronize access to the `OracleParameterCollection`.

### Declaration

```
// C#
public override Object SyncRoot { get; };
```

### Property Value

An object that can be used to synchronize access to the `OracleParameterCollection`.

### Implements

`ICollection`

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Class](#)
- [OracleParameterCollection Members](#)

## OracleParameterCollection Public Methods

`OracleParameterCollection` public methods are listed in [Table 7-138](#).

**Table 7-138 OracleParameterCollection Public Methods**

Public Method	Description
<a href="#">Add</a>	Adds objects to the collection (Overloaded)
<a href="#">AddRange</a>	Adds elements to the end of the <code>OracleParameterCollection</code>
<a href="#">Clear</a>	Removes all the <code>OracleParameter</code> objects from the collection
<a href="#">Contains</a>	Indicates whether or not objects exist in the collection (Overloaded)
<a href="#">CopyTo</a>	Copies <code>OracleParameter</code> objects from the collection, starting with the supplied index to the supplied array
<code>CreateObjRef</code>	Inherited from <code>System.MarshalByRefObject</code>
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)
<a href="#">GetEnumerator</a>	Returns an enumerator that iterates through the <code>OracleParameterCollection</code>
<code>GetHashCode</code>	Inherited from <code>System.Object</code>

Table 7-138 (Cont.) OracleParameterCollection Public Methods

Public Method	Description
GetLifetimeService	Inherited from <code>System.MarshalByRefObject</code>
GetType	Inherited from <code>System.Object</code>
InitializeLifetimeService	Inherited from <code>System.MarshalByRefObject</code>
<a href="#">IndexOf</a>	Returns the <code>index</code> of the objects in the collection (Overloaded)
<a href="#">Insert</a>	Inserts the supplied <code>OracleParameter</code> to the collection at the specified <code>index</code>
<a href="#">Remove</a>	Removes objects from the collection
<a href="#">RemoveAt</a>	Removes objects from the collection by location (Overloaded)
ToString	Inherited from <code>System.Object</code>

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Class](#)
- [OracleParameterCollection Members](#)

## Add

Add adds objects to the collection.

**Overload List:**

- [Add\(object\)](#)  
This method adds the supplied object to the collection.
- [Add\(OracleParameter\)](#)  
This method adds the supplied `OracleParameter` object to the collection.
- [Add\(string, object\)](#)  
This method adds an `OracleParameter` object to the collection using the supplied name and object value.
- [Add\(string, OracleDbType\)](#)  
This method adds an `OracleParameter` object to the collection using the supplied name and database type.
- [Add\(string, OracleDbType, ParameterDirection\)](#)  
This method adds an `OracleParameter` object to the collection using the supplied name, database type, and direction.

- [Add\(string, OracleDbType, object, ParameterDirection\)](#)  
This method adds an `OracleParameter` object to the collection using the supplied name, database type, parameter value, and direction.
- [Add\(string, OracleDbType, int, object, ParameterDirection\)](#)  
This method adds an `OracleParameter` object to the collection using the supplied name, database type, size, parameter value, and direction.
- [Add\(string, OracleDbType, int\)](#)  
This method adds an `OracleParameter` object to the collection using the supplied name, database type, and size.
- [Add \(string, OracleDbType, int, string\)](#)  
This method adds an `OracleParameter` object to the collection using the supplied name, database type, size, and source column.
- [Add\(string, OracleDbType, int, ParameterDirection, bool, byte, byte, string, DataRowVersion, object\)](#)  
This method adds an `OracleParameter` object to the collection using the supplied name, database type, size, direction, null indicator, precision, scale, source column, source version, and parameter value.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Class](#)
- [OracleParameterCollection Members](#)

## Add(object)

This method adds the supplied object to the collection.

### Declaration

```
// C#  
public override int Add(object obj);
```

### Parameters

- *obj*  
The supplied object.

### Return Value

The index at which the new `OracleParameter` is added.

### Implements

`IList`

### Remarks

`InvalidCastException` - The supplied `obj` cannot be cast to an `OracleParameter` object.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Class](#)
- [OracleParameterCollection Members](#)

## Add(OracleParameter)

This method adds the supplied `OracleParameter` object to the collection.

### Declaration

```
// C#  
public OracleParameter Add(OracleParameter paramObj);
```

### Parameters

- `paramObj`  
The supplied `OracleParameter` object.

### Return Value

The newly created `OracleParameter` object which was added to the collection.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Class](#)
- [OracleParameterCollection Members](#)

## Add(string, object)

This method adds an `OracleParameter` object to the collection using the supplied name and object value

### Declaration

```
// C#  
public OracleParameter Add(string name, object val);
```

### Parameters

- *name*  
The parameter name.
- *val*  
The `OracleParameter` value.

### Return Value

The newly created `OracleParameter` object which was added to the collection.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Class](#)
- [OracleParameterCollection Members](#)

## Add(string, OracleDbType)

This method adds an `OracleParameter` object to the collection using the supplied name and database type.

### Declaration

```
// C#  
public OracleParameter Add(string name, OracleDbType dbType);
```

### Parameters

- *name*  
The parameter name.
- *dbType*  
The data type of the `OracleParameter`.

### Return Value

The newly created `OracleParameter` object which was added to the collection.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Class](#)
- [OracleParameterCollection Members](#)

## Add(string, OracleDbType, ParameterDirection)

This method adds an `OracleParameter` object to the collection using the supplied name, database type, and direction.

### Declaration

```
// C#  
public OracleParameter Add(string name, OracleDbType dbType,  
    ParameterDirection direction);
```

### Parameters

- *name*  
The parameter name.
- *dbType*  
The data type of the `OracleParameter`.
- *direction*  
The `OracleParameter` direction.

### Return Value

The newly created `OracleParameter` object which was added to the collection.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Class](#)
- [OracleParameterCollection Members](#)
- ["OracleDbType Enumeration"](#)

## Add(string, OracleDbType, object, ParameterDirection)

This method adds an `OracleParameter` object to the collection using the supplied name, database type, parameter value, and direction.

## Declaration

```
// C#
public OracleParameter Add(string name, OracleDbType dbType, object val,
    ParameterDirection dir);
```

## Parameters

- *name*  
The parameter name.
- *dbType*  
The data type of the OracleParameter.
- *val*  
The OracleParameter value.
- *dir*  
The ParameterDirection value.

## Return Value

The newly created OracleParameter object which was added to the collection.

## Example

```
// C#

using System;
using System.Data;
using Oracle.DataAccess.Client;

class AddSample
{
    static void Main()
    {
        OracleCommand cmd = new OracleCommand();

        // Add parameter to the OracleParameterCollection
        OracleParameter prm = cmd.Parameters.Add(
            "MyParam", OracleDbType.Decimal, 1, ParameterDirection.Input);

        // Prints "cmd.Parameters.Count = 1"
        Console.WriteLine("cmd.Parameters.Count = " + cmd.Parameters.Count);

        prm.Dispose();
        cmd.Dispose();
    }
}
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Class](#)
- [OracleParameterCollection Members](#)
- ["OracleDbType Enumeration"](#)

## Add(string, OracleDbType, int, object, ParameterDirection)

This method adds an `OracleParameter` object to the collection using the supplied name, database type, size, parameter value, and direction.

### Declaration

```
// C#  
public OracleParameter Add(string name, OracleDbType dbType, int size,  
    object val, ParameterDirection dir;
```

### Parameters

- *name*  
The parameter name.
- *dbType*  
The data type of the `OracleParameter`.
- *size*  
The size of `OracleParameter`.
- *val*  
The `OracleParameter` value.
- *dir*  
The `ParameterDirection` value.

### Return Value

The newly created `OracleParameter` object which was added to the collection.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Class](#)
- [OracleParameterCollection Members](#)
- ["OracleDbType Enumeration"](#)

## Add(string, OracleDbType, int)

This method adds an `OracleParameter` object to the collection using the supplied name, database type, and size.

### Declaration

```
// C#  
public OracleParameter Add(string name, OracleDbType dbType, int size);
```

### Parameters

- *name*  
The parameter name.
- *dbType*  
The data type of the `OracleParameter`.
- *size*  
The size of `OracleParameter`.

### Return Value

The newly created `OracleParameter` object which was added to the collection.

### Example

```
// C#  
  
using System;  
using Oracle.DataAccess.Client;  
  
class AddSample  
{  
    static void Main()  
    {  
        OracleCommand cmd = new OracleCommand();  
  
        // Add parameter to the OracleParameterCollection  
        OracleParameter prm = cmd.Parameters.Add(  
            "MyParam", OracleDbType.Varchar2, 10);  
  
        // Prints "cmd.Parameters.Count = 1"  
        Console.WriteLine("cmd.Parameters.Count = " + cmd.Parameters.Count);  
    }  
}
```

```
        prm.Dispose();  
        cmd.Dispose();  
    }  
}
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Class](#)
- [OracleParameterCollection Members](#)

## Add (string, OracleDbType, int, string)

This method adds an `OracleParameter` object to the collection using the supplied name, database type, size, and source column.

### Declaration

```
// C#  
public OracleParameter Add(string name, OracleDbType dbType, int size,  
    string srcColumn);
```

### Parameters

- *name*  
The parameter name.
- *dbType*  
The data type of the `OracleParameter`.
- *size*  
The size of `OracleParameter`.
- *srcColumn*  
The name of the source column.

### Return Value

An `OracleParameter`.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Class](#)
- [OracleParameterCollection Members](#)

## Add(string, OracleDbType, int, ParameterDirection, bool, byte, byte, string, DataRowVersion, object)

This method adds an `OracleParameter` object to the collection using the supplied name, database type, size, direction, null indicator, precision, scale, source column, source version, and parameter value.

### Declaration

```
// C#  
public OracleParameter Add(string name, OracleDbType dbType, int size,  
    ParameterDirection dir, bool isNullable, byte precision,  
    byte scale, string srcColumn, DataRowVersion version, object val);
```

### Parameters

- *name*  
The parameter name.
- *dbType*  
The data type of the `OracleParameter`.
- *size*  
The size of `OracleParameter`.
- *dir*  
The `ParameterDirection` value.
- *isNullable*  
An indicator that specifies if the parameter value can be null.
- *precision*  
The precision of the parameter value.
- *scale*  
The scale of the parameter value.
- *srcColumn*  
The name of the source column.
- *version*  
The `DataRowVersion` value.
- *val*  
The parameter value.

### Return Value

The newly created `OracleParameter` object which was added to the collection.

## Exceptions

`ArgumentException` - The type of supplied `val` does not belong to the type of `Value` property in any of the ODP.NET Types.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Class](#)
- [OracleParameterCollection Members](#)

## AddRange

This method adds elements to the end of the `OracleParameterCollection`.

### Declaration

```
// C#  
public override void AddRange(Array paramArray );
```

### Parameters

`paramArray`

An array of `OracleParameter` objects.

### Exceptions

`ArgumentNullException` - The input parameter is null.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Class](#)
- [OracleParameterCollection Members](#)

## Clear

This method removes all the `OracleParameter` objects from the collection.

### Declaration

```
// C#  
public override void Clear();
```

## Implements

ICollection

## Example

```
// C#

using System;
using Oracle.DataAccess.Client;

class ClearSample
{
    static void Main()
    {
        OracleCommand cmd = new OracleCommand();

        // Add parameter to the OracleParameterCollection
        OracleParameter prm = cmd.Parameters.Add("MyParam", OracleDbType.Decimal);

        // Prints "cmd.Parameters.Count = 1"
        Console.WriteLine("cmd.Parameters.Count = " + cmd.Parameters.Count);

        // Clear all parameters in the OracleParameterCollection
        cmd.Parameters.Clear();

        // Prints "cmd.Parameters.Count = 0"
        Console.WriteLine("cmd.Parameters.Count = " + cmd.Parameters.Count);

        prm.Dispose();
        cmd.Dispose();
    }
}
```

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Class](#)
- [OracleParameterCollection Members](#)

## Contains

`Contains` indicates whether or not the supplied object exists in the collection.

### Overload List:

- [Contains\(object\)](#)  
This method indicates whether or not the supplied object exists in the collection.
- [Contains\(string\)](#)  
This method indicates whether or not an `OracleParameter` object exists in the collection using the supplied string.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Class](#)
- [OracleParameterCollection Members](#)

## Contains(object)

This method indicates whether or not the supplied object exists in the collection.

### Declaration

```
// C#  
public override bool Contains(object obj)
```

### Parameters

- *obj*  
The object.

### Return Value

A `bool` that indicates whether or not the `OracleParameter` specified is inside the collection.

### Implements

`IList`

### Exceptions

`InvalidCastException` - The supplied *obj* is not an `OracleParameter` object.

### Remarks

Returns `true` if the collection contains the `OracleParameter` object; otherwise, returns `false`.

### Example

```
// C#  
  
using System;  
using Oracle.DataAccess.Client;  
  
class ContainsSample  
{  
    static void Main()  
    {  
        OracleCommand cmd = new OracleCommand();  
  
        // Add parameter to the OracleParameterCollection  
        OracleParameter prm1 = cmd.Parameters.Add("MyParam", OracleDbType.Decimal);
```

```
// Check if the OracleParameterCollection contains prm1
bool bContains = cmd.Parameters.Contains(prm1);

// Prints "bContains = True"
Console.WriteLine("bContains = " + bContains);

OracleParameter prm2 = new OracleParameter();

// Check if the OracleParameterCollection contains prm2
bContains = cmd.Parameters.Contains(prm2);

// Prints "bContains = False"
Console.WriteLine("bContains = " + bContains);

prm1.Dispose();
prm2.Dispose();
cmd.Dispose();
}
}
```



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Class](#)
- [OracleParameterCollection Members](#)

## Contains(string)

This method indicates whether or not an `OracleParameter` object exists in the collection using the supplied string.

### Declaration

```
// C#
public override bool Contains(string name);
```

### Parameters

- *name*

The name of `OracleParameter` object.

### Return Value

Returns `true` if the collection contains the `OracleParameter` object with the specified parameter name; otherwise, returns `false`.

### Implements

`IDataParameterCollection`

## Example

```
// C#

using System;
using Oracle.DataAccess.Client;

class ContainsSample
{
    static void Main()
    {
        OracleCommand cmd = new OracleCommand();

        // Add parameter to the OracleParameterCollection
        OracleParameter prm = cmd.Parameters.Add("MyParam", OracleDbType.Decimal);

        // Check if the OracleParameterCollection contains "MyParam"
        bool bContains = cmd.Parameters.Contains("MyParam");

        // Prints "bContains = True"
        Console.WriteLine("bContains = " + bContains);

        // Check if the OracleParameterCollection contains "NoParam"
        bContains = cmd.Parameters.Contains("NoParam");

        // Prints "bContains = False"
        Console.WriteLine("bContains = " + bContains);

        prm.Dispose();
        cmd.Dispose();
    }
}
```

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Class](#)
- [OracleParameterCollection Members](#)

## CopyTo

This method copies `OracleParameter` objects from the collection, starting with the supplied index to the supplied array.

### Declaration

```
// C#
public override void CopyTo(Array array, int index);
```

### Parameters

- `array`

The specified array.

- *index*

The array index.

### Implements

ICollection

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Class](#)
- [OracleParameterCollection Members](#)

## GetEnumerator

`GetEnumerator` returns an enumerator that iterates through the `OracleParameterCollection`.

### Declaration

```
// C#  
public override IEnumerator GetEnumerator();
```

### Implements

IEnumerable

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Class](#)
- [OracleParameterCollection Members](#)

## IndexOf

`IndexOf` returns the index of the `OracleParameter` object in the collection.

### Overload List:

- [IndexOf\(object\)](#)  
This method returns the index of the `OracleParameter` object in the collection.
- [IndexOf\(String\)](#)

This method returns the `index` of the `OracleParameter` object with the specified name in the collection.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Class](#)
- [OracleParameterCollection Members](#)

## IndexOf(object)

This method returns the `index` of the `OracleParameter` object in the collection.

### Declaration

```
// C#  
public override int IndexOf(object obj);
```

### Parameters

- *obj*  
The specified object.

### Return Value

Returns the `index` of the `OracleParameter` object in the collection.

### Implements

`IList`

### Exceptions

`InvalidCastException` - The supplied *obj* cannot be cast to an `OracleParameter` object.

### Remarks

Returns the `index` of the supplied `OracleParameter` *obj* in the collection.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Class](#)
- [OracleParameterCollection Members](#)

## IndexOf(String)

This method returns the `index` of the `OracleParameter` object with the specified name in the collection.

### Declaration

```
// C#  
public override int IndexOf(String name);
```

### Parameters

- `name`  
The name of parameter.

### Return Value

Returns the `index` of the supplied `OracleParameter` in the collection.

### Implements

`IDataParameterCollection`

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Class](#)
- [OracleParameterCollection Members](#)

## Insert

This method inserts the supplied `OracleParameter` object to the collection at the specified `index`.

### Declaration

```
// C#  
public override void Insert(int index, object obj);
```

### Parameters

- `index`  
The specified index.
- `obj`  
The `OracleParameter` object.

### Implements

`IList`

## Remarks

An `InvalidCastException` is thrown if the supplied `obj` cannot be cast to an `OracleParameter` object.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Class](#)
- [OracleParameterCollection Members](#)

## Remove

This method removes the supplied `OracleParameter` from the collection.

### Declaration

```
// C#  
public override void Remove(object obj);
```

### Parameters

- `obj`  
The specified object to remove.

### Implements

`IList`

### Exceptions

`InvalidCastException` - The supplied `obj` cannot be cast to an `OracleParameter` object.

### Example

```
// C#  
  
using System;  
using Oracle.DataAccess.Client;  
  
class RemoveSample  
{  
    static void Main()  
    {  
        OracleCommand cmd = new OracleCommand();  
  
        // Add 2 parameters to the OracleParameterCollection  
        OracleParameter prm1 = cmd.Parameters.Add("MyParam1", OracleDbType.Decimal);  
        OracleParameter prm2 = cmd.Parameters.Add("MyParam2", OracleDbType.Decimal);  
  
        // Prints "cmd.Parameters.Count = 2"  
    }  
}
```

```
Console.WriteLine("cmd.Parameters.Count = " + cmd.Parameters.Count);

// Remove the 1st parameter from the OracleParameterCollection
cmd.Parameters.Remove(prm1);

// Prints "cmd.Parameters.Count = 1"
Console.WriteLine("cmd.Parameters.Count = " + cmd.Parameters.Count);

// Prints "cmd.Parameters[0].ParameterName = MyParam2"
Console.WriteLine("cmd.Parameters[0].ParameterName = " +
    cmd.Parameters[0].ParameterName);

prm1.Dispose();
prm2.Dispose();
cmd.Dispose();
}
}
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Class](#)
- [OracleParameterCollection Members](#)

## RemoveAt

`RemoveAt` removes the `OracleParameter` object from the collection by location.

### Overload List:

- [RemoveAt\(int\)](#)  
This method removes from the collection the `OracleParameter` object located at the index specified by the supplied index.
- [RemoveAt\(String\)](#)  
This method removes from the collection the `OracleParameter` object specified by the supplied name.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Class](#)
- [OracleParameterCollection Members](#)

## RemoveAt(int)

This method removes from the collection the `OracleParameter` object located at the index specified by the supplied index.

### Declaration

```
// C#  
public override void RemoveAt(int index);
```

### Parameters

- *index*

The specified index from which the `OracleParameter` is to be removed.

### Implements

`IList`



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Class](#)
- [OracleParameterCollection Members](#)

## RemoveAt(String)

This method removes from the collection the `OracleParameter` object specified by the supplied name.

### Declaration

```
// C#  
public override void RemoveAt(String name);
```

### Parameters

- *name*

The name of the `OracleParameter` object to be removed from the collection.

### Implements

`IDataParameterCollection`

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleParameterCollection Class](#)
- [OracleParameterCollection Members](#)

## OraclePermission Class

An `OraclePermission` object enables ODP.NET to enforce imperative security and helps ensure that a user has a security level adequate for accessing data.

### Class Inheritance

```
System.Object
    System.Security.CodeAccessPermission
        System.Data.Common.DBDataPermission
            Oracle.DataAccess.Client.OraclePermission
```

### Declaration

```
// C#
public class OraclePermission: DBDataPermission
```

### Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver
<b>Assembly</b>	<code>Oracle.DataAccess.dll</code>	<code>Oracle.ManagedDataAccess.dll</code>
<b>Namespace</b>	<code>Oracle.DataAccess.Client</code>	<code>Oracle.ManagedDataAccess.Client</code>
<b>.NET Framework</b>	4.8	4.8

### Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OraclePermission Members](#)
- [OraclePermission Constructor](#)
- [OraclePermission Static Methods](#)
- [OraclePermission Public Properties](#)
- [OraclePermission Public Methods](#)

## OraclePermission Members

`OraclePermission` members are listed in the following tables.

### OraclePermission Constructors

The `OraclePermission` constructor is listed in [Table 7-139](#).

**Table 7-139 OraclePermission Constructor**

Constructor	Description
<a href="#">OraclePermission Constructor</a>	Instantiates a new instance of the <code>OraclePermission</code> class.

### OraclePermission Static Methods

The `OraclePermission` static methods are listed in [Table 7-140](#).

**Table 7-140 OraclePermission Static Methods**

Static Method	Description
<code>Equals</code>	Inherited from <code>System.Object</code>
<code>ReferenceEquals</code>	Inherited from <code>System.Object</code>
<code>RevertAll</code>	Inherited from <code>CodeAccessPermission</code>
<code>RevertAssert</code>	Inherited from <code>CodeAccessPermission</code>
<code>RevertDeny</code>	Inherited from <code>CodeAccessPermission</code>
<code>RevertPermitOnly</code>	Inherited from <code>CodeAccessPermission</code>

### OraclePermission Public Properties

The `OraclePermission` public methods are listed in [Table 7-144](#).

**Table 7-141 OraclePermission Public Properties**

Public Properties	Description
AllowBlankPassword	Inherited from <code>DBDataPermission</code> OraclePermission does not support this property.

**OraclePermission Public Methods**

The `OraclePermission` public methods are listed in [Table 7-142](#).

**Table 7-142 OraclePermission Public Methods**

Public Method	Description
<a href="#">Add</a>	Adds a new connection string fragment and a list of restricted keywords to the <code>OraclePermission</code> object
Assert	Inherited from <code>CodeAccessPermission</code>
<a href="#">Copy</a>	Returns a copy of the current permission object
Demand	Inherited from <code>CodeAccessPermission</code>
Deny	Inherited from <code>CodeAccessPermission</code>
Equals	Inherited from <code>CodeAccessPermission</code>
FromXml	Inherited from <code>DBDataPermission</code>
GetHashCode	Inherited from <code>CodeAccessPermission</code>
GetType	Inherited from <code>System.Object</code>
Intersect	Inherited from <code>DBDataPermission</code>
<a href="#">IsSubsetOf</a>	Returns a boolean value that indicates whether or not the current permission is a subset of the target permission
IsUnrestricted	Inherited from <code>DBDataPermission</code>
PermitOnly	Inherited from <code>CodeAccessPermission</code>
ToString	Inherited from <code>CodeAccessPermission</code>
ToXml	Inherited from <code>DBDataPermission</code>
Union	Inherited from <code>DBDataPermission</code>

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OraclePermission Class](#)

## OraclePermission Constructor

The `OraclePermission` constructor instantiates a new instance of the `OraclePermission` class.

### Declaration

```
// C#  
public OraclePermission (PermissionState state);
```

### Parameters

- `state`

The `state` parameter takes one of the following two values: `PermissionState.None` OR `PermissionState.Unrestricted`.

### Exceptions

`ArgumentException` - The `PermissionState` value is invalid.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OraclePermission Class](#)
- [OraclePermission Members](#)

## OraclePermission Static Methods

The `OraclePermission` static methods are listed in [Table 7-143](#).

**Table 7-143 OraclePermission Static Methods**

Static Method	Description
<code>Equals</code>	Inherited from <code>System.Object</code>
<code>ReferenceEquals</code>	Inherited from <code>System.Object</code>
<code>RevertAll</code>	Inherited from <code>CodeAccessPermission</code>
<code>RevertAssert</code>	Inherited from <code>CodeAccessPermission</code>
<code>RevertDeny</code>	Inherited from <code>CodeAccessPermission</code>
<code>RevertPermitOnly</code>	Inherited from <code>CodeAccessPermission</code>

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OraclePermission Class](#)
- [OraclePermission Members](#)

## OraclePermission Public Properties

The `OraclePermission` public methods are listed in [Table 7-144](#).

**Table 7-144 OraclePermission Public Properties**

Public Properties	Description
<code>AllowBlankPassword</code>	Inherited from <code>DBDataPermission</code> <code>OraclePermission</code> ignores the value of this property. Any value set for this property, for an <code>OraclePermission</code> object, is ignored.

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OraclePermission Class](#)
- [OraclePermission Members](#)

## OraclePermission Public Methods

The `OraclePermission` public methods are listed in [Table 7-145](#).

**Table 7-145 OraclePermission Public Methods**

Public Method	Description
<a href="#">Add</a>	Adds a new connection string fragment and a list of restricted keywords to the <code>OraclePermission</code> object
<code>Assert</code>	Inherited from <code>CodeAccessPermission</code>
<a href="#">Copy</a>	Returns a copy of the current permission object
<code>Demand</code>	Inherited from <code>CodeAccessPermission</code>
<code>Deny</code>	Inherited from <code>CodeAccessPermission</code>
<code>Equals</code>	Inherited from <code>CodeAccessPermission</code>
<code>FromXml</code>	Inherited from <code>DBDataPermission</code>

Table 7-145 (Cont.) OraclePermission Public Methods

Public Method	Description
GetHashCode	Inherited from <code>CodeAccessPermission</code>
GetType	Inherited from <code>System.Object</code>
Intersect	Inherited from <code>DBDataPermission</code>
<a href="#">IsSubsetOf</a>	Returns a boolean value that indicates whether or not the current permission is a subset of the target permission
IsUnrestricted	Inherited from <code>DBDataPermission</code>
PermitOnly	Inherited from <code>CodeAccessPermission</code>
ToString	Inherited from <code>CodeAccessPermission</code>
ToXml	Inherited from <code>DBDataPermission</code>
Union	Inherited from <code>DBDataPermission</code>

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OraclePermission Class](#)
- [OraclePermission Members](#)

## Add

This method adds a new connection string fragment and a list of restricted keywords to the `OraclePermission` object.

### Declaration

```
// C#
public void Add(string connStr, string keyRestrict,
    KeyRestrictionBehavior behavior);
```

### Parameters

- `connStr`  
The connection string fragment.
- `keyRestrict`  
The key restrictions.
- `behavior`  
One of the following `KeyRestrictionBehavior` enumerations:
  - `AllowOnly`

- PreventUsage

### Exceptions

`ArgumentException` - The `KeyRestrictionBehavior` value or the format of the `connStr` or `keyRestrict` string is invalid.

### Remarks

The `Add` method configures the connection strings allowed or disallowed by the permission object.

Opening an `OracleConnection` is allowed or denied based upon the connection string fragment, key restrictions combination, and the key restriction behavior.

In the following example, `KeyRestrictionBehavior.AllowOnly` allows connection strings that use `orcl` as the `Data Source` with any `User Id` and `Password` combination but no other connection string keywords. Connection string keywords other than `User Id` and `Password` cause security exceptions.

```
orclPermission.Add("Data Source=orcl;", "User Id=;Password=;",  
    KeyRestrictionBehavior.AllowOnly);
```

In the next example, `KeyRestrictionBehavior.PreventUsage` restricts connection strings that use the keyword `Pooling`. Use of the `Pooling` keyword causes an exception.

```
orclPermission.Add("Data Source=orcl;", "Pooling=;",  
    KeyRestrictionBehavior.PreventUsage)
```

As a general rule, in an unrestricted environment, any connection string that is not allowed is restricted and throws a security exception.

If a connection string fragment contains key-value pairs for the `password` and `proxy password` attributes, then values for these attributes are ignored. However, the presence of the attributes themselves is still checked. This means that the connection is allowed only if the `password` and `proxy attributes` keywords are allowed in the connection string.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OraclePermission Class](#)
- [OraclePermission Members](#)

## Copy

This method returns a copy of the current permission object.

### Declaration

```
// C#  
public override IPermission Copy();
```

### Return Value

A copy of the `OraclePermission` object.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OraclePermission Class](#)
- [OraclePermission Members](#)

## IsSubsetOf

This method returns a boolean value that indicates whether or not the current permission is a subset of the target permission.

### Declaration

```
// C#  
public override bool IsSubsetOf(IPermission target);
```

### Parameters

- *target*  
A permission that must be of type `OraclePermission`.

### Return Value

A `bool` value that indicates whether or not the current permission is a subset of the target permission.

### Exceptions

`ArgumentException` - The permission is not of the `OraclePermission` type.

### Remarks

The `AllowBlankPassword` property is ignored when evaluating whether or not the current permission is a subset of the target permission.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OraclePermission Class](#)
- [OraclePermission Members](#)

# OraclePermissionAttribute Class

An `OraclePermissionAttribute` object enables ODP.NET to enforce declarative security and helps ensure that a user has a security level adequate for accessing data.

## Class Inheritance

```
System.Object
  System.Attribute
    System.Security.Permissions.SecurityAttribute
      System.Security.Permissions.CodeAccessSecurityAttribute
        System.Data.Common.DBDataPermissionAttribute
          Oracle.DataAccess.Client.OraclePermissionAttribute
```

## Declaration

```
// C#
[Serializable, AttributeUsage(AttributeTargets.Method |
AttributeTargets.Constructor | AttributeTargets.Class | AttributeTargets.Struct |
AttributeTargets.Assembly, AllowMultiple = true, Inherited = false)]
public sealed class OraclePermissionAttribute: DBDataPermissionAttribute
```

## Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8

## Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OraclePermissionAttribute Members](#)
- [OraclePermissionAttribute Constructor](#)
- [OraclePermissionAttribute Static Methods](#)
- [OraclePermissionAttribute Public Properties](#)
- [OraclePermissionAttribute Public Methods](#)

## OraclePermissionAttribute Members

OraclePermissionAttribute members are listed in the following tables.

### OraclePermissionAttribute Constructor

The OraclePermissionAttribute constructor is listed in [Table 7-146](#).

**Table 7-146 OraclePermission Constructor**

Constructor	Description
<a href="#">OraclePermissionAttribute Constructor</a>	Instantiates a new instance of the OraclePermissionAttribute class.

### OraclePermissionAttribute Static Methods

The OraclePermissionAttribute static methods are listed in [Table 7-147](#).

**Table 7-147 OraclePermissionAttribute Static Methods**

Static Methods	Description
GetCustomAttribute	Inherited from System.Attribute (Overloaded)
GetCustomAttributes	Inherited from System.Attribute(Overloaded)
IsDefined	Inherited from System.Attribute(Overloaded)
ReferenceEquals	Inherited from System.Object

### OraclePermissionAttribute Public Properties

The OraclePermissionAttribute public properties are listed in [Table 7-148](#).

**Table 7-148 OraclePermissionAttribute Public Properties**

Public Properties	Description
Action	Inherited from SecurityAttribute
AllowBlankPassword	Inherited from DBDataPermissionAttribute. OraclePermissionAttribute ignores this property. Any value set for this property, for an OraclePermissionAttribute object, is ignored.
ConnectionString	Inherited from DBDataPermissionAttribute
KeyRestrictionBehavior	Inherited from DBDataPermissionAttribute
KeyRestrictions	Inherited from DBDataPermissionAttribute
TypeId	Inherited from System.Attribute
Unrestricted	Inherited from SecurityAttribute

### OraclePermissionAttribute Public Methods

The OraclePermissionAttribute public methods are listed in [Table 7-149](#).

**Table 7-149 OraclePermissionAttribute Public Methods**

Public Methods	Description
<a href="#">CreatePermission</a>	Returns a new <code>OraclePermissionAttribute</code> object that is configured based on the attributes set
<code>Equals</code>	Inherited from <code>System.Attribute</code>
<code>GetHashCode</code>	Inherited from <code>System.Attribute</code>
<code>GetType</code>	Inherited from <code>System.Attribute</code>
<code>IsDefaultAttribute</code>	Inherited from <code>System.Attribute</code>
<code>Match</code>	Inherited from <code>System.Attribute</code>
<code>ShouldSerializeConnectionString</code>	Inherited from <code>DBDataPermissionAttribute</code>
<code>ShouldSerializeKeyRestrictions</code>	Inherited from <code>DBDataPermissionAttribute</code>
<code>ToString</code>	Inherited from <code>System.Object</code>

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OraclePermissionAttribute Class](#)

## OraclePermissionAttribute Constructor

The `OraclePermissionAttribute` constructor instantiates new instances of the `OraclePermissionAttribute` class.

### Declaration

```
// C#  
public OraclePermissionAttribute (SecurityAction action);
```

### Parameters

- `action`

A `System.Security.Permissions.SecurityAction` value representing an action that can be performed using declarative security.

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OraclePermissionAttribute Class](#)
- [OraclePermissionAttribute Members](#)

## OraclePermissionAttribute Static Methods

The `OraclePermissionAttribute` static methods are listed in [Table 7-150](#).

**Table 7-150 OraclePermissionAttribute Static Methods**

Static Methods	Description
<code>GetCustomAttribute</code>	Inherited from <code>System.Attribute (Overloaded)</code>
<code>GetCustomAttributes</code>	Inherited from <code>System.Attribute(Overloaded)</code>
<code>IsDefined</code>	Inherited from <code>System.Attribute(Overloaded)</code>
<code>ReferenceEquals</code>	Inherited from <code>System.Object</code>

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OraclePermissionAttribute Class](#)
- [OraclePermissionAttribute Members](#)

## OraclePermissionAttribute Public Properties

The `OraclePermissionAttribute` public properties are listed in [Table 7-151](#).

**Table 7-151 OraclePermissionAttribute Public Properties**

Public Properties	Description
<code>Action</code>	Inherited from <code>SecurityAttribute</code>
<code>AllowBlankPassword</code>	Inherited from <code>DBDataPermissionAttribute</code> . <code>OraclePermissionAttribute</code> ignores this property. Any value set for this property, for an <code>OraclePermissionAttribute</code> object, is ignored.
<code>ConnectionString</code>	Inherited from <code>DBDataPermissionAttribute</code>
<code>KeyRestrictionBehavior</code>	Inherited from <code>DBDataPermissionAttribute</code>

**Table 7-151 (Cont.) OraclePermissionAttribute Public Properties**

Public Properties	Description
KeyRestrictions	Inherited from DBDataPermissionAttribute
TypeId	Inherited from System.Attribute
Unrestricted	Inherited from SecurityAttribute

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OraclePermissionAttribute Class](#)
- [OraclePermissionAttribute Members](#)

## OraclePermissionAttribute Public Methods

The `OraclePermissionAttribute` public methods are listed in [Table 7-152](#).

**Table 7-152 OraclePermissionAttribute Public Methods**

Public Methods	Description
<a href="#">CreatePermission</a>	Returns a new <code>OraclePermissionAttribute</code> object that is configured based on the attributes set
Equals	Inherited from System.Attribute
GetHashCode	Inherited from System.Attribute
GetType	Inherited from System.Attribute
IsDefaultAttribute	Inherited from System.Attribute
Match	Inherited from System.Attribute
ShouldSerializeConnectionString	Inherited from DBDataPermissionAttribute
ShouldSerializeKeyRestrictions	Inherited from DBDataPermissionAttribute
ToString	Inherited from System.Object

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OraclePermissionAttribute Class](#)
- [OraclePermissionAttribute Members](#)

## CreatePermission

This method returns a new `OraclePermissionAttribute` object that is configured based on the attributes set.

### Declaration

```
// C#
public override IPermission CreatePermission();
```

### Return Value

An `OraclePermission` object.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OraclePermissionAttribute Class](#)
- [OraclePermissionAttribute Members](#)

## OracleRefreshAccessTokenEventArgs Class

The `OracleRefreshAccessTokenEventArgs` class provides a way for the application to return the refreshed signature token. When the token is about to expire, the callback registered using `RefreshAccessToken` event is triggered along with the `OracleRefreshAccessTokenEventArgs` object. The application is expected to provide the refreshed token with a new expiration within this object.

### Class Inheritance

`System.Object`

`System.EventArgs`

`Oracle.DataAccess.Client.OracleRefreshAccessTokenEventArgs`

### Declaration

```
// C#
public sealed class OracleRefreshAccessTokenEventArgs
```

### Requirements

Provider	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	<code>Oracle.ManagedDataAccess.dll</code>	<code>Oracle.ManagedDataAccess.dll</code>
<b>Namespace</b>	<code>Oracle.ManagedDataAccess.Client</code>	<code>Oracle.ManagedDataAccess.Client</code>

Provider	ODP.NET, Managed Driver	ODP.NET Core
.NET Framework	4.8	-
.NET (Core)	-	See <a href="#">System Requirements</a>

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleRefreshAccessTokenEventArgs Members](#)
- [OracleRefreshAccessTokenEventArgs Properties](#)

## OracleRefreshAccessTokenEventArgs Members

OracleRefreshAccessTokenEventArgs members are listed in the following tables.

### OracleRefreshAccessTokenEventArgs Properties

OracleRefreshAccessTokenEventArgs properties are listed in [Table 7-170](#).

**Table 7-153 OracleRefreshAccessTokenEventArgs Properties**

Property	Description
<a href="#">DbToken</a>	Sets the new/refreshed signature token in this object
<a href="#">PrivateKey</a>	Sets the refreshed private key in this object
<a href="#">Token</a>	Sets the new or refreshed access token in this object.

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleRefreshAccessTokenEventArgs Class](#)

## OracleRefreshAccessTokenEventArgs Properties

The OracleRefreshAccessTokenEventArgs properties are listed in [Table 7-160](#).

**Table 7-154 OracleRefreshAccessTokenEventArgs Properties**

Property	Description
<a href="#">DbToken</a>	Sets the new/refreshed signature token in this object
<a href="#">PrivateKey</a>	Sets the refreshed private key in this object

Table 7-154 (Cont.) OracleRefreshAccessTokenEventArgs Properties

Property	Description
<a href="#">Token</a>	Sets the new or refreshed access token in this object.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleRefreshAccessTokenEventArgs Class](#)
- [OracleRefreshAccessTokenEventArgs Members](#)

## DbToken

This property sets the new/refreshed signature token in this object.

### Declaration

```
// C#  
public char[] DbToken { set; }
```

### Description

The `char[]` used to set the value of this property will be cleared by ODP.NET. Applications should not depend on this `char[]` once this property is called.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleRefreshAccessTokenEventArgs Class](#)
- [OracleRefreshAccessTokenEventArgs Members](#)

## PrivateKey

This property sets the refreshed private key in this object.

### Declaration

```
// C#  
public char[] PrivateKey { set; }
```

### Description

The `char[]` used to set the value of this property will be cleared by ODP.NET. Applications should not depend on this `char[]` once this property is called.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleRefreshAccessTokenEventArgs Class](#)
- [OracleRefreshAccessTokenEventArgs Members](#)

## Token

This property sets the new or refreshed access token in this object.

### Declaration

```
// C#  
public char[] Token { set; }
```

### Description

This property can hold an access token.

The `char[]` used to set the value of this property will be cleared by ODP.NET for security reasons. The application should not depend on this `char[]` once this property is called.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleRefreshAccessTokenEventArgs Class](#)
- [OracleRefreshAccessTokenEventArgs Members](#)

## OracleRowUpdatedEventArgs Class

The `OracleRowUpdatedEventArgs` class provides event data for the `OracleDataAdapter.RowUpdated` event.

### Class Inheritance

```
System.Object  
  
    System.EventArgs  
  
        System.RowUpdatedEventArgs  
  
            System.OracleRowUpdatedEventArgs
```

### Declaration

```
// C#  
public sealed class OracleRowUpdatedEventArgs : RowUpdatedEventArgs
```

## Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

## Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

## Example

The example for the `RowUpdated` event shows how to use `OracleRowUpdatedEventArgs`. See [RowUpdated event "Example"](#).

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleRowUpdatedEventArgs Members](#)
- [OracleRowUpdatedEventArgs Constructor](#)
- [OracleRowUpdatedEventArgs Static Methods](#)
- [OracleRowUpdatedEventArgs Properties](#)
- [OracleRowUpdatedEventArgs Public Methods](#)
- [OracleDataAdapter Class](#)

## OracleRowUpdatedEventArgs Members

`OracleRowUpdatedEventArgs` members are listed in the following tables.

### OracleRowUpdatedEventArgs Constructors

`OracleRowUpdatedEventArgs` constructors are listed in [Table 7-155](#).

**Table 7-155 OracleRowUpdatedEventArgs Constructors**

Constructor	Description
<a href="#">OracleRowUpdatedEventArgs Constructor</a>	Instantiates a new instance of OracleRowUpdatedEventArgs class

**OracleRowUpdatedEventArgs Static Methods**

The OracleRowUpdatedEventArgs static method is listed in [Table 7-156](#).

**Table 7-156 OracleRowUpdatedEventArgs Static Method**

Method	Description
Equals	Inherited from System.Object (Overloaded)

**OracleRowUpdatedEventArgs Properties**

The OracleRowUpdatedEventArgs properties are listed in [Table 7-157](#).

**Table 7-157 OracleRowUpdatedEventArgs Properties**

Property	Description
<a href="#">Command</a>	Specifies the OracleCommand that is used when OracleDataAdapter.Update() is called
Errors	Inherited from System.Data.Common.RowUpdatedEventArgs
RecordsAffected	Inherited from System.Data.Common.RowUpdatedEventArgs
Row	Inherited from System.Data.Common.RowUpdatedEventArgs
StatementType	Inherited from System.Data.Common.RowUpdatedEventArgs
Status	Inherited from System.Data.Common.RowUpdatedEventArgs
TableMapping	Inherited from System.Data.Common.RowUpdatedEventArgs

**OracleRowUpdatedEventArgs Public Methods**

The OracleRowUpdatedEventArgs properties are listed in [Table 7-158](#).

**Table 7-158 OracleRowUpdatedEventArgs Public Methods**

Public Method	Description
Equals	Inherited from System.Object (Overloaded)
GetHashCode	Inherited from System.Object
GetType	Inherited from System.Object

Table 7-158 (Cont.) OracleRowUpdatedEventArgs Public Methods

Public Method	Description
ToString	Inherited from System.Object

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleRowUpdatedEventArgs Class](#)

## OracleRowUpdatedEventArgs Constructor

The `OracleRowUpdatedEventArgs` constructor creates a new `OracleRowUpdatedEventArgs` instance.

### Declaration

```
// C#  
public OracleRowUpdatedEventArgs(DataRow row, IDbCommand command,  
    StatementType statementType, DataTableMapping tableMapping);
```

### Parameters

- *row*  
The `DataRow` sent for Update.
- *command*  
The `IDbCommand` executed during the Update.
- *statementType*  
The `StatementType` Enumeration value indicating the type of SQL statement executed.
- *tableMapping*  
The `DataTableMapping` used for the Update.

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleRowUpdatedEventArgs Class](#)
- [OracleRowUpdatedEventArgs Members](#)

## OracleRowUpdatedEventArgs Static Methods

The `OracleRowUpdatedEventArgs` static method is listed in [Table 7-159](#).

**Table 7-159 OracleRowUpdatedEventArgs Static Method**

Method	Description
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleRowUpdatedEventArgs Class](#)
- [OracleRowUpdatedEventArgs Members](#)

## OracleRowUpdatedEventArgs Properties

The `OracleRowUpdatedEventArgs` properties are listed in [Table 7-160](#).

**Table 7-160 OracleRowUpdatedEventArgs Properties**

Property	Description
<a href="#">Command</a>	Specifies the <code>OracleCommand</code> that is used when <code>OracleDataAdapter.Update()</code> is called
<code>Errors</code>	Inherited from <code>System.Data.Common.RowUpdatedEventArgs</code>
<code>RecordsAffected</code>	Inherited from <code>System.Data.Common.RowUpdatedEventArgs</code>
<code>Row</code>	Inherited from <code>System.Data.Common.RowUpdatedEventArgs</code>
<code>StatementType</code>	Inherited from <code>System.Data.Common.RowUpdatedEventArgs</code>
<code>Status</code>	Inherited from <code>System.Data.Common.RowUpdatedEventArgs</code>
<code>TableMapping</code>	Inherited from <code>System.Data.Common.RowUpdatedEventArgs</code>

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleRowUpdatedEventArgs Class](#)
- [OracleRowUpdatedEventArgs Members](#)

## Command

This property specifies the `OracleCommand` that is used when `OracleDataAdapter.Update()` is called.

### Declaration

```
// C#  
public new OracleCommand Command {get;}
```

### Property Value

The `OracleCommand` executed when `Update` is called.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleRowUpdatedEventArgs Class](#)
- [OracleRowUpdatedEventArgs Members](#)

## OracleRowUpdatedEventArgs Public Methods

The `OracleRowUpdatedEventArgs` properties are listed in [Table 7-161](#).

**Table 7-161 OracleRowUpdatedEventArgs Public Methods**

Public Method	Description
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)
<code>GetHashCode</code>	Inherited from <code>System.Object</code>
<code>GetType</code>	Inherited from <code>System.Object</code>
<code>ToString</code>	Inherited from <code>System.Object</code>

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleRowUpdatedEventArgs Class](#)
- [OracleRowUpdatedEventArgs Members](#)

# OracleRowUpdatedEventHandler Delegate

The `OracleRowUpdatedEventHandler` delegate represents the signature of the method that handles the `OracleDataAdapter.RowUpdated` event.

## Declaration

```
// C#  
public delegate void OracleRowUpdatedEventHandler(object sender,  
    OracleRowUpdatedEventArgs eventArgs);
```

## Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

## Parameters

- sender*  
The source of the event.
- eventArgs*  
The `OracleRowUpdatedEventArgs` object that contains the event data.

## Remarks

Event callbacks can be registered through this event delegate for applications that wish to be notified after a row is updated.

In the .NET framework, the convention of an event delegate requires two parameters: the object that raises the event and the event data.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- ["RowUpdated"](#)

# OracleRowUpdatingEventArgs Class

The `OracleRowUpdatingEventArgs` class provides event data for the `OracleDataAdapter.RowUpdating` event.

## Class Inheritance

`System.Object`

`System.EventArgs`

`System.RowUpdatingEventArgs`

`System.OracleRowUpdatingEventArgs`

## Declaration

```
// C#
public sealed class OracleRowUpdatingEventArgs : RowUpdatingEventArgs
```

## Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	<code>Oracle.DataAccess.dll</code>	<code>Oracle.ManagedDataAccess.dll</code>	<code>Oracle.ManagedDataAccess.dll</code>
<b>Namespace</b>	<code>Oracle.DataAccess.Client</code>	<code>Oracle.ManagedDataAccess.Client</code>	<code>Oracle.ManagedDataAccess.Client</code>
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

## Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

## Example

The example for the `RowUpdated` event shows how to use `OracleRowUpdatingEventArgs`. See `RowUpdated` event "[Example](#)".

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleRowUpdatingEventArgs Members](#)
- [OracleRowUpdatingEventArgs Constructor](#)
- [OracleRowUpdatingEventArgs Static Methods](#)
- [OracleRowUpdatingEventArgs Properties](#)
- [OracleRowUpdatingEventArgs Public Methods](#)
- ["OracleDataAdapter Class "](#)

## OracleRowUpdatingEventArgs Members

OracleRowUpdatingEventArgs members are listed in the following tables.

### OracleRowUpdatingEventArgs Constructors

OracleRowUpdatingEventArgs constructors are listed in [Table 7-162](#).

**Table 7-162 OracleRowUpdatingEventArgs Constructors**

Constructor	Description
<a href="#">OracleRowUpdatingEventArgs Constructor</a>	Instantiates a new instance of OracleRowUpdatingEventArgs class (Overloaded)

### OracleRowUpdatingEventArgs Static Methods

The OracleRowUpdatingEventArgs static methods are listed in [Table 7-163](#).

**Table 7-163 OracleRowUpdatingEventArgs Static Methods**

Method	Description
Equals	Inherited from System.Object (Overloaded)

### OracleRowUpdatingEventArgs Properties

The OracleRowUpdatingEventArgs properties are listed in [Table 7-164](#).

**Table 7-164 OracleRowUpdatingEventArgs Properties**

Property	Description
<a href="#">Command</a>	Specifies the OracleCommand that is used when the OracleDataAdapter.Update() is called
Errors	Inherited from System.Data.Common.RowUpdatingEventArgs

**Table 7-164 (Cont.) OracleRowUpdatingEventArgs Properties**

Property	Description
Row	Inherited from System.Data.Common.RowUpdatingEventArgs
StatementType	Inherited from System.Data.Common.RowUpdatingEventArgs
Status	Inherited from System.Data.Common.RowUpdatingEventArgs
TableMapping	Inherited from System.Data.Common.RowUpdatingEventArgs

**OracleRowUpdatingEventArgs Public Methods**

The `OracleRowUpdatingEventArgs` public methods are listed in [Table 7-165](#).

**Table 7-165 OracleRowUpdatingEventArgs Public Methods**

Public Method	Description
Equals	Inherited from System.Object (Overloaded)
GetHashCode	Inherited from System.Object
GetType	Inherited from System.Object
ToString	Inherited from System.Object

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleRowUpdatingEventArgs Class](#)

## OracleRowUpdatingEventArgs Constructor

The `OracleRowUpdatingEventArgs` constructor creates a new instance of the `OracleRowUpdatingEventArgs` class using the supplied data row, `IDbCommand`, type of SQL statement, and table mapping.

**Declaration**

```
// C#
public OracleRowUpdatingEventArgs(DataRow row, IDbCommand command,
    StatementType statementType, DataTableMapping tableMapping);
```

**Parameters**

- *row*  
The `DataRow` sent for Update.

- *command*  
The IDbCommand executed during the Update.
- *statementType*  
The StatementType enumeration value indicating the type of SQL statement executed.
- *tableMapping*  
The DataTableMapping used for the Update.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleRowUpdatingEventArgs Class](#)
- [OracleRowUpdatingEventArgs Members](#)

## OracleRowUpdatingEventArgs Static Methods

The OracleRowUpdatingEventArgs static method is listed in [Table 7-166](#).

**Table 7-166 OracleRowUpdatingEventArgs Static Method**

Method	Description
Equals	Inherited from System.Object (Overloaded)

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleRowUpdatingEventArgs Class](#)
- [OracleRowUpdatingEventArgs Members](#)

## OracleRowUpdatingEventArgs Properties

The OracleRowUpdatingEventArgs properties are listed in [Table 7-167](#).

**Table 7-167 OracleRowUpdatingEventArgs Properties**

Property	Description
<a href="#">Command</a>	Specifies the OracleCommand that is used when the OracleDataAdapter.Update() is called
Errors	Inherited from System.Data.Common.RowUpdatingEventArgs

**Table 7-167 (Cont.) OracleRowUpdatingEventArgs Properties**

Property	Description
Row	Inherited from <code>System.Data.Common.RowUpdatingEventArgs</code>
StatementType	Inherited from <code>System.Data.Common.RowUpdatingEventArgs</code>
Status	Inherited from <code>System.Data.Common.RowUpdatingEventArgs</code>
TableMapping	Inherited from <code>System.Data.Common.RowUpdatingEventArgs</code>

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleRowUpdatingEventArgs Class](#)
- [OracleRowUpdatingEventArgs Members](#)

## Command

This property specifies the `OracleCommand` that is used when the `OracleDataAdapter.Update()` is called.

### Declaration

```
// C#  
public new OracleCommand Command {get; set;}
```

### Property Value

The `OracleCommand` executed when `Update` is called.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleRowUpdatingEventArgs Class](#)
- [OracleRowUpdatingEventArgs Members](#)

## OracleRowUpdatingEventArgs Public Methods

The `OracleRowUpdatingEventArgs` public methods are listed in [Table 7-168](#).

**Table 7-168 OracleRowUpdatingEventArgs Public Methods**

Public Method	Description
Equals	Inherited from System.Object (Overloaded)
GetHashCode	Inherited from System.Object
GetType	Inherited from System.Object
ToString	Inherited from System.Object

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleRowUpdatingEventArgs Class](#)
- [OracleRowUpdatingEventArgs Members](#)

## OracleRowUpdatingEventHandler Delegate

The `OracleRowUpdatingEventHandler` delegate represents the signature of the method that handles the `OracleDataAdapter.RowUpdating` event.

### Declaration

```
// C#
public delegate void OracleRowUpdatingEventHandler (object sender,
    OracleRowUpdatingEventArgs eventArgs);
```

### Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

### Parameters

- *sender*  
The source of the event.
- *eventArgs*

The `OracleRowUpdatingEventArgs` object that contains the event data.

### Remarks

Event callbacks can be registered through this event delegate for applications that wish to be notified after a row is updated.

In the .NET framework, the convention of an event delegate requires two parameters: the object that raises the event and the event data.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- ["RowUpdating"](#)

## OracleShardingKey Class

An `OracleShardingKey` object can represent either a sharding key or a super sharding key.

### Class Inheritance

`System.Object`

`Oracle.DataAccess.Client.OracleShardingKey`

### Declaration

```
// C#
public class OracleShardingKey : IDisposable
```

### Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	<code>Oracle.DataAccess.dll</code>	<code>Oracle.ManagedDataAccess.dll</code>	<code>Oracle.ManagedDataAccess.dll</code>
<b>Namespace</b>	<code>Oracle.DataAccess.Client</code>	<code>Oracle.ManagedDataAccess.Client</code>	<code>Oracle.ManagedDataAccess.Client</code>
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

### Example

```
// C#
using System;
using Oracle.DataAccess.Client;
```

```

class Sharding
{
    static void Main()
    {
        OracleConnection con = new OracleConnection("user id=hr;password=hr;Data
Source=orcl;");
        //Setting a shard key
        OracleShardingKey shardingKey = new OracleShardingKey(OracleDbType.Int32, 123);
        //Setting a second shard key value for a composite key
        shardingKey.SetShardingKey(OracleDbType.Varchar2, "gold");
        //Creating and setting the super shard key
        OracleShardingKey superShardingKey = new OracleShardingKey();
        superShardingKey.SetShardingKey(OracleDbType.Int32, 1000);

        //Setting super sharding key and sharding key on the connection
        con.SetShardingKey(shardingKey, superShardingKey);
        con.Open();

        //perform SQL query
    }
}

```

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleShardingKey Members](#)
- [OracleShardingKey Constructors](#)
- [OracleShardingKey Instance Methods](#)

## OracleShardingKey Members

OracleShardingKey members are listed in the following tables.

### OracleShardingKey Constructors

OracleShardingKey constructors are listed in [Table 7-169](#).

**Table 7-169 OracleShardingKey Constructors**

Constructor	Description
<a href="#">OracleShardingKey Constructors</a>	Instantiates a new instance of OracleShardingKey class (Overloaded)

### OracleShardingKey Instance Methods

OracleShardingKey instance methods are listed in [Table 7-170](#).

Table 7-170 OracleShardingKey Instance Methods

Method	Description
<a href="#">SetShardingKey(OracleDbType, object)</a>	Enables applications to set a key within the OracleShardingKey object
<a href="#">Dispose</a>	Enables applications to explicitly dispose the OracleShardingKey object

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleShardingKey Class](#)

## OracleShardingKey Constructors

OracleShardingKey constructors instantiate new instances of the OracleShardingKey class.

**Overload List:**

- [OracleShardingKey\(\)](#)  
This constructor instantiates a new instance of OracleShardingKey class.
- [OracleShardingKey\(OracleDbType, object\)](#)  
This constructor instantiates a new instance of the OracleShardingKey class using the supplied data type and key.

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleShardingKey Class](#)
- [OracleShardingKey Members](#)

## OracleShardingKey()

This constructor enables applications to construct the OracleShardingKey object.

**Declaration**

```
// C#  
public OracleShardingKey();
```

### Exceptions

None

### Remarks

This constructs an `OracleShardingKey` without any keys set.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleShardingKey Class](#)
- [OracleShardingKey Members](#)

## OracleShardingKey(OracleDbType, object)

This constructor enables applications to construct the `OracleShardingKey` object with the supplied key.

### Declaration

```
// C#  
public OracleShardingKey(OracleDbType type, object key);
```

### Exceptions

`InvalidArgumentException` – The supplied argument is invalid

### Remarks

This constructs an `OracleShardingKey` with the supplied key set.

**Acceptable `OracleDbType` enumeration values are** `Byte`, `Decimal`, `Double`, `Int16`, `In32`, `Int64`, `Single`, `Varchar2`, `String`, `Date`, `TimeStamp`, **and** `Raw`.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleShardingKey Class](#)
- [OracleShardingKey Members](#)

## OracleShardingKey Instance Methods

`OracleShardingKey` instance methods are listed in [Table 7-171](#).

Table 7-171 OracleShardingKey Instance Methods

Instance Method	Description
<a href="#">SetShardingKey(OracleDbType, object)</a>	Enables applications to set a key within the OracleShardingKey object
<a href="#">Dispose</a>	Enables applications to explicitly dispose the OracleShardingKey object

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleShardingKey Class](#)
- [OracleShardingKey Members](#)

## SetShardingKey(OracleDbType, object)

This instance method enables applications to set a key within the OracleShardingKey object.

### Declaration

```
// C#  
public void SetShardingKey(OracleDbType type, object key);
```

### Exceptions

InvalidArgumentException – The supplied argument is invalid

### Remarks

This method sets a key within the OracleShardingKey object.

Acceptable OracleDbType enumeration values are Byte, Decimal, Double, Int16, In32, Int64, Single, Varchar2, String, Date, TimeStamp, and Raw.

This can be called multiple times to construct a composite key.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleShardingKey Class](#)
- [OracleShardingKey Members](#)

## Dispose

This instance method enables applications to explicitly dispose the `OracleShardingKey` object.

### Declaration

```
// C#  
public void Dispose();
```

### Exceptions

None

### Remarks

This method disposes the `OracleShardingKey` object.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleShardingKey Class](#)
- [OracleShardingKey Members](#)

## OracleTransaction Class

An `OracleTransaction` object represents a local transaction.

### Class Inheritance

`System.Object`

`System.MarshalByRefObject`

`System.Data.Common.DbTransaction`

`Oracle.DataAccess.Client.OracleTransaction`

### Declaration

```
// C#  
public sealed class OracleTransaction : DbTransaction  
  
// C#  
public sealed class OracleTransaction : MarshalByRefObject,  
    IDbTransaction, IDisposable
```

## Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

## Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

## Remarks

The application calls `BeginTransaction` on the `OracleConnection` object to create an `OracleTransaction` object. The `OracleTransaction` object can be created in `Read Committed` mode only. Any other mode results in an exception.

The execution of a [DDL](#) statement in the context of a transaction is not recommended since it results in an implicit commit that is not reflected in the state of the `OracleTransaction` object.

All operations related to [savepoints](#) pertain to the current local transaction. Operations like commit and rollback performed on the transaction have no effect on data in any existing `DataSet`.

## Example

```
// Database Setup, if you have not done so yet.
/*
connect scott/tiger@oracle
DROP TABLE MyTable;
CREATE TABLE MyTable (MyColumn NUMBER);
--CREATE TABLE MyTable (MyColumn NUMBER PRIMARY KEY);

*/

// C#

using System;
using System.Data;
using Oracle.DataAccess.Client;

class OracleTransactionSample
{
    static void Main()
    {
        // Drop & Create MyTable as indicated Database Setup, at beginning

        // This sample starts a transaction and inserts two records with the same
        // value for MyColumn into MyTable.
    }
}
```

```
// If MyColumn is not a primary key, the transaction will commit.
// If MyColumn is a primary key, the second insert will violate the
// unique constraint and the transaction will rollback.

string constr = "User Id=scott;Password=tiger;Data Source=oracle";
OracleConnection con = new OracleConnection(constr);
con.Open();

OracleCommand cmd = con.CreateCommand();

// Check the number of rows in MyTable before transaction
cmd.CommandText = "SELECT COUNT(*) FROM MyTable";
int myTableCount = int.Parse(cmd.ExecuteScalar().ToString());

// Print the number of rows in MyTable
Console.WriteLine("myTableCount = " + myTableCount);

// Start a transaction
OracleTransaction txn = con.BeginTransaction(
    IsolationLevel.ReadCommitted);

try
{
    // Insert the same row twice into MyTable
    cmd.CommandText = "INSERT INTO MyTable VALUES (1)";
    cmd.ExecuteNonQuery();
    cmd.ExecuteNonQuery(); // This may throw an exception
    txn.Commit();
}
catch (Exception e)
{
    // Print the exception message
    Console.WriteLine("e.Message = " + e.Message);

    // Rollback the transaction
    txn.Rollback();
}

// Check the number of rows in MyTable after transaction
cmd.CommandText = "SELECT COUNT(*) FROM MyTable";
myTableCount = int.Parse(cmd.ExecuteScalar().ToString());

// Prints the number of rows
// If MyColumn is not a PRIMARY KEY, the value should increase by two.
// If MyColumn is a PRIMARY KEY, the value should remain same.
Console.WriteLine("myTableCount = " + myTableCount);

txn.Dispose();
cmd.Dispose();

con.Close();
con.Dispose();
}
}
```

*Not supported in a .NET stored procedure*

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleTransaction Members](#)
- [OracleTransaction Static Methods](#)
- [OracleTransaction Properties](#)

## OracleTransaction Members

`OracleTransaction` members are listed in the following tables.

### OracleTransaction Static Methods

The `OracleTransaction` static method is listed in [Table 7-172](#).

**Table 7-172 OracleTransaction Static Method**

Method	Description
<a href="#">Equals</a>	Inherited from <code>System.Object</code> (Overloaded)

### OracleTransaction Properties

`OracleTransaction` properties are listed in [Table 7-173](#).

**Table 7-173 OracleTransaction Properties**

Property	Description
<a href="#">IsolationLevel</a>	Specifies the isolation level for the transaction
<a href="#">Connection</a>	Specifies the connection that is associated with the transaction

### OracleTransaction Public Methods

`OracleTransaction` public methods are listed in [Table 7-174](#).

**Table 7-174 OracleTransaction Public Methods**

Public Method	Description
<a href="#">Commit</a>	Commits the database transaction
<a href="#">CreateObjRef</a>	Inherited from <code>System.MarshalByRefObject</code>
<a href="#">Dispose</a>	Frees the resources used by the <code>OracleTransaction</code> object
<a href="#">Equals</a>	Inherited from <code>System.Object</code> (Overloaded)
<a href="#">GetHashCode</a>	Inherited from <code>System.Object</code>

**Table 7-174 (Cont.) OracleTransaction Public Methods**

Public Method	Description
GetLifetimeService	Inherited from <code>System.MarshalByRefObject</code>
GetType	Inherited from <code>System.Object</code>
InitializeLifetimeService	Inherited from <code>System.MarshalByRefObject</code>
<a href="#">Rollback</a>	Rolls back a database transaction (Overloaded)
<a href="#">Save</a>	Creates a savepoint within the current transaction
ToString	Inherited from <code>System.Object</code>

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleTransaction Class](#)

## OracleTransaction Static Methods

The `OracleTransaction` static method is listed in [Table 7-175](#).

**Table 7-175 OracleTransaction Static Method**

Method	Description
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleTransaction Class](#)
- [OracleTransaction Members](#)

## OracleTransaction Properties

`OracleTransaction` properties are listed in [Table 7-176](#).

Table 7-176 OracleTransaction Properties

Property	Description
<a href="#">IsolationLevel</a>	Specifies the isolation level for the transaction
<a href="#">Connection</a>	Specifies the connection that is associated with the transaction

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleTransaction Class](#)
- [OracleTransaction Members](#)

## IsolationLevel

This property specifies the isolation level for the transaction.

### Declaration

```
// C#  
public override IsolationLevel IsolationLevel {get;}
```

### Property Value

IsolationLevel

### Implements

IDbTransaction

### Exceptions

InvalidOperationException - The transaction has already completed.

### Remarks

Default = IsolationLevel.ReadCommitted

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleTransaction Class](#)
- [OracleTransaction Members](#)

## Connection

This property specifies the connection that is associated with the transaction.

### Declaration

```
// C#
public OracleConnection Connection {get;}
```

### Property Value

Connection

### Implements

IDbTransaction

### Remarks

This property indicates the `OracleConnection` object that is associated with the transaction.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleTransaction Class](#)
- [OracleTransaction Members](#)

## OracleTransaction Public Methods

`OracleTransaction` public methods are listed in [Table 7-177](#).

**Table 7-177 OracleTransaction Public Methods**

Public Method	Description
<a href="#">Commit</a>	Commits the database transaction
<code>CreateObjRef</code>	Inherited from <code>System.MarshalByRefObject</code>
<a href="#">Dispose</a>	Frees the resources used by the <code>OracleTransaction</code> object
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)
<code>GetHashCode</code>	Inherited from <code>System.Object</code>
<code>GetLifetimeService</code>	Inherited from <code>System.MarshalByRefObject</code>
<code>GetType</code>	Inherited from <code>System.Object</code>
<code>InitializeLifetimeService</code>	Inherited from <code>System.MarshalByRefObject</code>
<a href="#">Rollback</a>	Rolls back a database transaction (Overloaded)
<a href="#">Save</a>	Creates a savepoint within the current transaction

**Table 7-177 (Cont.) OracleTransaction Public Methods**

Public Method	Description
ToString	Inherited from System.Object

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleTransaction Class](#)
- [OracleTransaction Members](#)

## Commit

This method commits the database transaction.

### Declaration

```
// C#  
public override void Commit();
```

### Implements

```
IDbTransaction
```

### Exceptions

`InvalidOperationException` - The transaction has already been completed successfully, has been rolled back, or the associated connection is closed.

### Remarks

Upon a successful commit, the transaction enters a completed state.

### Example

```
// Database Setup, if you have not done so yet  
/*  
connect scott/tiger@oracle  
DROP TABLE MyTable;  
CREATE TABLE MyTable (MyColumn NUMBER);  
--CREATE TABLE MyTable (MyColumn NUMBER PRIMARY KEY);  
  
*/  
  
// C#  
  
using System;  
using System.Data;  
using Oracle.DataAccess.Client;  
  
class CommitSample
```

```
{
    static void Main()
    {
        // Drop & Create MyTable as indicated in Database Setup, at beginning

        // This sample starts a transaction and inserts two records with the same
        // value for MyColumn into MyTable.
        // If MyColumn is not a primary key, the transaction will commit.
        // If MyColumn is a primary key, the second insert will violate the
        // unique constraint and the transaction will rollback.

        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();

        OracleCommand cmd = con.CreateCommand();

        // Check the number of rows in MyTable before transaction
        cmd.CommandText = "SELECT COUNT(*) FROM MyTable";
        int myTableCount = int.Parse(cmd.ExecuteScalar().ToString());

        // Print the number of rows in MyTable
        Console.WriteLine("myTableCount = " + myTableCount);

        // Start a transaction
        OracleTransaction txn = con.BeginTransaction(
            IsolationLevel.ReadCommitted);

        try
        {
            // Insert the same row twice into MyTable
            cmd.CommandText = "INSERT INTO MyTable VALUES (1)";
            cmd.ExecuteNonQuery();
            cmd.ExecuteNonQuery(); // This may throw an exception
            txn.Commit();
        }
        catch (Exception e)
        {
            // Print the exception message
            Console.WriteLine("e.Message = " + e.Message);

            // Rollback the transaction
            txn.Rollback();
        }

        // Check the number of rows in MyTable after transaction
        cmd.CommandText = "SELECT COUNT(*) FROM MyTable";
        myTableCount = int.Parse(cmd.ExecuteScalar().ToString());

        // Prints the number of rows
        // If MyColumn is not a PRIMARY KEY, the value should increase by two.
        // If MyColumn is a PRIMARY KEY, the value should remain same.
        Console.WriteLine("myTableCount = " + myTableCount);

        txn.Dispose();
        cmd.Dispose();

        con.Close();
        con.Dispose();
    }
}
```

```
}  
}
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleTransaction Class](#)
- [OracleTransaction Members](#)

## Dispose

This method frees the resources used by the `OracleTransaction` object.

### Declaration

```
// C#  
public void Dispose();
```

### Implements

`IDisposable`

### Remarks

This method releases both the managed and unmanaged resources held by the `OracleTransaction` object. If the transaction is not in a completed state, an attempt to rollback the transaction is made.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleTransaction Class](#)
- [OracleTransaction Members](#)

## Rollback

`Rollback` rolls back a database transaction.

### Overload List:

- [Rollback\(\)](#)  
This method rolls back a database transaction.
- [Rollback\(string\)](#)

This method rolls back a database transaction to a [savepoint](#) within the current transaction.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleTransaction Class](#)
- [OracleTransaction Members](#)

## Rollback()

This method rolls back a database transaction.

### Declaration

```
// C#  
public override void Rollback();
```

### Implements

```
IDbTransaction
```

### Exceptions

`InvalidOperationException` - The transaction has already been completed successfully, has been rolled back, or the associated connection is closed.

### Remarks

After a `Rollback()`, the `OracleTransaction` object can no longer be used because the `Rollback` ends the transaction.

### Example

```
// Database Setup, if you have not done so yet.  
/*  
connect scott/tiger@oracle  
DROP TABLE MyTable;  
CREATE TABLE MyTable (MyColumn NUMBER);  
  
*/  
  
// C#  
  
using System;  
using System.Data;  
using Oracle.DataAccess.Client;  
  
class RollbackSample  
{  
    static void Main()  
    {  
        // Drop & Create MyTable as indicated previously in Database Setup
```

```
// This sample starts a transaction and inserts one record into MyTable.
// It then rollsback the transaction, the number of rows remains the same

string constr = "User Id=scott;Password=tiger;Data Source=oracle";
OracleConnection con = new OracleConnection(constr);
con.Open();

OracleCommand cmd = con.CreateCommand();

// Check the number of rows in MyTable before transaction
cmd.CommandText = "SELECT COUNT(*) FROM MyTable";
int myTableCount = int.Parse(cmd.ExecuteScalar().ToString());

// Print the number of rows in MyTable
Console.WriteLine("myTableCount = " + myTableCount);

// Start a transaction
OracleTransaction txn = con.BeginTransaction(
    IsolationLevel.ReadCommitted);

// Insert a row into MyTable
cmd.CommandText = "INSERT INTO MyTable VALUES (1)";
cmd.ExecuteNonQuery();

// Rollback the transaction
txn.Rollback();

// Check the number of rows in MyTable after transaction
cmd.CommandText = "SELECT COUNT(*) FROM MyTable";
myTableCount = int.Parse(cmd.ExecuteScalar().ToString());

// Prints the number of rows, should remain the same
Console.WriteLine("myTableCount = " + myTableCount);

txn.Dispose();
cmd.Dispose();

con.Close();
con.Dispose();
}
}
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleTransaction Class](#)
- [OracleTransaction Members](#)

## Rollback(string)

This method rolls back a database transaction to a [savepoint](#) within the current transaction.

### Declaration

```
// C#  
public override void Rollback(string savepointName);
```

### Parameters

- *savepointName*

The name of the savepoint to rollback to, in the current transaction.

### Exceptions

`InvalidOperationException` - The transaction has already been completed successfully, has been rolled back, or the associated connection is closed.

### Remarks

After a rollback to a savepoint, the current transaction remains active and can be used for further operations.

The *savepointName* specified does not have to match the case of the *savepointName* created using the `Save` method, since savepoints are created in the database in a case-insensitive manner.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleTransaction Class](#)
- [OracleTransaction Members](#)

## Save

This method creates a [savepoint](#) within the current transaction.

### Declaration

```
// C#  
public void Save(string savepointName);
```

### Parameters

- *savepointName*

The name of the savepoint being created in the current transaction.

### Exceptions

`InvalidOperationException` - The transaction has already been completed.

## Remarks

After creating a savepoint, the transaction does not enter a completed state and can be used for further operations.

The *savepointName* specified is created in the database in a case-insensitive manner. Calling the `Rollback` method rolls back to *savepointName*. This allows portions of a transaction to be rolled back, instead of the entire transaction.

## Example

```
// Database Setup, if you have not done so yet.
/*
connect scott/tiger@oracle
DROP TABLE MyTable;
CREATE TABLE MyTable (MyColumn NUMBER);

*/

// C#

using System;
using System.Data;
using Oracle.DataAccess.Client;

class SaveSample
{
    static void Main()
    {
        // Drop & Create MyTable as indicated in Database Setup, at beginning

        // This sample starts a transaction and creates a savepoint after
        // inserting one record into MyTable.
        // After inserting the second record it rollsback to the savepoint
        // and commits the transaction. Only the first record will be inserted

        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();

        OracleCommand cmd = con.CreateCommand();

        // Check the number of rows in MyTable before transaction
        cmd.CommandText = "SELECT COUNT(*) FROM MyTable";
        int myTableCount = int.Parse(cmd.ExecuteScalar().ToString());

        // Print the number of rows in MyTable
        Console.WriteLine("myTableCount = " + myTableCount);

        // Start a transaction
        OracleTransaction txn = con.BeginTransaction(
            IsolationLevel.ReadCommitted);

        // Insert a row into MyTable
        cmd.CommandText = "INSERT INTO MyTable VALUES (1)";
        cmd.ExecuteNonQuery();

        // Create a savepoint
        txn.Save("MySavePoint");
    }
}
```

```

// Insert another row into MyTable
cmd.CommandText = "insert into mytable values (2)";
cmd.ExecuteNonQuery();

// Rollback to the savepoint
txn.Rollback("MySavePoint");

// Commit the transaction
txn.Commit();

// Check the number of rows in MyTable after transaction
cmd.CommandText = "SELECT COUNT(*) FROM MyTable";
myTableCount = int.Parse(cmd.ExecuteScalar().ToString());

// Prints the number of rows, should have increased by 1
Console.WriteLine("myTableCount = " + myTableCount);

txn.Dispose();
cmd.Dispose();

con.Close();
con.Dispose();
}
}

```



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleTransaction Class](#)
- [OracleTransaction Members](#)

## OracleConnectionType Enumeration

`OracleConnectionType` enumerated values specify whether a particular connection object is associated with an Oracle database connection, a TimesTen database connection, or no physical connection at all.

[Table 7-178](#) lists all the `OracleConnectionType` enumeration values with a description of each enumerated value.

**Table 7-178 OracleConnectionType Enumeration Values**

Member Name	Description
Undefined	No connection is associated with the <code>OracleConnection</code> object.
Oracle	The <code>OracleConnection</code> object is associated with an Oracle database.
TimesTen	The <code>OracleConnection</code> object is associated with a TimesTen database.

## Requirements

<b>Provider</b>	<b>ODP.NET, Unmanaged Driver</b>
<b>Assembly</b>	Oracle.DataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client
<b>.NET Framework</b>	4.8



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- ["OracleConnection Class"](#)
- ["ConnectionType"](#)

# OracleCollectionType Enumeration

OracleCollectionType enumerated values specify whether or not the OracleParameter object represents a collection, and if so, specifies the collection type.

Table 7-179 lists all the OracleCollectionType enumeration values with a description of each enumerated value.

**Table 7-179 OracleCollectionType Enumeration Values**

Member Name	Description
None	Is not a collection type
PLSQLAssociativeArray	Indicates that the collection type is a PL/SQL Associative Array (or PL/SQL Index-By Table)

## Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- ["OracleParameter Class"](#)
- ["CollectionType"](#)

## OracleDBAPrivilege Enumeration

OracleDBAPrivilege enumerated values are used to explicitly specify the DBA Privilege required while creating the OracleCredential object.

Table 7-178 lists all the OracleDBAPrivilege enumeration values with a description of each enumerated value.

**Table 7-180 OracleDBAPrivilege Enumeration Values**

Member Name	Description
None	Default value, no DBA privilege set.
SYSASM	SYSASM connection
SYSBACKUP	SYSBACKUP connection
SYSDBA	SYSDBA connection
SYSDG	SYSDG connection
SYSKM	SYSKM connection
SYSOPER	SYSOPER connection
SYSRAC	SYSRAC connection

### Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleCredential Class](#)
- [DBAPrivilege](#)

## OracleDBShutdownMode Enumeration

OracleDBShutdownMode enumerated values specify the database shutdown options.

[Table 7-182](#) lists all the OracleDBShutdownMode enumeration values with a description of each enumerated value.

**Table 7-181 OracleDBShutdownMode Enumeration Values**

Member Name	Description
Default	Refuses new connections and waits for existing connections to end.
Transactional	Refuses new connections and does not allow any new transactions. Waits for active transactions to commit.
TransactionalLocal	Refuses new connections and does not allow any new transactions. Waits for only local transactions to commit.
Immediate	Does not wait for current calls to complete or users to disconnect from the database. All uncommitted transactions are terminated and rolled back.
Final	Shuts down the database. Used in the second call for shutdown after the database has been closed and dismounted.
Abort	Does not wait for current calls to complete or users to disconnect from the database. All uncommitted transactions are terminated and are not rolled back.

### Requirements

<b>Provider</b>	ODP.NET, Unmanaged Driver
<b>Assembly</b>	Oracle.DataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client
<b>.NET Framework</b>	4.8

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- ["OracleConnection Class"](#)
- ["Shutdown"](#)

## OracleDBStartupMode Enumeration

OracleDBStartupMode enumerated values specify the database startup options.

Table 7-182 lists all the OracleDBStartupMode enumeration values with a description of each enumerated value.

**Table 7-182 OracleDBStartupMode Enumeration Values**

Member Name	Description
NoRestriction	Starts the database and allows access to all users.
Restrict	Starts the database and allows database access only to users having the CREATE SESSION and RESTRICTED SESSION privileges. These privileges are normally assigned to database administrators.
Force	Shuts down a running instance in abort mode and starts a new instance.

### Requirements

<b>Provider</b>	ODP.NET, Unmanaged Driver
<b>Assembly</b>	Oracle.DataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client
<b>.NET Framework</b>	4.8

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- ["OracleConnection Class"](#)
- ["Startup"](#)

# OracleDbType Enumeration

OracleDbType enumerated values are used to explicitly specify the OracleDbType of an OracleParameter.

Table 7-183 lists all the OracleDbType enumeration values with a description of each enumerated value.

**Table 7-183 OracleDbType Enumeration Values**

Member Name	Description
Array	Oracle Collection (VArray or Nested Table)
BFile	Oracle BFILE type
BinaryFloat	Oracle BINARY_FLOAT type
BinaryDouble	Oracle BINARY_DOUBLE type
Blob	Oracle BLOB type
Boolean	Oracle BOOLEAN type
Byte	byte type
Char	Oracle CHAR type
Clob	Oracle CLOB type
Date	Oracle DATE type
Decimal	Oracle NUMBER type
Double	8-byte FLOAT type
Int16	2-byte INTEGER type
Int32	4-byte INTEGER type
Int64	8-byte INTEGER type
IntervalDS	Oracle INTERVAL DAY TO SECOND type
IntervalYM	Oracle INTERVAL YEAR TO MONTH type
Long	Oracle LONG type
Json	Oracle JSON type
LongRaw	Oracle LONG RAW type
NChar	Oracle NCHAR type
NClob	Oracle NCLOB type
NVarChar2	Oracle NVARCHAR2 type
Object	Oracle Object
Raw	Oracle RAW type
Ref	Oracle REF
RefCursor	Oracle REF CURSOR type
Single	4-byte FLOAT type, supports 6 precisions
TimeStamp	Oracle TIMESTAMP type
TimeStampLTZ	Oracle TIMESTAMP WITH LOCAL TIME ZONE type

**Table 7-183 (Cont.) OracleDbType Enumeration Values**

Member Name	Description
TimeStampTZ	Oracle <code>TIMESTAMP WITH TIME ZONE</code> type
Varchar2	Oracle <code>VARCHAR2</code> type
XmlType	Oracle <code>XMLType</code> type

**Requirements**

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

**See Also:**

- "[Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces](#)"
- "[OracleParameter Class](#)"
- "[OracleParameterCollection Class](#)"
- OracleParameter "[OracleDbType](#) "

## OracleDRCPurity Enumeration

OracleDRCPurity enumerated values specify the session purity.

[Table 7-184](#) lists all the OracleDRCPurity enumeration values with a description of each enumerated value.

**Table 7-184 OracleDRCPurity Enumeration Values**

Member Name	Description
New	The application requires a session without any previously set session state.
Pooled	An application can reuse a pooled session (i.e. the session can have been used before)

**Requirements**

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- ["OracleConnection Class"](#)
- [DRCPPurity](#)

## OracleIdentityType Enumeration

The `OracleIdentityType` enumeration specifies how Oracle identity column values are generated.

[Table 7-185](#) lists all the `OracleIdentityType` enumeration values with a description of each enumerated value.

**Table 7-185 OracleIdentityType Members**

Member Name	Description
<code>GeneratedAlways</code>	Indicates that unique values are generated for every insertion. No updates or inserts are allowed for this identity column.
<code>GeneratedByDefault</code>	Indicates that the values are generated only if no explicit value is provided for the identity column. Null values are not allowed for this identity column.
<code>GeneratedByDefaultOnNull</code>	Indicates that the values are generated only if no explicit value is provided or a NULL is inserted for the identity column.

**Requirements**

Provider	ODP.NET, Unmanaged Driver
<b>Assembly</b>	Oracle.DataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client
<b>.NET Framework</b>	4.8

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- ["OracleDataAdapter Class "](#)
- `OracleDataAdapter` ["IdentityInsert"](#)
- `OracleDataAdapter` ["IdentityUpdate"](#)

## OracleParameterStatus Enumeration

The `OracleParameterStatus` enumeration type indicates whether a `NULL` value is fetched from a column, or truncation has occurred during the fetch, or a `NULL` value is to be inserted into a database column.

[Table 7-186](#) lists all the `OracleParameterStatus` enumeration values with a description of each enumerated value.

**Table 7-186 OracleParameterStatus Members**

Member Name	Description
<code>Success</code>	Indicates that (for input parameters) the input value has been assigned to the column. For output parameter, it indicates that the provider assigned an intact value to the parameter.
<code>NullFetched</code>	Indicates that a <code>NULL</code> value has been fetched from a column or an <code>OUT</code> parameter.
<code>NullInsert</code>	Indicates that a <code>NULL</code> value is to be inserted into a column.
<code>Truncation</code>	Indicates that truncation has occurred when fetching the data from the column.

### Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	<code>Oracle.DataAccess.dll</code>	<code>Oracle.ManagedDataAccess.dll</code>	<code>Oracle.ManagedDataAccess.dll</code>
<b>Namespace</b>	<code>Oracle.DataAccess.Client</code>	<code>Oracle.ManagedDataAccess.Client</code>	<code>Oracle.ManagedDataAccess.Client</code>
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- ["OracleParameter Class"](#)
- OracleParameter ["ArrayBindStatus "](#)
- OracleParameter ["Value "](#)

## OraclePasswordAuth Enumeration

OraclePasswordAuth enumerated values specify which PASSWORD\_AUTH mode must be enabled for database token authentication. There is no impact on external authentication. Possible values are:

[Table 7-187](#) lists all the OracleTokenAuth enumeration values with a description of each enumerated value.

**Table 7-187 OraclePasswordAuth Members**

Member Name	Description
PasswordVerifier	Default value. Indicates database authentication is to be used.
OciToken	ODP.NET makes REST calls to IAM endpoint to retrieve the database token for authentication.

### Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAccessToken Class](#)
- [OracleRefreshAccessTokenEventArgs Class](#)

## OracleTokenAuth Enumeration

OracleTokenAuth enumerated values are used to explicitly specify which `TOKEN_AUTH` mode needs to be enabled for token authentication. Possible values for this enumeration are:

[Table 7-188](#) lists all the OracleTokenAuth enumeration values with a description of each enumerated value.

**Table 7-188 OracleTokenAuth Members**

Member Name	Description
Disabled	Default value. Token authentication is DISABLED.
OciToken	Token authentication is enabled for Oracle Identity and Access Management.
OAuth	Token authentication enabled for Azure Active Directory.

### Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAccessToken Class](#)
- [OracleRefreshAccessTokenEventArgs Class](#)

# 8

## Oracle Data Provider for .NET XML-Related Classes

This chapter describes ODP.NET XML-related classes and enumerations.

This chapter contains these topics:

- [OracleXmlCommandType Enumeration](#)
- [OracleXmlQueryProperties Class](#)
- [OracleXmlSaveProperties Class](#)
- [OracleXmlStream Class](#)
- [OracleXmlType Class](#)

All offsets are 0-based for `OracleXmlStream` object parameters.

### OracleXmlCommandType Enumeration

The `OracleXmlCommandType` enumeration specifies the values that are allowed for the `XmlCommandType` property of the `OracleCommand` class. It is used to specify the type of XML operation.

[Table 8-1](#) lists all the `OracleXmlCommandType` enumeration values with a description of each enumerated value.

**Table 8-1 OracleXmlCommandType Members**

Member Name	Description
None	No XML operation is desired
Query	The command text is a SQL query and the result of the query is an XML document. The SQL query needs to be a select statement
Insert	The command text is an XML document containing rows to insert.
Update	The command text is an XML document containing rows to update.
Delete	The command text is an XML document containing rows to delete.

#### Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
.NET Framework	4.8	4.8	-
.NET (Core)	-	-	See <a href="#">System Requirements</a>



#### See Also:

"[Oracle.DataAccess.Client](#) and [Oracle.ManagedDataAccess.Client](#) Namespaces"

## OracleXmlQueryProperties Class

An `OracleXmlQueryProperties` object represents the XML properties used by the `OracleCommand` class when the `XmlCommandType` property is `Query`.

### Class Inheritance

`System.Object`

`System.OracleXmlQueryProperties`

### Declaration

```
public sealed class OracleXmlQueryProperties : ICloneable
```

### Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	<code>Oracle.DataAccess.dll</code>	<code>Oracle.ManagedDataAccess.dll</code>	<code>Oracle.ManagedDataAccess.dll</code>
<b>Namespace</b>	<code>Oracle.DataAccess.Client</code>	<code>Oracle.ManagedDataAccess.Client</code>	<code>Oracle.ManagedDataAccess.Client</code>
.NET Framework	4.8	4.8	-
.NET (Core)	-	-	See <a href="#">System Requirements</a>

### Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

### Remarks

`OracleXmlQueryProperties` can be accessed, and modified using the `XmlQueryProperties` property of the `OracleCommand` class. Each `OracleCommand` object has its own instance of the `OracleXmlQueryProperties` class in the `XmlQueryProperties` property.

Use the default constructor to get a new instance of the `OracleXmlQueryProperties`. Use the `OracleXmlQueryProperties.Clone()` method to get a copy of an `OracleXmlQueryProperties` instance.

### Example

This example retrieves relational data as XML.

```
// C#

using System;
using System.IO;
using System.Data;
using System.Xml;
using System.Text;
using Oracle.DataAccess.Client;

class OracleXmlQueryPropertiesSample
{
    static void Main()
    {
        int rows = 0;
        StreamReader sr = null;

        // Define the XSL document for doing the transform.
        string xslstr = "<?xml version='1.0'?>\n" +
            "<xsl:stylesheet version='1.0'\n" +
            "  xmlns:xsl=\"http://www.w3.org/1999/XSL/Transform\"\n" +
            "  <xsl:output encoding='utf-8'>\n" +
            "  <xsl:template match='/'>\n" +
            "    <EMPLOYEES>\n" +
            "      <xsl:apply-templates select='\"ROWSET\"'/>\n" +
            "    </EMPLOYEES>\n" +
            "  </xsl:template>\n" +
            "  <xsl:template match='\"ROWSET\"'/>\n" +
            "    <xsl:apply-templates select='\"ROW\"'/>\n" +
            "  </xsl:template>\n" +
            "  <xsl:template match='\"ROW\"'/>\n" +
            "    <EMPLOYEE>\n" +
            "      <EMPLOYEE_ID>\n" +
            "        <xsl:apply-templates select='\"EMPNO\"'/>\n" +
            "      </EMPLOYEE_ID>\n" +
            "      <EMPLOYEE_NAME>\n" +
            "        <xsl:apply-templates select='\"ENAME\"'/>\n" +
            "      </EMPLOYEE_NAME>\n" +
            "      <HIRE_DATE>\n" +
            "        <xsl:apply-templates select='\"HIREDATE\"'/>\n" +
            "      </HIRE_DATE>\n" +
            "      <JOB_TITLE>\n" +
            "        <xsl:apply-templates select='\"JOB\"'/>\n" +
            "      </JOB_TITLE>\n" +
            "    </EMPLOYEE>\n" +
            "  </xsl:template>\n" +
            "</xsl:stylesheet>\n";

        // Create the connection.
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();

        // Set the date, and timestamp formats for Oracle 9i Release 2, or later.
```

```
// This is just needed for queries.
if (!con.ServerVersion.StartsWith("9.0") &&
    !con.ServerVersion.StartsWith("8.1"))
{
    OracleGlobalization sessionParams = con.GetSessionInfo();
    sessionParams.DateFormat = "YYYY-MM-DD\"T\"HH24:MI:SS";
    sessionParams.TimeStampFormat = "YYYY-MM-DD\"T\"HH24:MI:SS.FF3";
    sessionParams.TimeStampTZFormat = "YYYY-MM-DD\"T\"HH24:MI:SS.FF3";
    con.SetSessionInfo(sessionParams);
}

// Create the command.
OracleCommand cmd = new OracleCommand("", con);

// Set the XML command type to query.
cmd.XmlCommandType = OracleXmlCommandType.Query;

// Set the SQL query.
cmd.CommandText = "select * from emp e where e.empno = :empno";

// Set command properties that affect XML query behaviour.
cmd.BindByName = true;

// Bind values to the parameters in the SQL query.
Int32 empNum = 7369;
cmd.Parameters.Add("empno", OracleDbType.Int32, empNum,
    ParameterDirection.Input);

// Set the XML query properties.
cmd.XmlQueryProperties.MaxRows = 1;
cmd.XmlQueryProperties.RootTag = "ROWSET";
cmd.XmlQueryProperties.RowTag = "ROW";
cmd.XmlQueryProperties.Xslt = xslstr;

// Test query execution without returning a result.
Console.WriteLine("SQL query: select * from emp e where e.empno = 7369");
Console.WriteLine("Maximum rows: all rows (-1)");
Console.WriteLine("Return Value from OracleCommand.ExecuteNonQuery():");
rows = cmd.ExecuteNonQuery();
Console.WriteLine(rows);
Console.WriteLine("\n");

// Get the XML document as an XmlReader.
Console.WriteLine("SQL query: select * from emp e where e.empno = 7369");
Console.WriteLine("Maximum rows: all rows (-1)");
Console.WriteLine("XML Document from OracleCommand.ExecuteXmlReader():");

XmlReader xmlReader = cmd.ExecuteXmlReader();
XmlDocument xmlDoc = new XmlDocument();
xmlDoc.PreserveWhitespace = true;
xmlDoc.Load(xmlReader);
Console.WriteLine(xmlDoc.OuterXml);
Console.WriteLine("\n");

// Change the SQL query, and set the maximum number of rows to 2.
cmd.CommandText = "select * from emp e";
cmd.Parameters.Clear();
cmd.XmlQueryProperties.MaxRows = 2;

// Get the XML document as a Stream.
Console.WriteLine("SQL query: select * from emp e");
```

```

Console.WriteLine("Maximum rows: 2");
Console.WriteLine("XML Document from OracleCommand.ExecuteStream()");
Stream stream = cmd.ExecuteStream();
sr = new StreamReader(stream, Encoding.Unicode);
Console.WriteLine(sr.ReadToEnd());
Console.WriteLine("\n");

// Get all the rows.
cmd.XmlQueryProperties.MaxRows = -1;

// Append the XML document to an existing Stream.
Console.WriteLine("SQL query: select * from emp e");
Console.WriteLine("Maximum rows: all rows (-1)");
Console.WriteLine("XML Document from OracleCommand.ExecuteToStream()");
MemoryStream mstream = new MemoryStream(32);
cmd.ExecuteToStream(mstream);
mstream.Seek(0, SeekOrigin.Begin);
sr = new StreamReader(mstream, Encoding.Unicode);
Console.WriteLine(sr.ReadToEnd());
Console.WriteLine("\n");

// Clean up.
cmd.Dispose();
con.Close();
con.Dispose();
}
}

```

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleXmlQueryProperties Members](#)
- [OracleXmlQueryProperties Constructor](#)
- [OracleXmlQueryProperties Properties](#)
- [OracleXmlQueryProperties Public Methods](#)

## OracleXmlQueryProperties Members

OracleXmlQueryProperties members are listed in the following tables.

### OracleXmlQueryProperties Constructors

The OracleXmlQueryProperties constructors are listed in [Table 8-2](#).

**Table 8-2 OracleXmlQueryProperties Constructors**

Constructor	Description
<a href="#">OracleXmlQueryProperties Constructor</a>	Instantiates a new instance of the OracleXmlQueryProperties class

## OracleXmlQueryProperties Properties

The `OracleXmlQueryProperties` properties are listed in [Table 8-3](#).

**Table 8-3 OracleXmlQueryProperties Properties**

Name	Description
<a href="#">MaxRows</a>	Specifies the maximum number of rows from the result set of the query that can be represented in the result XML document
<a href="#">RootTag</a>	Specifies the root element of the result XML document
<a href="#">RowTag</a>	Specifies the value of the XML element which identifies a row of data from the result set in an XML document
<a href="#">Xslt</a>	Specifies the XSL document used for XML transformation using XSLT
<a href="#">XsltParams</a>	Specifies parameters for the XSL document

## OracleXmlQueryProperties Public Methods

The `OracleXmlQueryProperties` public methods are listed in [Table 8-4](#).

**Table 8-4 OracleXmlQueryProperties Public Methods**

Name	Description
<a href="#">Clone</a>	Creates a copy of an <code>OracleXmlQueryProperties</code> object



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleXmlQueryProperties Class](#)

## OracleXmlQueryProperties Constructor

The `OracleXmlQueryProperties` constructor instantiates a new instance of the `OracleXmlQueryProperties` class.

### Declaration

```
// C#  
public OracleXmlQueryProperties();
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleXmlQueryProperties Class](#)
- [OracleXmlQueryProperties Members](#)

## OracleXmlQueryProperties Properties

The `OracleXmlQueryProperties` properties are listed in [Table 8-5](#).

**Table 8-5 OracleXmlQueryProperties Properties**

Name	Description
<a href="#">MaxRows</a>	Specifies the maximum number of rows from the result set of the query that can be represented in the result XML document
<a href="#">RootTag</a>	Specifies the root element of the result XML document
<a href="#">RowTag</a>	Specifies the value of the XML element which identifies a row of data from the result set in an XML document
<a href="#">Xslt</a>	Specifies the XSL document used for XML transformation using XSLT
<a href="#">XsltParams</a>	Specifies parameters for the XSL document

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleXmlQueryProperties Class](#)
- [OracleXmlQueryProperties Members](#)

## MaxRows

This property specifies the maximum number of rows from the result set of the query that can be represented in the result XML document.

### Declaration

```
// C#  
public int MaxRows {get; set;}
```

### Property Value

The maximum number of rows.

### Exceptions

`ArgumentException` - The new value for `MaxRows` is not valid.

### Remarks

Default value is `-1`.

Possible values are:

- `-1` (all rows).
- A number greater than or equal to `0`.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleXmlQueryProperties Class](#)
- [OracleXmlQueryProperties Members](#)

## RootTag

This property specifies the root element of the result XML document.

### Declaration

```
// C#  
public string RootTag {get; set;}
```

### Property Value

The root element of the result XML document.

### Remarks

The default root tag is `ROWSET`.

To indicate that no root tag is to be used in the result XML document, set this property to `null` or `""` or `String.Empty`.

If both `RootTag` and `RowTag` are set to `null`, an XML document is returned only if the result set returns one row and one column.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleXmlQueryProperties Class](#)
- [OracleXmlQueryProperties Members](#)

## RowTag

This property specifies the value of the XML element which identifies a row of data from the result set in an XML document.

### Declaration

```
// C#  
public string RowTag {get; set;}
```

### Property Value

The value of the XML element.

### Remarks

The default is ROW.

To indicate that no row tag is be used in the result XML document, set this property to `null` or `""` or `String.Empty`.

If both `RootTag` and `RowTag` are set to `null`, an XML document is returned only if the result set returns one row and one column.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleXmlQueryProperties Class](#)
- [OracleXmlQueryProperties Members](#)

## Xslt

This property specifies the XSL document used for XML transformation using XSLT.

### Declaration

```
// C#  
public string Xslt {get; set;}
```

### Property Value

The XSL document used for XML transformation.

### Remarks

Default value is `null`.

The XSL document is used for XML transformation of the XML document generated from the result set of the query.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleXmlQueryProperties Class](#)
- [OracleXmlQueryProperties Members](#)

## XsltParams

This property specifies parameters for the XSL document.

### Declaration

```
// C#  
public string XsltParams {get; set;}
```

### Property Value

The parameters for the XSL document.

### Remarks

Default value is `null`.

The parameters are specified as a string of "name=value" pairs of the form "param1=value1; param2=value2;..." delimited by semicolons.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleXmlQueryProperties Class](#)
- [OracleXmlQueryProperties Members](#)

## OracleXmlQueryProperties Public Methods

The `OracleXmlQueryProperties` public methods are listed in [Table 8-6](#).

**Table 8-6 OracleXmlQueryProperties Public Methods**

Name	Description
<a href="#">Clone</a>	Creates a copy of an <code>OracleXmlQueryProperties</code> object

### Clone

This method creates a copy of an `OracleXmlQueryProperties` object.

#### Declaration

```
// C#  
public object Clone();
```

#### Return Value

An `OracleXmlQueryProperties` object

#### Implements

`ICloneable`



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleXmlQueryProperties Class](#)
- [OracleXmlQueryProperties Members](#)

## OracleXmlSaveProperties Class

An `OracleXmlSaveProperties` object represents the XML properties used by the `OracleCommand` class when the `XmlCommandType` property is `Insert`, `Update`, or `Delete`.

#### Class Inheritance

`System.Object`

`System.OracleXmlSaveProperties`

#### Declaration

```
public sealed class OracleXmlSaveProperties : ICloneable
```

## Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

## Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

## Remarks

OracleXmlSaveProperties can be accessed and modified using the XmlSaveProperties property of the OracleCommand class. Each OracleCommand object has its own instance of the OracleXmlSaveProperties class in the XmlSaveProperties property.

Use the default constructor to get a new instance of OracleXmlSaveProperties. Use the OracleXmlSaveProperties.Clone() method to get a copy of an OracleXmlSaveProperties instance.

## Example

This sample demonstrates how to do inserts, updates, and deletes to a relational table or view using an XML document.

```
// C#
/* -- If HR account is being locked, you need to log on as a DBA
   -- to unlock the account first. Unlock a locked users account:

ALTER USER hr ACCOUNT UNLOCK;
*/

using System;
using Oracle.DataAccess.Client;

class OracleXmlSavePropertiesSample
{
    static void Main()
    {
        string[] KeyColumnsList = null;
        string[] UpdateColumnsList = null;
        int rows = 0;

        // Create the connection.
        string constr = "User Id=hr;Password=hr;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();
```

```
// Create the command.
OracleCommand cmd = new OracleCommand("", con);

// Set the XML command type to insert.
cmd.XmlCommandType = OracleXmlCommandType.Insert;

// Set the XML document.
cmd.CommandText = "<?xml version='1.0'?>\n" +
    "<ROWSET>\n" +
    "  <MYROW num = '1'>\n" +
    "    <EMPLOYEE_ID>1234</EMPLOYEE_ID>\n" +
    "    <LAST_NAME>Smith</LAST_NAME>\n" +
    "    <EMAIL>Smith@Oracle.com</EMAIL>\n" +
    "    <HIRE_DATE>1982-01-23T00:00:00.000</HIRE_DATE>\n" +
    "    <JOB_ID>IT_PROG</JOB_ID>\n" +
    "  </MYROW>\n" +
    "  <MYROW num = '2'>\n" +
    "    <EMPLOYEE_ID>1235</EMPLOYEE_ID>\n" +
    "    <LAST_NAME>Barney</LAST_NAME>\n" +
    "    <EMAIL>Barney@Oracle.com</EMAIL>\n" +
    "    <HIRE_DATE>1982-01-23T00:00:00.000</HIRE_DATE>\n" +
    "    <JOB_ID>IT_PROG</JOB_ID>\n" +
    "  </MYROW>\n" +
    "</ROWSET>\n";

// Set the XML save properties.
KeyColumnsList = new string[1];
KeyColumnsList[0] = "EMPLOYEE_ID";
UpdateColumnsList = new string[5];
UpdateColumnsList[0] = "EMPLOYEE_ID";
UpdateColumnsList[1] = "LAST_NAME";
UpdateColumnsList[2] = "EMAIL";
UpdateColumnsList[3] = "HIRE_DATE";
UpdateColumnsList[4] = "JOB_ID";
cmd.XmlSaveProperties.KeyColumnsList = KeyColumnsList;
cmd.XmlSaveProperties.RowTag = "MYROW";
cmd.XmlSaveProperties.Table = "employees";
cmd.XmlSaveProperties.UpdateColumnsList = UpdateColumnsList;
cmd.XmlSaveProperties.Xslt = null;
cmd.XmlSaveProperties.XsltParams = null;

// Do the inserts.
rows = cmd.ExecuteNonQuery();
Console.WriteLine("rows: " + rows);

// Set the XML command type to update.
cmd.XmlCommandType = OracleXmlCommandType.Update;

// Set the XML document.
cmd.CommandText = "<?xml version='1.0'?>\n" +
    "<ROWSET>\n" +
    "  <MYROW num = '1'>\n" +
    "    <EMPLOYEE_ID>1234</EMPLOYEE_ID>\n" +
    "    <LAST_NAME>Adams</LAST_NAME>\n" +
    "  </MYROW>\n" +
    "</ROWSET>\n";

// Set the XML save properties.
KeyColumnsList = new string[1];
KeyColumnsList[0] = "EMPLOYEE_ID";
UpdateColumnsList = new string[1];
```

```
UpdateColumnsList[0] = "LAST_NAME";
cmd.XmlSaveProperties.KeyColumnsList = KeyColumnsList;
cmd.XmlSaveProperties.UpdateColumnsList = UpdateColumnsList;
rows = cmd.ExecuteNonQuery();
Console.WriteLine("rows: " + rows);

// Set the XML command type to delete.
cmd.XmlCommandType = OracleXmlCommandType.Delete;

// Set the XML document.
cmd.CommandText = "<?xml version=\"1.0\"?>\n" +
    "<ROWSET>\n" +
    "  <MYROW num = \"1\">\n" +
    "    <EMPLOYEE_ID>1234</EMPLOYEE_ID>\n" +
    "  </MYROW>\n" +
    "  <MYROW num = \"2\">\n" +
    "    <EMPLOYEE_ID>1235</EMPLOYEE_ID>\n" +
    "  </MYROW>\n" +
    "</ROWSET>\n";

// Set the XML save properties.
KeyColumnsList = new string[1];
KeyColumnsList[0] = "EMPLOYEE_ID";
cmd.XmlSaveProperties.KeyColumnsList = KeyColumnsList;
cmd.XmlSaveProperties.UpdateColumnsList = null;

// Do the deletes.
rows = cmd.ExecuteNonQuery();
Console.WriteLine("rows: " + rows);

// Clean up.
cmd.Dispose();
con.Close();
con.Dispose();
}
}
```

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleXmlSaveProperties Members](#)
- [OracleXmlSaveProperties Constructor](#)
- [OracleXmlSaveProperties Properties](#)
- [OracleXmlSaveProperties Public Methods](#)

## OracleXmlSaveProperties Members

OracleXmlSaveProperties members are listed in the following tables.

### OracleXmlSaveProperties Constructor

OracleXmlSaveProperties constructors are listed in [Table 8-7](#)

**Table 8-7 OracleXmlSaveProperties Constructor**

Constructor	Description
<a href="#">OracleXmlSaveProperties Constructor</a>	Instantiates a new instance of the <code>OracleXmlSaveProperties</code> class

**OracleXmlSaveProperties Properties**

The `OracleXmlSaveProperties` properties are listed in [Table 8-8](#).

**Table 8-8 OracleXmlSaveProperties Properties**

Name	Description
<a href="#">KeyColumnsList</a>	Specifies the list of columns used as a key to locate existing rows for update or delete using an XML document
<a href="#">RowTag</a>	Specifies the value for the XML element that identifies a row of data in an XML document
<a href="#">Table</a>	Specifies the name of the table or view to which changes are saved
<a href="#">UpdateColumnsList</a>	Specifies the list of columns to update or insert
<a href="#">Xslt</a>	Specifies the XSL document used for XML transformation using XSLT
<a href="#">XsltParams</a>	Specifies the parameters for the XSLT document specified in the <code>Xslt</code> property

**OracleXmlSaveProperties Public Methods**

The `OracleXmlSaveProperties` public methods are listed in [Table 8-9](#).

**Table 8-9 OracleXmlSaveProperties Public Methods**

Name	Description
<a href="#">Clone</a>	Creates a copy of an <code>OracleXmlSaveProperties</code> object

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleXmlSaveProperties Class](#)
- [OracleXmlSaveProperties Members](#)

## OracleXmlSaveProperties Constructor

The `OracleXmlSaveProperties` constructor instantiates a new instance of `OracleXmlSaveProperties` class.

## Declaration

```
// C#  
public OracleXmlSaveProperties;
```

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleXmlSaveProperties Class](#)
- [OracleXmlSaveProperties Members](#)

## OracleXmlSaveProperties Properties

The `OracleXmlSaveProperties` properties are listed in [Table 8-10](#).

**Table 8-10 OracleXmlSaveProperties Properties**

Name	Description
<a href="#">KeyColumnsList</a>	Specifies the list of columns used as a key to locate existing rows for update or delete using an XML document
<a href="#">RowTag</a>	Specifies the value for the XML element that identifies a row of data in an XML document
<a href="#">Table</a>	Specifies the name of the table or view to which changes are saved
<a href="#">UpdateColumnsList</a>	Specifies the list of columns to update or insert
<a href="#">Xslt</a>	Specifies the XSL document used for XML transformation using XSLT
<a href="#">XsltParams</a>	Specifies the parameters for the XSLT document specified in the <code>Xslt</code> property

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleXmlSaveProperties Class](#)
- [OracleXmlSaveProperties Members](#)

## KeyColumnsList

This property specifies the list of columns used as a key to locate existing rows for update or delete using an XML document.

**Declaration**

```
// C#  
public string[] KeyColumnsList {get; set;}
```

**Property Value**

The list of columns.

**Remarks**

Default value is null.

The first null value (if any) terminates the list.

`KeyColumnsList` usage with `XMLCommandType` property values:

- Insert - `KeyColumnsList` is ignored and can be null.
- Update - `KeyColumnsList` must be specified; it identifies the columns to use to find the rows to be updated.
- Delete - If `KeyColumnsList` is null, all the column values in each row element in the XML document are used to locate the rows to delete. Otherwise, `KeyColumnsList` specifies the columns used to identify the rows to delete.

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleXmlSaveProperties Class](#)
- [OracleXmlSaveProperties Members](#)

## RowTag

This property specifies the value for the XML element that identifies a row of data in an XML document.

**Declaration**

```
// C#  
public string RowTag {get; set;}
```

**Property Value**

An XML element name.

**Remarks**

The default value is `ROW`.

Each element in the XML document identifies one row in a table or view.

If `RowTag` is set to "" or `null`, no row tag is used in the XML document. In this case, the XML document is assumed to contain only one row.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleXmlSaveProperties Class](#)
- [OracleXmlSaveProperties Members](#)

## Table

This property specifies the name of the table or view to which changes are saved.

### Declaration

```
// C#  
public string Table {get; set;}
```

### Property Value

A table name.

### Remarks

Default value is `null`.

The property must be set to a valid table or view name.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleXmlSaveProperties Class](#)
- [OracleXmlSaveProperties Members](#)

## UpdateColumnsList

This property specifies the list of columns to update or insert.

### Declaration

```
// C#  
public string[] UpdateColumnsList {get; set;}
```

### Property Value

A list of columns.

**Remarks**

Default value is null.

The first null value (if any) terminates the list.

UpdateColumnList usage with XMLCommandType property values:

- Insert - UpdateColumnList indicates which columns are assigned values when a new row is created. If UpdateColumnList is null, then all columns are assigned values. If a column is on the UpdateColumnList, but no value is specified for the row in the XML file, then NULL is used. If a column is not on the UpdateColumnList, then the default value for that column is used.
- Update - UpdateColumnList specifies columns to modify for each row of data in the XML document. If UpdateColumnList is null, all the values in each XML element in the XML document are used to modify the columns.
- Delete - UpdateColumnsList is ignored and can be null.

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleXmlSaveProperties Class](#)
- [OracleXmlSaveProperties Members](#)

## Xslt

This property specifies the XSL document used for XML transformation using XSLT.

**Declaration**

```
// C#  
public string Xslt {get; set;}
```

**Property Value**

The XSL document used for XML transformation.

**Remarks**

Default = null.

The XSL document is used for XSLT transformation of a given XML document. The transformed XML document is used to save changes to the table or view.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleXmlSaveProperties Class](#)
- [OracleXmlSaveProperties Members](#)

## XsltParams

This property specifies the parameters for the XSLT document specified in the `Xslt` property.

### Declaration

```
// C#
public string XsltParams {get; set;}
```

### Property Value

The parameters for the XSLT document.

### Remarks

Default is `null`.

This property is a string delimited by semicolons in "name=value" pairs of the form "param1=value1; param2=value2; ...".

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleXmlSaveProperties Class](#)
- [OracleXmlSaveProperties Members](#)

## OracleXmlSaveProperties Public Methods

The `OracleXmlSaveProperties` public methods are listed in [Table 8-11](#).

**Table 8-11 OracleXmlSaveProperties Public Methods**

Name	Description
<a href="#">Clone</a>	Creates a copy of an <code>OracleXmlSaveProperties</code> object

## Clone

This method creates a copy of an `OracleXmlSaveProperties` object.

### Declaration

```
// C#
public object Clone();
```

### Return Value

An `OracleXmlSaveProperties` object

### Implements

`ICloneable`



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleXmlSaveProperties Class](#)
- [OracleXmlSaveProperties Members](#)

## OracleXmlStream Class

An `OracleXmlStream` object represents a read-only stream of XML data stored in an `OracleXmlType` object.

### Class Inheritance

```
System.Object
    System.MarshalByRefObject
        System.Stream
            System.OracleXmlStream
```

### Declaration

```
// C#
public sealed class OracleXmlStream : IDisposable, ICloneable
```

### Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

### Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlStream Members](#)
- [OracleXmlStream Constructor](#)
- [OracleXmlStream Static Methods](#)
- [OracleXmlStream Instance Properties](#)
- [OracleXmlStream Instance Methods](#)

## OracleXmlStream Members

OracleXmlStream members are listed in the following tables.

### OracleXmlStream Constructors

The OracleXmlStream constructors are listed in [Table 8-12](#).

**Table 8-12 OracleXmlStream Constructors**

Constructor	Description
<a href="#">OracleXmlStream Constructor</a>	Creates an instance of an OracleXmlStream object which provides a Stream representation of the XML data stored in an OracleXmlType

### OracleXmlStream Static Methods

The OracleXmlStream static methods are listed in [Table 8-13](#).

**Table 8-13 OracleXmlStream Static Methods**

Methods	Description
Equals	Inherited from <code>System.Object</code> (Overloaded)

**OracleXmlStream Instance Properties**

The `OracleXmlStream` instance properties are listed in [Table 8-14](#).

**Table 8-14 OracleXmlStream Instance Properties**

Properties	Description
<a href="#">CanRead</a>	Indicates whether or not the XML stream can be read
<a href="#">CanSeek</a>	Indicates whether or not forward and backward seek operation can be performed
<a href="#">CanWrite</a>	<code>OracleXmlStream</code> is a sequential read only, forward only stream.
<a href="#">Connection</a>	Indicates the <code>OracleConnection</code> that is used to retrieve the XML data
<a href="#">Length</a>	Indicates the number of bytes in the XML stream
<a href="#">Position</a>	Gets or sets the byte position within the stream
<a href="#">Value</a>	Returns the XML data, starting from the first character in the stream as a string

**OracleXmlStream Instance Methods**

The `OracleXmlStream` instance methods are listed in [Table 8-15](#).

**Table 8-15 OracleXmlStream Instance Methods**

Methods	Description
BeginRead	Inherited from <code>System.IO.Stream</code>
BeginWrite	Inherited from <code>System.IO.Stream</code>
<a href="#">Clone</a>	Creates a copy of an <code>OracleXmlStream</code> object
<a href="#">Close</a>	Closes the current stream and releases any resources associated with it
<a href="#">Dispose</a>	Releases resources allocated by this object
EndRead	Inherited from <code>System.IO.Stream</code>
EndWrite	Inherited from <code>System.IO.Stream</code>
Equals	Inherited from <code>System.Object</code>
<a href="#">Flush</a>	<i>Not Supported</i>
GetHashCode	Inherited from <code>System.Object</code>
GetLifetimeService	Inherited from <code>System.MarshalByRefObject</code>
GetType	Inherited from <code>System.Object</code>
InitializeLifetimeService	Inherited from <code>System.MarshalByRefObject</code>

Table 8-15 (Cont.) OracleXmlStream Instance Methods

Methods	Description
<a href="#">Read</a>	Reads a specified amount from the current stream instance and populates the array buffer (Overloaded)
ReadByte	Inherited from <code>System.IO.Stream</code>
<a href="#">Seek</a>	Sets the position within the current stream and returns the new position within the current stream
<a href="#">SetLength</a>	<i>Not Supported</i>
ToString	Inherited from <code>System.Object</code>
<a href="#">Write</a>	<i>Not Supported</i>
WriteByte	<i>Not Supported</i>
<a href="#">WriteLine</a>	<i>Not Supported</i>

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlStream Class](#)

## OracleXmlStream Constructor

This constructor creates an instance of an `OracleXmlStream` object which provides a Stream representation of the XML data stored in an `OracleXmlType` object.

### Declaration

```
// C#
public OracleXmlStream(OracleXmlType xmlType);
```

### Parameters

- `xmlType`  
The `OracleXmlType` object.

### Remarks

The `OracleXmlStream` implicitly uses the `OracleConnection` object from the `OracleXmlType` object from which it was constructed.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlStream Class](#)
- [OracleXmlStream Members](#)

## OracleXmlStream Static Methods

The `OracleXmlStream` static methods are listed in [Table 8-16](#).

**Table 8-16 OracleXmlStream Static Methods**

Methods	Description
<a href="#">Equals</a>	Inherited from <code>System.Object</code> (Overloaded)

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlStream Class](#)
- [OracleXmlStream Members](#)

## OracleXmlStream Instance Properties

The `OracleXmlStream` instance properties are listed in [Table 8-17](#).

**Table 8-17 OracleXmlStream Instance Properties**

Properties	Description
<a href="#">CanRead</a>	Indicates whether or not the XML stream can be read
<a href="#">CanSeek</a>	Indicates whether or not forward and backward seek operation can be performed
<a href="#">CanWrite</a>	<code>OracleXmlStream</code> is a sequential read only, forward only stream.
<a href="#">Connection</a>	Indicates the <code>OracleConnection</code> that is used to retrieve the XML data
<a href="#">Length</a>	Indicates the number of bytes in the XML stream
<a href="#">Position</a>	Gets or sets the byte position within the stream
<a href="#">Value</a>	Returns the XML data, starting from the first character in the stream as a string

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlStream Class](#)
- [OracleXmlStream Members](#)

## CanRead

Overrides `Stream`

This property indicates whether or not the XML stream can be read.

### Declaration

```
// C#  
public override bool CanRead{get;}
```

### Property Value

If the XML stream is can be read, returns `true`; otherwise, returns `false`.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlStream Class](#)
- [OracleXmlStream Members](#)

## CanSeek

Overrides `Stream`

This property indicates whether or not forward and backward seek operation can be performed.

### Declaration

```
// C#  
public override bool CanSeek{get;}
```

### Property Value

If forward and backward seek operations can be performed, this property returns `true`. Otherwise, returns `false`.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlStream Class](#)
- [OracleXmlStream Members](#)

## CanWrite

Overrides `Stream`

`OracleXmlStream` is a sequential read only, forward only stream.

### Declaration

```
// C#  
public override bool CanWrite {get;}
```

### Property Value

Always returns `false`.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlStream Class](#)
- [OracleXmlStream Members](#)

## Connection

This instance property indicates the `OracleConnection` that is used to retrieve the XML data.

### Declaration

```
// C#  
public OracleConnection Connection {get;}
```

### Property Value

An `OracleConnection`.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlStream Class](#)
- [OracleXmlStream Members](#)

## Length

Overrides `Stream`

This property indicates the number of bytes in the XML stream.

### Declaration

```
// C#  
public override Int64 Length{get;}
```

### Property Value

An `Int64` value representing the number of bytes in the XML stream. An empty stream has a length of 0 bytes.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlStream Class](#)
- [OracleXmlStream Members](#)

## Position

Overrides `Stream`

This property gets or sets the byte position within the stream.

### Declaration

```
// C#  
public override Int64 Position{get; set;}
```

### Property Value

An `Int64` that indicates the current position in the stream.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

`ArgumentOutOfRangeException` - The `Position` is less than 0.

### Remarks

The beginning of the stream is represented by position 0. Seeking to any location beyond the length of the stream is supported.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlStream Class](#)
- [OracleXmlStream Members](#)

## Value

This property returns the XML data, starting from the first character of the stream as a string.

### Declaration

```
// C#  
public string Value{get; set;}
```

### Property Value

A `string`.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

### Remarks

The value of `Position` is neither used nor changed by using this property.

The maximum length of the string that can be returned by this property is 2 GB.

 See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlStream Class](#)
- [OracleXmlStream Members](#)

## OracleXmlStream Instance Methods

The `OracleXmlStream` instance methods are listed in [Table 8-18](#).

**Table 8-18 OracleXmlStream Instance Methods**

Methods	Description
<code>BeginRead</code>	Inherited from <code>System.IO.Stream</code>
<code>BeginWrite</code>	Inherited from <code>System.IO.Stream</code>
<a href="#">Clone</a>	Creates a copy of an <code>OracleXmlStream</code> object
<a href="#">Close</a>	Closes the current stream and releases any resources associated with it
<a href="#">Dispose</a>	Releases resources allocated by this object
<code>EndRead</code>	Inherited from <code>System.IO.Stream</code>
<code>EndWrite</code>	Inherited from <code>System.IO.Stream</code>
<code>Equals</code>	Inherited from <code>System.Object</code>
<code>Flush</code>	<i>Not Supported</i>
<code>GetHashCode</code>	Inherited from <code>System.Object</code>
<code>GetLifetimeService</code>	Inherited from <code>System.MarshalByRefObject</code>
<code>GetType</code>	Inherited from <code>System.Object</code>
<code>InitializeLifetimeService</code>	Inherited from <code>System.MarshalByRefObject</code>
<a href="#">Read</a>	Reads a specified amount from the current XML stream instance and populates the array buffer (Overloaded)
<code>ReadByte</code>	Inherited from <code>System.IO.Stream</code>
<a href="#">Seek</a>	Sets the position within the current stream and returns the new position within the current stream
<code>SetLength</code>	<i>Not Supported</i>
<code>ToString</code>	Inherited from <code>System.Object</code>
<code>Write</code>	<i>Not Supported</i>
<code>WriteByte</code>	<i>Not Supported</i>
<code>WriteLine</code>	<i>Not Supported</i>

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlStream Class](#)
- [OracleXmlStream Members](#)

## Clone

This method creates a copy of an `OracleXmlStream` object.

### Declaration

```
// C#  
public object Clone();
```

### Return Value

An `OracleXmlStream` object.

### Implements

`ICloneable`

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

### Remarks

The cloned object has the same property values as that of the object being cloned.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlStream Class](#)
- [OracleXmlStream Members](#)

## Close

Overrides `Stream`

This method closes the current stream and releases any resources associated with it.

**Declaration**

```
// C#  
public override void Close();
```

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlStream Class](#)
- [OracleXmlStream Members](#)

## Dispose

This public method releases resources allocated by this object.

**Declaration**

```
// C#  
public void Dispose();
```

**Implements**

IDisposable

**Remarks**

The object cannot be reused after being disposed. Although some properties can still be accessed, their values cannot be accountable. Since resources are freed, method calls can lead to exceptions.

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlStream Class](#)
- [OracleXmlStream Members](#)

## Flush

This method is not supported.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlStream Class](#)
- [OracleXmlStream Members](#)

## Read

This method reads a specified amount from the current XML stream instance and populates the array buffer.

**Overload List:**

- [Read\(byte\[\], int, int\)](#)  
This method reads a specified amount of unicode bytes from the current instance, advances the position within the stream, and populates the byte array buffer.
- [Read\(char\[\], int, int\)](#)  
This method reads a specified amount of characters from the current instance, advances the position within the stream, and populates the character array buffer.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlStream Class](#)
- [OracleXmlStream Members](#)

## Read(byte[], int, int)

Overrides `Stream`

This method reads a specified amount of unicode bytes from the current instance, advances the position within the stream, and populates the byte array buffer.

**Declaration**

```
// C#  
public override int Read(byte[] buffer, int offset, int count);
```

**Parameters**

- *buffer*  
The byte array buffer that is populated.
- *offset*

The zero-based offset (in bytes) at which the buffer is populated.

- *count*

The maximum amount of bytes to be read.

### Return Value

The number of unicode bytes read into the given `byte[]` buffer or 0 if the end of the stream has been reached.

### Remarks

This method reads a maximum of *count* bytes from the current stream and stores them in buffer beginning at *offset*. The current position within the stream is advanced by the number of bytes read. However, if an exception occurs, the current position within the stream remains unchanged.

The XML data is read starting from the position specified by the `Position` property.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlStream Class](#)
- [OracleXmlStream Members](#)

## Read(char[ ], int, int)

Overrides `Stream`

This method reads a specified amount of characters from the current instance, advances the position within the stream, and populates the character array buffer.

### Declaration

```
// C#  
public override int Read(char[] buffer, int offset, int count);
```

### Parameters

- *buffer*

The character array buffer to be populated.

- *offset*

The zero-based offset (in characters) in the buffer at which the buffer is populated.

- *count*

The maximum amount of characters to be read from the stream.

### Return Value

The return value indicates the number of characters read from the stream or 0 if the end of the stream has been reached.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

### Remarks

This method requires that the `Position` on the stream instance be zero or an even number.

The XML data is read starting from the position specified by the `Position` property.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlStream Class](#)
- [OracleXmlStream Members](#)

## Seek

Overrides `Stream`.

This method sets the position within the current stream and returns the new position within the current stream.

### Declaration

```
// C#  
public long Seek(long offset, SeekOrigin origin);
```

### Parameters

- *offset*

A byte offset relative to origin.

- If *offset* is negative, the new position precedes the position specified by *origin* by the number of bytes specified by *offset*.
- If *offset* is zero, the new position is the position specified by *origin*.
- If *offset* is positive, the new position follows the position specified by *origin* by the number of bytes specified by *offset*.

- *origin*

A value of type `SeekOrigin` indicating the reference point used to obtain the new position.

### Return Value

The new `Position` within the current stream.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object

### Remarks

Use the `CanSeek` property to determine whether or not the current instance supports seeking. Seeking to any location beyond the length of the stream is supported.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlStream Class](#)
- [OracleXmlStream Members](#)

## SetLength

This method is not supported.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlStream Class](#)
- [OracleXmlStream Members](#)

## Write

This method is not supported.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlStream Class](#)
- [OracleXmlStream Members](#)

## WriteLine

This method is not supported.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlStream Class](#)
- [OracleXmlStream Members](#)

## OracleXmlType Class

An `OracleXmlType` object represents an Oracle `XMLType` instance.

### Class Inheritance

`System.Object`

`System.OracleXmlType`

### Declaration

```
// C#
public sealed class OracleXmlType : IDisposable, INullable
```

### Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

### Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

### Remarks

`OracleXmlType` objects can be used for well-formed XML documents with or without XML schemas or XML fragments.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Members](#)
- [OracleXmlType Constructors](#)
- [OracleXmlType Static Methods](#)
- [OracleXmlType Static Fields](#)
- [OracleXmlType Instance Properties](#)
- [OracleXmlType Instance Methods](#)

## OracleXmlType Members

`OracleXmlType` members are listed in the following tables.

### OracleXmlType Constructors

The `OracleXmlType` constructors are listed in [Table 8-19](#).

**Table 8-19 OracleXmlType Constructors**

Constructor	Description
<a href="#">OracleXmlType Constructors</a>	Creates an instance of the <code>OracleXmlType</code> class (Overloaded)

### OracleXmlType Static Methods

The `OracleXmlType` static methods are listed in [Table 8-20](#).

**Table 8-20 OracleXmlType Static Methods**

Methods	Description
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)

## OracleXmlType Static Fields

The `OracleXmlType` static field is listed in [Table 8-21](#).

**Table 8-21 OracleXmlType Static Field**

Static Field	Description
<a href="#">Null</a>	Represents a null value that can be assigned to an <code>OracleXmlType</code> instance

## OracleXmlType Instance Properties

The `OracleXmlType` instance properties are listed in [Table 8-22](#).

**Table 8-22 OracleXmlType Instance Properties**

Properties	Description
<a href="#">Connection</a>	Indicates the <code>OracleConnection</code> that is used to retrieve and store XML data in the <code>OracleXmlType</code>
<a href="#">IsEmpty</a>	Indicates whether or not the <code>OracleXmlType</code> is empty
<a href="#">IsFragment</a>	Indicates whether the XML data is a collection of XML elements or a well-formed XML document
<a href="#">IsNull</a>	Indicates whether or not the <code>OracleXmlType</code> is null
<a href="#">IsSchemaBased</a>	Indicates whether or not the XML data represented by the <code>OracleXmlType</code> is based on an XML schema
<a href="#">RootElement</a>	Represents the name of the top-level element of the schema-based XML data contained in the <code>OracleXmlType</code>
<a href="#">Schema</a>	Represents the XML schema of the XML data contained in the <code>OracleXmlType</code>
<a href="#">SchemaUri</a>	Represents in the database for the XML schema of the XML data contained in the <code>OracleXmlType</code> .
<a href="#">Value</a>	Returns the XML data starting from the first character in the current instance as a string

## OracleXmlType Instance Methods

The `OracleXmlType` instance methods are listed in [Table 8-23](#).

**Table 8-23 OracleXmlType Instance Methods**

Methods	Description
<a href="#">Clone</a>	Creates a copy of the <code>OracleXmlType</code> instance
<a href="#">Dispose</a>	Releases the resources allocated by this <code>OracleXmlType</code> object
<code>Equals</code>	Inherited from <code>System.Object</code>
<a href="#">Extract</a>	Extracts a subset from the XML data using the given XPath expression (Overloaded)
<code>GetHashCode</code>	Inherited from <code>System.Object</code>

Table 8-23 (Cont.) OracleXmlType Instance Methods

Methods	Description
<a href="#">GetStream</a>	Returns an instance of <code>OracleXmlStream</code> which provides a read-only stream of the XML data stored in this <code>OracleXmlType</code> instance
<code>GetType</code>	Inherited from <code>System.Object</code>
<a href="#">GetXmlDocument</a>	Returns a <code>XmlDocument</code> object containing the XML data stored in this <code>OracleXmlType</code> instance
<a href="#">GetXmlReader</a>	Returns a <code>XmlTextReader</code> object that can be used to manipulate XML data directly using the .NET Framework classes and methods
<a href="#">IsExists</a>	Checks for the existence of a particular set of nodes identified by the given XPath expression in the XMLdata (Overloaded)
<code>ToString</code>	Inherited from <code>System.Object</code>
<a href="#">Transform</a>	Transforms the <code>OracleXmlType</code> into another <code>OracleXmlType</code> instance using the given XSL document (Overloaded)
<a href="#">Update</a>	Updates the XML node or fragment identified by the given XPath expression in the current <code>OracleXmlType</code> instance (Overloaded)
<a href="#">Validate</a>	Validates whether or not the XML data in the <code>OracleXmlType</code> object conforms to the given XML schema.

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)

## OracleXmlType Constructors

`OracleXmlType` constructors create instances of the `OracleXmlType` class.

**Overload List:**

- [OracleXmlType\(OracleClob\)](#)  
This constructor creates an instance of the `OracleXmlType` class using the XML data contained in an `OracleClob` object.
- [OracleXmlType\(OracleConnection, string\)](#)  
This constructor creates an instance of the `OracleXmlType` class using the XML data contained in the .NET `String`.
- [OracleXmlType\(OracleConnection, XmlReader\)](#)  
This constructor creates an instance of the `OracleXmlType` class using the contents of the .NET `XmlReader` object.
- [OracleXmlType\(OracleConnection, XmlDocument\)](#)

This constructor creates an instance of the `OracleXmlType` object using the contents of the XML DOM document in the .NET `XmlDocument` object.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

## OracleXmlType(OracleClob)

This constructor creates an instance of the `OracleXmlType` class using the XML data contained in an `OracleClob` object.

### Declaration

```
// C#  
public OracleXmlType(OracleClob oraClob);
```

### Parameters

- `oraClob`  
An `OracleClob` object.

### Exceptions

`ArgumentNullException` - The `OracleClob` object is null.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

### Remarks

The CLOB data depends on a valid connection object and the new `OracleXMLType` uses the `OracleConnection` in the `OracleClob` object to store data for the current instance.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

## OracleXmlType(OracleConnection, string)

This constructor creates an instance of the `OracleXmlType` class using the XML data contained in the .NET `String`.

### Declaration

```
// C#  
public OracleXmlType(OracleConnection con, string xmlData);
```

### Parameters

- `con`  
An `OracleConnection` object.
- `xmlData`  
A string containing the XML data.

### Exceptions

`ArgumentNullException` - The `OracleConnection` object is null.

`ArgumentException` - The `xmlData` argument is an empty string.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

### Remarks

The new `OracleXmlType` uses the given `OracleConnection` object to store data for the current instance.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

## OracleXmlType(OracleConnection, XmlReader)

This constructor creates an instance of the `OracleXmlType` class using the contents of the .NET `XmlReader` object.

### Declaration

```
// C#  
public OracleXmlType(OracleConnection con, XmlReader reader);
```

### Parameters

- *con*  
An `OracleConnection` object.
- *reader*  
An `XmlReader` object.

### Exceptions

`ArgumentNullException` - The `OracleConnection` object is null.

`ArgumentException` - The *reader* argument contains no data.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

### Remarks

The new `OracleXMLType` uses the given `OracleConnection` object to store data for the current instance.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

## OracleXmlType(OracleConnection, XmlDocument)

This constructor creates an instance of the `OracleXmlType` object using the contents of the XML **DOM** document in the .NET `XmlDocument` object.

### Declaration

```
// C#  
public OracleXmlType(OracleConnection con, XmlDocument domDoc);
```

### Parameters

- *con*  
An `OracleConnection` object.
- *domDoc*  
An XML document.

### Exceptions

`ArgumentNullException` - The `OracleConnection` object is null.

`ArgumentException` - The `domDoc` argument contains no data.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

### Remarks

The new `OracleXMLType` uses the given `OracleConnection` object to store data for the current instance.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

## OracleXmlType Static Methods

The `OracleXmlType` static methods are listed in [Table 8-24](#).

**Table 8-24 OracleXmlType Static Methods**

Methods	Description
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

## OracleXmlType Static Fields

The `OracleXmlType` static field is listed in [Table 8-25](#).

**Table 8-25 OracleXmlType Static Field**

Static Field	Description
<code>Null</code>	Represents a null value that can be assigned to an <code>OracleXmlType</code> instance

 See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

## Null

This static field represents a null value that can be assigned to an `OracleXmlType` instance.

### Declaration

```
// C#
public static readonly OracleXmlType Null;
```

 See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

## OracleXmlType Instance Properties

The `OracleXmlType` instance properties are listed in [Table 8-26](#).

**Table 8-26 OracleXmlType Instance Properties**

Properties	Description
<a href="#">Connection</a>	Indicates the <code>OracleConnection</code> that is used to retrieve and store XML data in the <code>OracleXmlType</code>
<a href="#">IsEmpty</a>	Indicates whether or not the <code>OracleXmlType</code> is empty
<a href="#">IsFragment</a>	Indicates whether the XML data is a collection of XML elements or a well-formed XML document
<a href="#">IsNull</a>	Indicates whether or not the <code>OracleXmlType</code> is null
<a href="#">IsSchemaBased</a>	Indicates whether or not the XML data represented by the <code>OracleXmlType</code> is based on an XML schema
<a href="#">Null</a>	Represents a null value that can be assigned to an <code>OracleXmlType</code> instance
<a href="#">RootElement</a>	Represents the name of the top-level element of the schema-based XML data contained in the <code>OracleXmlType</code>

**Table 8-26 (Cont.) OracleXmlType Instance Properties**

Properties	Description
<a href="#">Schema</a>	Represents the XML schema of the XML data contained in the <code>OracleXmlType</code>
<a href="#">SchemaUrl</a>	Represents <a href="#">URL</a> in the database for the XML schema of the XML data contained in the <code>OracleXmlType</code>
<a href="#">Value</a>	Returns the XML data starting from the first character in the current instance as a string

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

## Connection

This property indicates the `OracleConnection` that is used to retrieve and store XML data in the `OracleXmlType`.

### Declaration

```
// C#  
public OracleConnection Connection {get;}
```

### Property Value

An `OracleConnection` object.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

### Remarks

The connection must explicitly be opened by the user before creating or using `OracleXmlType`.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

## IsEmpty

This property indicates whether or not the `OracleXmlType` is empty.

### Declaration

```
// C#  
public bool IsEmpty {get;}
```

### Property Value

Returns `true` if the `OracleXmlType` represents an empty XML document. Returns `false` otherwise.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

## IsFragment

This property indicates whether the XML data is a collection of XML elements or a well-formed XML document.

### Declaration

```
// C#  
public bool IsFragment {get;}
```

### Property Value

Returns `true` if the XML data contained in the `OracleXmlType` object is a collection of XML elements with no root element. Returns `false` otherwise.

## Exceptions

`ObjectDisposedException` - The object is already disposed.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

## IsNull

This property indicates whether or not the `OracleXmlType` is null.

### Declaration

```
// C#  
public bool IsNull {get;}
```

### Property Value

Returns `true` if the `OracleXmlType` represents a null value. Returns `false` otherwise.

## Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

## IsSchemaBased

This property indicates whether or not the XML data represented by the `OracleXmlType` is based on an XML schema.

### Declaration

```
// C#  
public bool IsSchemaBased {get;}
```

### Property Value

Returns `true` if the XML data represented by the `OracleXmlType` is based on an XML schema. Returns `false` otherwise.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

## RootElement

This property represents the name of the top-level or root element of the schema-based XML data contained in the `OracleXmlType`.

### Declaration

```
// C#  
public string RootElement{get;}
```

### Property Value

A string that represents the name of the top-level or root element of the XML data contained in the `OracleXmlType`.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

### Remarks

If the `OracleXmlType` instance contains non-schema based XML data, this property returns an empty string.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

## Schema

This property represents the XML schema for the XML data contained in the `OracleXmlType`.

### Declaration

```
// C#  
public OracleXmlType Schema {get;}
```

### Property Value

An `OracleXmlType` instance that represents the XML schema for the XML data contained in the `OracleXmlType`.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

### Remarks

If the `OracleXmlType` instance contains non-schema based XML data, this property returns an `OracleXmlType` instance representing an empty XML document.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

## SchemaUrl

This property represents the XML schema in the database for the XML schema of the XML data contained in the `OracleXmlType`.

### Declaration

```
// C#  
public string SchemaUrl {get;}
```

### Property Value

A string that represents the URL in the database for the XML schema of the XML data.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

### Remarks

If the `OracleXmlType` instance contains non-schema based XML data, this property returns an empty string.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

## Value

This property returns the XML data starting from the first character in the current instance as a string.

### Declaration

```
// C#  
public string Value{get;}
```

### Property Value

The entire XML data as a string.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

## OracleXmlType Instance Methods

The `OracleXmlType` instance methods are listed in [Table 8-27](#).

Table 8-27 OracleXmlType Instance Methods

Methods	Description
<a href="#">Clone</a>	Creates a copy of the <code>OracleXmlType</code> instance
<a href="#">Dispose</a>	Releases the resources allocated by this <code>OracleXmlType</code> object
<code>Equals</code>	Inherited from <code>System.Object</code>
<a href="#">Extract</a>	Extracts a subset from the XML data using the given XPath expression (Overloaded)
<code>GetHashCode</code>	Inherited from <code>System.Object</code>
<a href="#">GetStream</a>	Returns an instance of <code>OracleXmlStream</code> which provides a read-only stream of the XML data stored in this <code>OracleXmlType</code> instance
<code>GetType</code>	Inherited from <code>System.Object</code>
<a href="#">GetXmlDocument</a>	Returns a <code>XmlDocument</code> object containing the XML data stored in this <code>OracleXmlType</code> instance
<a href="#">GetXmlReader</a>	Returns a <code>XmlTextReader</code> object that can be used to manipulate XML data directly using the .NET Framework classes and methods
<a href="#">IsExists</a>	Checks for the existence of a particular set of nodes identified by the given XPath expression in the XMLdata (Overloaded)
<code>ToString</code>	Inherited from <code>System.Object</code>
<a href="#">Transform</a>	Transforms the <code>OracleXmlType</code> into another <code>OracleXmlType</code> instance using the given XSL document (Overloaded)
<a href="#">Update</a>	Updates the XML node or fragment identified by the given XPath expression in the current <code>OracleXmlType</code> instance (Overloaded)
<a href="#">Validate</a>	Validates whether or not the XML data in the <code>OracleXmlType</code> object conforms to the given XML schema.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

## Clone

This method creates a copy of this `OracleXmlType` instance.

### Declaration

```
// C#
public object Clone();
```

**Implements**

ICloneable

**Return Value**

An OracleXmlType object.

**Exceptions**

ObjectDisposedException - The object is already disposed.

InvalidOperationException - The OracleConnection is not open or has been closed during the lifetime of the object.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

## Dispose

This method releases the resources allocated by this object.

**Declaration**

```
// C#  
public void Dispose();
```

**Implements**

IDisposable

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

## Extract

This method extracts a subset from the XML data using the given XPath expression.

**Overload List:**

- [Extract\(string, string\)](#)

This method extracts a subset from the XML data represented by the `OracleXmlType` object using the given XPath expression and a string parameter for namespace resolution.

- [Extract\(string, XmlNamespaceManager\)](#)

This method extracts a subset from the XML data represented by the `OracleXmlType` object, using the given XPath expression and a .NET `XmlNamespaceManager` object for namespace resolution.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

## Extract(string, string)

This method extracts a subset from the XML data represented by the `OracleXmlType` object using the given XPath expression and a string parameter for namespace resolution.

**Declaration**

```
// C#  
public OracleXmlType Extract(string xpathExpr, string nsMap);
```

**Parameters**

- *xpathExpr*

The XPath expression.

- *nsMap*

The string parameter used for namespace resolution of the XPath expression. *nsMap* has zero or more namespaces separated by spaces. *nsMap* can be null. For example:

```
xmlns:nsi="http://www.company1.com" xmlns:nsz="http://www.company2.com"
```

**Return Value**

An `OracleXmlType` object.

**Exceptions**

`ObjectDisposedException` - The object is already disposed.

`ArgumentNullException` - The *xpathExpr* is null or zero-length.

InvalidOperationException - The `OracleConnection` is not open or has been closed during the lifetime of the object.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

## Extract(string, XmlNameSpaceManager)

This public method extracts a subset from the XML data represented by the `OracleXmlType` object, using the given XPath expression and a .NET `XmlNameSpaceManager` object for namespace resolution.

### Declaration

```
// C#  
public OracleXmlType Extract(string xpathExpr, XmlNameSpaceManager nsMgr);
```

### Parameters

- *xpathExpr*  
The XPath expression.
- *nsMgr*  
The .NET `XmlNameSpaceManager` object used for namespace resolution of the XPath expression. *nsMgr* can be null.

### Return Value

An `OracleXmlType`.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`ArgumentNullException` - The *xpathExpr* is null or zero-length.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

### Remarks

The default namespace is ignored if its value is an empty string.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

## GetStream

This public method returns an instance of `OracleXmlStream` which provides a read-only stream of the XML data stored in this `OracleXmlType` instance.

### Declaration

```
// C#  
public Stream GetStream();
```

### Return Value

A `Stream` object.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

## GetXmlDocument

This public method returns a `XmlDocument` object containing the XML data stored in this `OracleXmlType` instance.

### Declaration

```
// C#  
public XmlDocument GetXmlDocument();
```

### Return Value

An `XmlDocument` object.

## Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

## Remarks

The XML data in the `XmlDocument` object is a copy of the XML data in the `OracleXmlType` instance and modifying it does not automatically modify the XML data in the `OracleXmlType` instance. The `XmlDocument` instance returned has the `PreserveWhitespace` property set to `true`.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

## GetXmlReader

This public method returns a `XmlTextReader` object that can be used to manipulate XML data directly using the .NET Framework classes and methods.

## Declaration

```
// C#  
public XmlTextReader GetXmlReader();
```

## Return Value

An `XmlTextReader` object.

## Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

## Remarks

The `XmlTextReader` is a read-only, forward-only representation of the XML data stored in the `OracleXmlType` instance.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

## IsExists

`IsExists` checks for the existence of a particular set of nodes identified by the XPath expression in the XML data.

### Overload List:

- [IsExists\(string, string\)](#)

This method checks for the existence of a particular set of nodes identified by the XPath expression in the XML data represented by the current `OracleXmlType` instance using a string parameter for namespace resolution.
- [IsExists\(string, XmlNamespaceManager\)](#)

This method checks for the existence of a particular set of nodes identified by the XPath expression in the XML document represented by the current `OracleXmlType` instance using a .NET `XmlNamespaceManager` object for namespace resolution.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

## IsExists(string, string)

This method checks for the existence of a particular set of nodes identified by the XPath expression in the XML data represented by the current `OracleXmlType` instance using a string parameter for namespace resolution.

### Declaration

```
// C#  
public bool IsExists(string xpathExpr, string nsMap);
```

### Parameters

- `xpathExpr`  
The XPath expression.

- *nsMap*

The string parameter used for namespace resolution of the XPath expression. *nsMap* has zero or more namespaces separated by spaces. *nsMap* can be null.

### Return Value

Returns `true` if the required set of nodes exists; otherwise, returns `false`.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`ArgumentNullException` - The *xpathExpr* is null or zero-length.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

### Remarks

The default namespace is ignored if its value is an empty string.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

## IsExists(string, XmlNamespaceManager)

This method checks the existence of a particular set of nodes identified by the XPath expression in the XML document represented by the current `OracleXmlType` instance using a .NET `XmlNamespaceManager` object for namespace resolution.

### Declaration

```
// C#  
public bool IsExists(string xpathExpr, XmlNamespaceManager nsMgr);
```

### Parameters

- *xpathExpr*

The XPath expression.

- *nsMgr*

The .NET `XmlNamespaceManager` object used for namespace resolution of the XPath expression. *nsMgr* can be null.

### Return Value

Returns `true` if the required set of nodes exists; otherwise, returns `false`.

## Exceptions

`ObjectDisposedException` - The object is already disposed.

`ArgumentNullException` - The `xpathExpr` is null or zero-length.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

## Remarks

The default namespace is ignored if its value is an empty string.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

## Transform

This method transforms the `OracleXmlType` into another `OracleXmlType` instance using the given XSL document.

### Overload List:

- [Transform\(OracleXmlType, string\)](#)

This method transforms the current `OracleXmlType` instance into another `OracleXmlType` instance using the given XSL document (as an `OracleXmlType` object) and a string of XSLT parameters.
- [Transform\(string, string\)](#)

This public method transforms the current `OracleXmlType` instance into another `OracleXmlType` instance using the given XSL document and a string of XSLT parameters.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

## Transform(OracleXmlType, string)

This method transforms the current `OracleXmlType` instance into another `OracleXmlType` instance using the given XSL document and a string of XSLT parameters.

### Declaration

```
// C#  
public OracleXmlType Transform(OracleXmlType xslDoc, string paramMap);
```

### Parameters

- `xslDoc`  
The XSL document as an `OracleXmlType` object.
- `paramMap`  
A string which provides the parameters for the XSL document.  
For this release, `paramMap` is ignored.

### Return Value

An `OracleXmlType` object containing the transformed XML document.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`ArgumentNullException` - The `xslDoc` parameter is null.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

## Transform(string, string)

This method transforms the current `OracleXmlType` instance into another `OracleXmlType` instance using the given XSL document and a string of XSLT parameters.

### Declaration

```
// C#  
public OracleXmlType Transform(string xslDoc, string paramMap);
```

### Parameters

- *xslDoc*  
The XSL document to be used for XSLT.
- *paramMap*  
A string which provides the parameters for the XSL document.  
For this release, *paramMap* is ignored.

### Return Value

An `OracleXmlType` object containing the transformed XML document.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`ArgumentNullException` - The *xslDoc* parameter is null.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

## Update

This method updates the XML node or fragment identified by the given XPath expression in the current `OracleXmlType` instance.

### Overload List:

- [Update\(string, string, string\)](#)  
This method updates the XML nodes identified by the given XPath expression with the given string value and a string parameter for namespace resolution.
- [Update\(string, XmlNamespaceManager, string\)](#)  
This method updates the XML nodes identified by the given XPath expression with the given string value and a .NET `XmlNamespaceManager` object for namespace resolution.
- [Update\(string, string, OracleXmlType\)](#)  
This method updates the XML nodes identified by the given XPath expression with the XML data stored in the given `OracleXmlType` value and a string parameter for namespace resolution.

- [Update\(string, XmlNamespaceManager, OracleXmlType\)](#)

This method updates the XML nodes identified by the given XPath expression with the XML data stored in the given `OracleXmlType` value and a .NET `XmlNamespaceManager` object for namespace resolution.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

## Update(string, string, string)

This method updates the XML nodes identified by the given XPath expression with the given string value and a string parameter for namespace resolution.

### Declaration

```
// C#  
public void Update(string xpathExpr, string nsMap, string value);
```

### Parameters

- *xpathExpr*  
The XPath expression that identifies the nodes to update.
- *nsMap*  
The string parameter used for namespace resolution of the XPath expression. *nsMap* has zero or more namespaces separated by spaces. *nsMap* can be null. For example:  

```
xmlns:nsi="http://www.company1.com" xmlns:nsz="http://www.company2.com"
```
- *value*  
The new value as a string.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`ArgumentNullException` - The *xpathExpr* is null or zero-length.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

### Remarks

The default namespace is ignored if its value is an empty string.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

## Update(string, XmlNamespaceManager, string)

This method updates the XML nodes identified by the given XPath expression with the given string value and a .NET `XmlNamespaceManager` object for namespace resolution.

### Declaration

```
// C#  
public void Update(string xpathExpr, XmlNamespaceManager nsMgr, string  
    value);
```

### Parameters

- *xpathExpr*  
The XPath expression that identifies the nodes to update.
- *nsMgr*  
The .NET `XmlNamespaceManager` object used for namespace resolution of the XPath expression. *nsMgr* can be null.
- *value*  
The new value as a string.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`ArgumentNullException` - The *xpathExpr* is null or zero-length.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

### Remarks

The default namespace is ignored if its value is an empty string.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

## Update(string, string, OracleXmlType)

This method updates the XML nodes identified by the given XPath expression with the XML data stored in the given `OracleXmlType` value and a string parameter for namespace resolution.

### Declaration

```
// C#  
public void Update(string xpathExpr, string nsMap, OracleXmlType value);
```

### Parameters

- *xpathExpr*  
The XPath expression that identifies the nodes to update.
- *nsMap*  
The string parameter used for namespace resolution of the XPath expression. *nsMap* has zero or more namespaces separated by spaces. *nsMap* can be null.
- *value*  
The new value as an `OracleXmlType` object.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`ArgumentNullException` - The *xpathExpr* is null or zero-length.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

### Remarks

The default namespace is ignored if its value is an empty string.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

## Update(string, XmlNamespaceManager, OracleXmlType)

This method updates the XML nodes identified by the given XPath expression with the XML data stored in the given `OracleXmlType` value and a .NET `XmlNamespaceManager` object for namespace resolution.

### Declaration

```
// C#  
public void Update(string xpathExpr, XmlNamespaceManager nsMgr,  
OracleXmlType value);
```

### Parameters

- *xpathExpr*  
The XPath expression that identifies the nodes to update.
- *nsMgr*  
The .NET `XmlNamespaceManager` object used for namespace resolution of the XPath expression. *nsMgr* can be null.
- *value*  
The new value as an `OracleXmlType` object.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`ArgumentNullException` - The *xpathExpr* is null or zero-length.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

### Remarks

The default namespace is ignored if its value is an empty string.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

## Validate

This methods validates whether or not the XML data in the `OracleXmlType` object conforms to the given XML schema.

### Declaration

```
// C#  
public bool Validate(String schemaUrl);
```

### Parameters

- `schemaUrl`  
A string representing the [URL](#) in the database of the XML schema.

### Return Value

Returns true if the XML data conforms to the XML schema; otherwise, returns false.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

`ArgumentNullException` - The `schemaUrl` argument is null or an empty string.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleXmlType Class](#)
- [OracleXmlType Members](#)

# 9

## Oracle Data Provider for .NET HA Event Classes

This chapter describes the following ODP.NET HA event class and enumerations:

- [OracleHAEventArgs Class](#)
- [OracleHAEventHandler Delegate](#)
- [OracleHAEventSource Enumeration](#)
- [OracleHAEventStatus Enumeration](#)

### OracleHAEventArgs Class

The `OracleHAEventArgs` class provides event data for the `OracleConnection.HAEvent` event.

#### Class Inheritance

```
System.Object
    System.EventArgs
        Oracle.DataAccess.Client.OracleHAEventArgs
```

#### Declaration

```
// C#
public sealed class OracleHAEventArgs
```

#### Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

#### Thread Safety

All public methods are thread-safe, although instance methods do not guarantee thread safety.

## Remarks

When any HA event occurs for a service, service member, host, node, or instance that an `OracleConnection` object is set to with `"ha events=true"`, the `OracleConnection.HAEvent` is triggered and passes an instance of `OracleHAEventArgs` to all the delegates that have registered with the event.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleHAEventArgs Members](#)
- [OracleHAEventArgs Properties](#)
- ["OracleConnection Class"](#)
- ["HAEvent"](#)

## OracleHAEventArgs Members

`OracleHAEventArgs` members are listed in the following table.

### OracleHAEventArgs Properties

The `OracleHAEventArgs` properties are listed in [Table 9-2](#).

**Table 9-1 OracleHAEventArgs Properties**

Name	Description
<a href="#">DatabaseDomainName</a>	Specifies the domain name of the database affected by the <code>HAevent</code>
<a href="#">DatabaseName</a>	Specifies the database affected by the <code>HAevent</code>
<a href="#">DrainTimeout</a>	Indicates the number of seconds allowed for resource draining to be completed during a planned outage
<a href="#">HostName</a>	Specifies the host that triggered the event
<a href="#">InstanceName</a>	Specifies the instance that triggered the event
<a href="#">Reason</a>	Specifies the reason for which the HA event was sent by the server
<a href="#">ServiceName</a>	Specifies the service that triggered the event
<a href="#">Source</a>	Specifies the source that triggered the event
<a href="#">Status</a>	Specifies the status of the source that triggered the event
<a href="#">Time</a>	Specifies the time when the event was triggered on the server

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleHAEventArgs Class](#)
- ["HAEvent"](#)

## OracleHAEventArgs Properties

The `OracleHAEventArgs` properties are listed in [Table 9-2](#).

**Table 9-2 OracleHAEventArgs Properties**

Name	Description
<a href="#">DatabaseDomainName</a>	Specifies the domain name of the database affected by the <code>HAEvent</code>
<a href="#">DatabaseName</a>	Specifies the database affected by the <code>HAEvent</code>
<a href="#">DrainTimeout</a>	Indicates the number of seconds allowed for resource draining to be completed during a planned outage
<a href="#">HostName</a>	Specifies the host that triggered the event
<a href="#">InstanceName</a>	Specifies the instance that triggered the event
<a href="#">Reason</a>	Specifies the reason for which the HA event was sent by the server
<a href="#">ServiceName</a>	Specifies the service that triggered the event
<a href="#">Source</a>	Specifies the source that triggered the event
<a href="#">Status</a>	Specifies the status of the source that triggered the event
<a href="#">Time</a>	Specifies the time when the event was triggered on the server

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleHAEventArgs Class](#)
- [OracleHAEventArgs Members](#)

## DatabaseDomainName

This property specifies the domain name of the database that is affected by the HA event.

### Declaration

```
// C#
public string DatabaseDomainName {get;}
```

### Property Value

The domain name of the database that is affected by the HA Event.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleHAEventArgs Class](#)
- [OracleHAEventArgs Members](#)
- ["HAEvent"](#)

## DatabaseName

This property specifies the database that is affected by the HA event.

### Declaration

```
// C#  
public string DatabaseName {get;}
```

### Property Value

This property specifies the database name that is affected by the HA event.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleHAEventArgs Class](#)
- [OracleHAEventArgs Members](#)
- ["HAEvent"](#)

## DrainTimeout

An integer value indicating the maximum time period in seconds that ODP.NET waits for the service to drain connections from the database service from when the Fast Application Notification `SERVICE DOWN` event is received.

### Declaration

```
// C#  
public int DrainTimeout {get;}
```

### Property Value

The number of seconds allowed for resource draining to be completed during a planned outage

### Remarks

When connecting to Oracle Data Guard in Oracle Database 12c Release 2 or later, database administrators can set their own timeout value, `drain_timeout`, to indicate the number of seconds allowed for resource draining to be completed during a planned outage. The `drain_timeout` value populates `OracleHAEventArgs.DrainTimeout.drain_timeout` can be used by the ODP.NET `ServiceRelocationConnectionTimeout` to wait for a service to be relocated before attempting new connections.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleHAEventArgs Class](#)
- [OracleHAEventArgs Members](#)
- ["HAEvent"](#)
- [ServiceRelocationConnectionTimeout](#)

## HostName

This property specifies the host that triggered the HA event.

### Declaration

```
// C#  
public string HostName {get;}
```

### Property Value

The host that is affected by the HA Event.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleHAEventArgs Class](#)
- [OracleHAEventArgs Members](#)
- ["HAEvent"](#)

## InstanceName

This property specifies the instance that triggered the HA event.

### Declaration

```
// C#  
public string InstanceName {get;}
```

### Property Value

The instance that is affected by the HA Event.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleHAEventArgs Class](#)
- [OracleHAEventArgs Members](#)
- ["HAEvent"](#)

## Reason

This property specifies reason for which the HA event was sent by the server.

### Declaration

```
// C#  
public string Reason {get;}
```

### Property Value

The reason the HA Event was triggered. Possible values include `Data_Guard_Failover`, `Failure`, `Dependency`, `User`, `Autostart`, and `Restart`.

The value `User` is indicative of a planned outage. All other values are indicative of an unplanned outage.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleHAEventArgs Class](#)
- [OracleHAEventArgs Members](#)
- ["HAEvent"](#)

## ServiceName

This property specifies the service that triggered the HA event.

### Declaration

```
// C#  
public string ServiceName {get;}
```

### Property Value

The service that is affected by the HA Event.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleHAEventArgs Class](#)
- [OracleHAEventArgs Members](#)
- ["HAEvent"](#)

## Source

This property specifies the source that triggered the HA event.

### Declaration

```
// C#  
public OracleHAEventSource Source {get;}
```

### Property Value

The source that triggered the HA Event.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleHAEventArgs Class](#)
- [OracleHAEventArgs Members](#)
- ["HAEvent"](#)

## Status

This property specifies the status of the source that triggered the HA event.

### Declaration

```
// C#  
public OracleHAEventStatus Status {get;}
```

### Property Value

The status of the source that triggered the HA Event.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleHAEventArgs Class](#)
- [OracleHAEventArgs Members](#)
- ["HAEvent"](#)

## Time

This property specifies the time when the HA event was triggered on the server.

### Declaration

```
// C#  
public DateTime Time {get;}
```

### Property Value

The time that the HA Event was triggered.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleHAEventArgs Class](#)
- [OracleHAEventArgs Members](#)
- ["HAEvent"](#)

## OracleHAEventHandler Delegate

The `OracleHAEventHandler` delegate represents the signature of the method that handles the `OracleConnection.HAEvent` event.

## Declaration

```
// C#
public delegate void OracleHAEvEntHandler(OracleHAEvEntArgs eventArgs);
```

## Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

## Parameters

- *sender*  
The source of the event.
- *EventArgs*  
The `OracleHAEvEntArgs` object that contains the event data.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleHAEvEntArgs Class](#)
- ["HAEvEnt"](#)

# OracleHAEvEntSource Enumeration

The `OracleHAEvEntSource` enumeration indicates the source of the HA event.

[Table 9-3](#) lists all the `OracleHAEvEntSource` enumeration values with a description of each enumerated value.

**Table 9-3 OracleHAEvEntSource Enumeration Member Values**

Member Name	Description
Service	The source of the HA Event is a service.
ServiceMember	The source of the HA Event is a service member.
Database	The source of the HA Event is a database.

**Table 9-3 (Cont.) OracleHAEventSource Enumeration Member Values**

Member Name	Description
Host	The source of the HA Event is a host.
Instance	The source of the HA Event is an instance.
Node	The source of the HA Event is a node.

**Requirements**

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleHAEventArgs Class](#)
- ["Source"](#)

## OracleHAEventStatus Enumeration

The `OracleHAEventStatus` enumeration indicates the status of the HA event source.

[Table 9-4](#) lists all the `OracleHAEventStatus` enumeration values with a description of each enumerated value.

**Table 9-4 OracleHAEventStatus Enumeration Values**

Member Name	Description
Up	The source of the HA Event is up.
Down	The source of the HA Event is down.

## Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleHAEventArgs Class](#)
- ["Status"](#)

# 10

## Continuous Query Notification Classes

This chapter describes Oracle Data Provider for .NET Continuous Query Notification Classes, Event Delegates, and Enumerations.



### See Also:

["Continuous Query Notification Support "](#)

This chapter contains these topics:

- [OracleDependency Class](#)
- [OracleNotificationRequest Class](#)
- [OracleNotificationEventArgs Class](#)
- [OnChangeEventHandler Delegate](#)
- [OracleRowidInfo Enumeration](#)
- [OracleNotificationType Enumeration](#)
- [OracleNotificationSource Enumeration](#)
- [OracleNotificationInfo Enumeration](#)

## OracleDependency Class

An `OracleDependency` class represents a dependency between an application and an Oracle database, enabling the application to get notifications whenever the data of interest or the state of the Oracle database changes.

### Class Inheritance

```
System.Object
```

```
Oracle.DataAccess.Client.OracleDependency
```

### Declaration

```
// C#  
public sealed class OracleDependency
```

### Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

Not supported in a .NET stored procedure

### Thread Safety

All public static methods are thread-safe, although methods do not guarantee thread safety.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDependency Members](#)
- [OracleDependency Constructors](#)
- [OracleDependency Static Fields](#)
- [OracleDependency Static Methods](#)
- [OracleDependency Methods](#)
- [OracleDependency Properties](#)
- [OracleDependency Events](#)

## OracleDependency Members

OracleDependency members are listed in the following tables.

### OracleDependency Constructors

OracleDependency constructors are listed in [Table 10-1](#).

**Table 10-1 OracleDependency Constructors**

Constructors	Description
<a href="#">OracleDependency Constructors</a>	Instantiates a new instance of OracleDependency class (Overloaded)

### OracleDependency Static Fields

The OracleDependency static fields are listed in [Table 10-2](#).

**Table 10-2 OracleDependency Static Fields**

Static Field	Description
<a href="#">Address</a>	Indicates the address that the notification listener listens on, for database notifications Supported in ODP.NET Core only
<a href="#">Port</a>	Indicates the port number that the notification listener listens on, for database notifications

**OracleDependency Static Methods**

OracleDependency static methods are listed in [Table 10-3](#).

**Table 10-3 OracleDependency Static Methods**

Static Methods	Description
<a href="#">Equals</a>	Inherited from <code>System.Object</code>
<a href="#">GetOracleDependency</a>	Returns an <code>OracleDependency</code> instance based on the specified unique identifier

**OracleDependency Properties**

OracleDependency properties are listed in [Table 10-4](#).

**Table 10-4 OracleDependency Properties**

Properties	Description
<a href="#">DataSource</a>	Indicates the data source associated with the <code>OracleDependency</code> instance
<a href="#">HasChanges</a>	Indicates whether or not there is any change in the database associated with this dependency
<a href="#">Id</a>	Represents the unique identifier for the <code>OracleDependency</code> instance
<a href="#">IsEnabled</a>	Specifies whether or not the dependency is enabled between the application and the database
<a href="#">QueryBasedNotification</a>	Specifies whether the change notification registration is object-based or query-based
<a href="#">RegisteredQueryIDs</a>	Provides a list of <code>CHANGE_NOTIFICATION_QUERY_IDS</code>
<a href="#">RegisteredResources</a>	Indicates the database resources that are registered in the notification registration
<a href="#">RowidInfo</a>	Specifies whether or not <code>ROWID</code> information is part of change notification events fired whenever data changes on the database
<a href="#">UserName</a>	Indicates the database user name associated with the <code>OracleDependency</code> instance

**OracleDependency Methods**

OracleDependency methods are listed in [Table 10-5](#).

**Table 10-5 OracleDependency Methods**

Methods	Description
<a href="#">AddCommandDependency</a>	Binds the <code>OracleDependency</code> instance to the specified <code>OracleCommand</code> instance
<code>Equals</code>	Inherited from <code>System.Object</code>
<code>GetHashCode</code>	Inherited from <code>System.Object</code>
<code>GetType</code>	Inherited from <code>System.Object</code>
<a href="#">RemoveRegistration</a>	Removes the specified dependency between the application and the database
<code>ToString</code>	Inherited from <code>System.Object</code>

**OracleDependency Events**

The `OracleDependency` event is listed in [Table 10-6](#).

**Table 10-6 OracleDependency Events**

Event	Description
<a href="#">OnChange</a>	An event that is sent when a database notification associated with the dependency is received from the database

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDependency Class](#)

## OracleDependency Constructors

`OracleDependency` constructors create instances of the `OracleDependency` class.

**Overload List:**

- [OracleDependency \(\)](#)  
This constructor creates an instance of the `OracleDependency` class.
- [OracleDependency\(OracleCommand\)](#)  
This constructor creates an instance of the `OracleDependency` class and binds it to the specified `OracleCommand` instance.
- [OracleDependency\(OracleCommand, bool, int, bool\)](#)  
This constructor creates an instance of the `OracleDependency` class and binds it to the specified `OracleCommand` instance, specifying whether or not a notification is to

be removed upon notification, the timeout value of the notification registration, and the persistence of the notification.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDependency Class](#)
- [OracleDependency Members](#)

## OracleDependency ( )

This constructor creates an instance of the `OracleDependency` class.

### Declaration

```
// C#  
public OracleDependency ()
```

### Remarks

Using this constructor does not bind any `OracleCommand` to the newly constructed `OracleDependency`. Use the `AddCommandDependency` method to do so.

 **Note:**

The dependency between the application and the database is not established when the `OracleDependency` instance is created. The dependency is established when the command that is associated with this dependency is executed.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDependency Class](#)
- [OracleDependency Members](#)

## OracleDependency(OracleCommand)

This constructor creates an instance of the `OracleDependency` class and binds it to an `OracleCommand` instance.

## Declaration

```
// C#  
public OracleDependency (OracleCommand cmd)
```

## Parameters

- *cmd*

The command that the `OracleDependency` object binds to.

## Exceptions

`ArgumentNullException` - The *cmd* parameter is null.

`InvalidOperationException` - The specified `OracleCommand` instance already contains a notification request.

## Remarks

When this `OracleDependency` constructor binds the `OracleCommand` instance to an `OracleDependency` instance, it causes the creation of an `OracleNotificationRequest` instance and then sets that `OracleNotificationRequest` instance to the `OracleCommand.Notification` property.

The Continuous Query Notification is registered with the database, when the command is executed. Any of the command execution methods (for example, `ExecuteNonQuery`, `ExecuteReader`, and so on) will register the notification request. An `OracleDependency` may be bound to more than one `OracleCommand`. When one of these `OracleCommand` object statements is executed, the statement is registered with the associated `OracleCommand`. Although the registration happens on each `OracleCommand` separately, one `OracleDependency` can be responsible for detecting and sending notifications that occur for all `OracleCommand` objects that the `OracleDependency` is associated with. The `OnChangeEventArgs` that is passed to the application for the `OnChange` event provides information on what has changed in the database.

The `OracleNotificationRequest` instance that is created by this constructor has the following default property values:

- `IsNotifiedOnce` is set to the value `True`.
- `Timeout` is set to 50,000 seconds.
- `IsPersistent` is set to the value `False`, that is, the invalidation message is not persistent, but is stored in an in-memory queue before delivery.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDependency Class](#)
- [OracleDependency Members](#)

## OracleDependency(OracleCommand, bool, int, bool)

This constructor creates an instance of the `OracleDependency` class and binds it to the specified `OracleCommand` instance, while specifying whether or not a registration is to be removed upon notification, the timeout value of the notification registration, and the persistence of the notification.

### Declaration

```
// C#  
public OracleDependency (OracleCommand cmd, bool isNotifiedOnce, long timeout,  
    bool isPersistent)
```

### Parameters

- *cmd*  
The command associated with the Continuous Query Notification request.
- *isNotifiedOnce*  
An indicator that specifies whether or not the registration is removed automatically once the notification occurs.
- *timeout*  
The amount of time, in seconds, that the registration stays active. When *timeout* is set to 0, the registration never expires. The valid values for *timeout* are between 0 and 4294967295.
- *isPersistent*  
Indicates whether or not the invalidation message should be queued persistently in the database before delivery. If the *isPersistent* parameter is set to `True`, the message is queued persistently in the database and cannot be lost upon database failures or shutdowns. If the *isPersistent* property is set to `False`, the message is stored in an in-memory queue before delivery and might be lost.  
  
Database performance is faster if the message is stored in an in-memory queue rather than in the database queue.

### Exceptions

`ArgumentNullException` - The *cmd* parameter is null.

`ArgumentOutOfRangeException` - The specified *timeout* is invalid.

`InvalidOperationException` - The specified `OracleCommand` instance already contains a notification request.

### Remarks

When this `OracleDependency` constructor binds the `OracleCommand` instance to an `OracleDependency` instance, it causes the creation of an `OracleNotificationRequest` instance and then sets that `OracleNotificationRequest` instance to the `OracleCommand.Notification` property.

The Continuous Query Notification is registered with the database, when the command is executed. Any of the command execution methods (for example, `ExecuteNonQuery`,

ExecuteReader, and so on) will register the notification request. An `OracleDependency` may be bound to more than one `OracleCommand`. When one of these `OracleCommand` object statements is executed, the statement is registered with the associated `OracleCommand`. Although the registration happens on each `OracleCommand` separately, one `OracleDependency` can be responsible for detecting and sending notifications that occur for all `OracleCommand` objects that the `OracleDependency` is associated with. The `OnChangeEventArgs` that is passed to the application for the `OnChange` event provides information on what has changed in the database.

The `OracleNotificationRequest` instance that is created by this constructor has the following default property values:

- `IsNotifiedOnce` is set to the specified value.
- `Timeout` is set to the specified value.
- `IsPersistent` is set to the specified value.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDependency Class](#)
- [OracleDependency Members](#)

## OracleDependency Static Fields

The `OracleDependency` static fields are listed in [Table 10-7](#).

**Table 10-7 OracleDependency Static Fields**

Static Field	Description
<a href="#">Address</a>	Indicates the address that the notification listener listens on, for database notifications Supported in ODP.NET Core only
<a href="#">Port</a>	Indicates the port number that the notification listener listens on, for database notifications

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDependency Class](#)
- [OracleDependency Members](#)

## Address

This static field indicates the address that the notification listener listens on, for database notifications.

### Declaration

```
// C#  
public static string Address{get; set}
```

### Property Value

A `string` value that represents the address that listens for the database notifications.

If the address is not set, then `OracleConfiguration.DBNotificationAddress` will be used if set. If `OracleDependency.Address` is explicitly set to `string.Empty` or null, then the hostname will be used.

### Remarks

This property allows specifying a particular IPv4 or IPv6 address to use, such as the case with a machine that contains multiple network cards. The address can be set to any valid hostname, IPv4, or IPv6 address, which is associated with the machine on which the ODP.NET application is running on, which will be listening for notifications.

The address specified by the `OracleDependency.Address` static field is used by the notification listener that runs within the same application domain as ODP.NET. This address receives Continuous Query Notifications from the database. One notification listener is capable of listening to all Continuous Query Notifications and therefore, only one notification listener is created for each application domain.

The notification listener is created when a command associated with an `OracleDependency` object is executed for the first time during the application domain lifetime. The address specified for the `OracleDependency.Address` static field is used by the listener for its lifetime. The `OracleDependency.Address` static field can be changed after the creation of the notification listener, but doing so does not affect the actual address that the notification listener listens on.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDependency Class](#)
- [OracleDependency Members](#)

## Port

This static field indicates the port number that the notification listener listens on, for database notifications.

**Declaration**

```
// C#
public static int Port{get; set}
```

**Property Value**

An `int` value that represents the number of the port that listens for the database notifications. If the port number is set to `-1`, a random port number is assigned for the listener when the listener is started. Otherwise, the specified port number is used to start the listener.

**Exceptions**

`ArgumentOutOfRangeException` - The port number is set to a negative value.

`InvalidOperationException` - The port number is being changed after the listener has started.

**Remarks**

The port number specified by the `OracleDependency.Port` static field is used by the notification listener that runs within the same application domain as ODP.NET. This port number receives Continuous Query Notifications from the database. One notification listener is capable of listening to all Continuous Query Notifications and therefore, only one notification listener is created for each application domain.

The notification listener is created when a command associated with an `OracleDependency` object is executed for the first time during the application domain lifetime. The port number specified for the `OracleDependency.Port` static field is used by the listener for its lifetime. The `OracleDependency.Port` static field can be changed after the creation of the notification listener, but doing so does not affect the actual port number that the notification listener listens on.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDependency Class](#)
- [OracleDependency Members](#)

## OracleDependency Static Methods

`OracleDependency` static methods are listed in [Table 10-8](#).

**Table 10-8 OracleDependency Static Methods**

Static Methods	Description
Equals	Inherited from <code>System.Object</code>

Table 10-8 (Cont.) OracleDependency Static Methods

Static Methods	Description
<a href="#">GetOracleDependency</a>	Returns an <code>OracleDependency</code> instance based on the specified unique identifier

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDependency Class](#)
- [OracleDependency Members](#)

## GetOracleDependency

This static method returns an `OracleDependency` instance based on the specified unique identifier.

### Declaration

```
// C#  
public static OracleDependency GetOracleDependency(string guid)
```

### Parameters

- *guid*  
The string representation of the unique identifier of an `OracleDependency` instance.

### Exceptions

`ArgumentException` - The specified unique identifier cannot locate an `OracleDependency` instance.

### Return Value

An `OracleDependency` instance that has the specified *guid* parameter.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDependency Class](#)
- [OracleDependency Members](#)

## OracleDependency Properties

OracleDependency properties are listed in [Table 10-9](#).

**Table 10-9 OracleDependency Properties**

Properties	Description
<a href="#">DataSource</a>	Indicates the data source associated with the OracleDependency instance
<a href="#">HasChanges</a>	Indicates whether or not there is any change in the database associated with this dependency
<a href="#">Id</a>	Represents the unique identifier for the OracleDependency instance
<a href="#">IsEnabled</a>	Specifies whether or not the dependency is enabled between the application and the database
<a href="#">QueryBasedNotification</a>	Specifies whether the change notification registration is object-based or query-based
<a href="#">RegisteredQueryIDs</a>	Provides a list of CHANGE_NOTIFICATION_QUERY_IDS
<a href="#">RegisteredResources</a>	Indicates the database resources that are registered in the notification registration
<a href="#">RowidInfo</a>	Specifies whether or not ROWID information is part of change notification events fired whenever data changes on the database
<a href="#">UserName</a>	Indicates the database user name associated with the OracleDependency instance

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDependency Class](#)
- [OracleDependency Members](#)

## DataSource

This property indicates the data source associated with the OracleDependency instance.

### Declaration

```
// C#
public string DataSource{get;}
```

### Property Value

A string that indicates the data source associated with the OracleDependency instance.

## Remarks

The `DataSource` property is populated with the data source once the `OracleCommand` associated with the `OracleDependency` executes and registers for the notification successfully.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDependency Class](#)
- [OracleDependency Members](#)

## HasChanges

This property indicates whether or not there is any change in the database associated with this dependency.

### Declaration

```
// C#  
public bool HasChanges{get;}
```

### Property Value

A `bool` value that returns `True` if the database has detected changes that are associated with this dependency; otherwise, returns `False`.

### Remarks

As an alternative to using the `OnChange` event, applications can check the `HasChanges` property to determine if there are any changes in the database associated with this dependency.

Once the `HasChanges` property is accessed, its value is reset to `False` so that the next notification can then be acknowledged.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDependency Class](#)
- [OracleDependency Members](#)

## Id

This property represents the unique identifier for the `OracleDependency` instance.

**Declaration**

```
// C#  
public string Id{get;}
```

**Property Value**

A string that represents the unique identifier that was generated for the `OracleDependency` instance when it was created.

**Remarks**

This property is set when the `OracleDependency` instance is created.

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDependency Class](#)
- [OracleDependency Members](#)

## IsEnabled

This property specifies whether or not the dependency is enabled between the application and the database.

**Declaration**

```
// C#  
public bool IsEnabled {get;}
```

**Property Value**

A `bool` value that specifies whether or not dependency is enabled between the application and the database.

**Remarks**

The dependency between the application and the database is not established when the `OracleDependency` instance is created. The dependency is established when the command that is associated with this dependency is executed, at which time the notification request is registered with the database. The dependency ends when the notification registration is removed from the database or when it times out.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDependency Class](#)
- [OracleDependency Members](#)

## QueryBasedNotification

This instance property specifies whether the change notification registration is object-based or query-based.

### Declaration

```
// C#  
public bool QueryBasedNotification {get; set;}
```

### Property Value

Specifies whether the change notification registration is object-based or not.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

### Remarks

This property value will be ignored if it is set after the command execution that registers the command for change notification.

By default, this property is true.

ODP.NET developers can register their queries on the row level, not just the object level, beginning with Oracle Data Provider for .NET release 11.1 and Oracle Database 11g release 1 (11.1). The application only receives notification when the selected row or rows change. Query-based notifications provide developers more granularity for using client-side cached data, as they can be more specific about what changes the application needs to be notified of.

`OracleNotificationType` enumeration is set to `Query` for query-based notifications.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDependency Class](#)
- [OracleDependency Members](#)

## RegisteredQueryIDs

This instance property provides a list of `CHANGE_NOTIFICATION_QUERY_IDS`.

### Declaration

```
// C#  
public ArrayList RegisteredQueryIDs {get;}
```

### Property Value

This property is an `ArrayList` of `CHANGE_NOTIFICATION_QUERY_IDS`.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

### Remarks

This property provides a list of `CHANGE_NOTIFICATION_QUERY_IDS` that uniquely identify the query that has been registered for change notification. The notification returned from the database will also contain these IDs, allowing applications to determine the query that the notifications are for.

The `QueryId` at index *n* in `RegisteredQueryIDs` is for the statement at index *n* the `RegisteredResources` at index *n*.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDependency Class](#)
- [OracleDependency Members](#)

## RegisteredResources

This property indicates the database resources that are registered in the notification registration.

### Declaration

```
// C#  
public ArrayList RegisteredResources{get;}
```

### Property Value

The registered resources in the notification registration.

## Remarks

The `ArrayList` contains all the command statement or statements that are registered for notification through this `OracleDependency` object. It is appropriately updated when the Continuous Query Notification is registered by a command execution.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDependency Class](#)
- [OracleDependency Members](#)

## RowidInfo

This property specifies whether or not `ROWID` information is part of change notification events fired whenever data changes on the database.

### Declaration

```
// C#  
public OracleRowidInfo RowidInfo {get; set;};
```

### Property Value

An `OracleRowidInfo` enumeration type that determines the inclusion of `ROWID` in the change notification event.

### Remarks

There are three `OracleRowidInfo` enumeration types that are valid for this property:

- **Default** includes `ROWID` information in the change notification event only if `OracleCommand.AddRowid` property is set to `true` or if `ROWID` is in the select list of the query that is registered for change notification.
- **Include** includes `ROWID` information regardless of whether or not `ROWID` is in the select-list for the query.
- **Exclude** excludes `ROWID` information regardless of whether or not `ROWID` is in the select-list.

For change notification registrations that involve stored procedure executions, change notification events related to the `REF CURSOR` contain `ROWID` information only if `RowidInfo` property is set to `OracleRowidInfo.Include`.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDependency Class](#)
- [OracleDependency Members](#)
- ["OracleRowidInfo Enumeration"](#)

## UserName

This property indicates the database user name associated with the `OracleDependency` instance.

### Declaration

```
// C#  
public string UserName{get;}
```

### Property Value

A string that indicates the database user name associated with the `OracleDependency` instance. This database user registers the Continuous Query Notification request with the database.

### Remarks

The `UserName` property is populated with the user name once the `OracleCommand` associated with the `OracleDependency` executes and registers for the notification successfully. Only the database user who creates the notification registration, or the database system administrator, can remove the registration.

The user specified by this property must have the `CHANGE NOTIFICATION` privilege to register successfully for the Continuous Query Notification with the database.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDependency Class](#)
- [OracleDependency Members](#)

## OracleDependency Methods

`OracleDependency` methods are listed in [Table 10-10](#).

**Table 10-10 OracleDependency Methods**

Methods	Description
<a href="#">AddCommandDependency</a>	Binds the OracleDependency instance to the specified OracleCommand instance
Equals	Inherited from System.Object
GetHashCode	Inherited from System.Object
GetType	Inherited from System.Object
<a href="#">RemoveRegistration</a>	Removes the specified dependency between the application and the database
ToString	Inherited from System.Object

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDependency Class](#)
- [OracleDependency Members](#)

## AddCommandDependency

This instance method binds the OracleDependency instance to the specified OracleCommand instance.

### Declaration

```
// C#  
Public void AddCommandDependency (OracleCommand cmd);
```

### Parameters

- *cmd*

The command that is to be bound to the OracleDependency object.

### Exceptions

ArgumentNullException - The *cmd* parameter is null.

InvalidOperationException - The specified OracleCommand instance already contains a notification request.

### Remarks

An OracleDependency instance can bind to multiple OracleCommand instances.

While it binds an existing OracleDependency instance to an OracleCommand instance, the AddCommandDependency method creates an OracleNotificationRequest instance, and sets it to the specified OracleCommand.Notification property.

When this method creates an `OracleNotificationRequest` instance, the following `OracleNotificationRequest` properties are set:

- `IsNotifiedOnce` is set to the value `True`.
- `Timeout` is set to 50,000 seconds.
- `IsPersistent` is set to the value `False`, indicating that the invalidation message is stored in an in-memory queue before delivery.

With this method, multiple commands can be associated with a single Continuous Query Notification registration request. Furthermore, the `OracleNotificationRequest` attribute values assigned to the `OracleCommand` can be changed once the association between the `OracleCommand` and the `OracleDependency` is established.

However, when multiple `OracleCommand` objects are associated with a single `OracleDependency` object, the `OracleNotificationRequest` attributes (`Timeout`, `IsPersistent`, and `IsNotifiedOnce`) of the first executed `OracleCommand` object are used for registration, the attributes associated with subsequent `OracleCommand` executions will be ignored.

Furthermore, once a command associated with an `OracleDependency` is executed and registered, all other subsequent command executions and registration associated with the same `OracleDependency` must use a connection with the same "User Id" and "Data Source" connection string attribute value settings.

Otherwise, an exception will be thrown.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDependency Class](#)
- [OracleDependency Members](#)
- ["OracleDependency\(OracleCommand\)"](#) for `OracleNotificationRequest` property value

## RemoveRegistration

This instance method removes the specified dependency between the application and the database. Once the registration of the dependency is removed from the database, the `OracleDependency` is no longer able to detect any changes that the database undergoes.

### Declaration

```
// C#  
public void RemoveRegistration(OracleConnection con)
```

### Parameters

- `con`

The connection associated with the `OracleDependency` instance.

### Exceptions

`InvalidOperationException` - The associated connection is not open.

### Remarks

The notification registration associated with the `OracleDependency` instance is removed from the database.

The `OracleConnection` parameter must be in an *opened state*. This instance method does not open the connection implicitly for the application.

An exception is thrown if the dependency is not valid.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDependency Class](#)
- [OracleDependency Members](#)

## OracleDependency Events

The `OracleDependency` event is listed in [Table 10-11](#).

**Table 10-11 OracleDependency Event**

Event	Description
<a href="#">OnChange</a>	An event that is sent when a database notification associated with the dependency is received from the database

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDependency Class](#)
- [OracleDependency Members](#)

## OnChange

The `OnChange` event is sent when a database notification associated with the dependency is received from the database. The information related to the notification is stored in the `OracleChangeNotificationEventArgs` class.

**Declaration**

```
// C#
public event OnChangeEventHandler OnChange;
```

**Remarks**

The `OnChange` event occurs if any result set associated with the dependency changes. For objects that are part of a Transaction, notifications will be received for each modified object. This event also occurs for other actions related to database or registration status, such as database shutdowns and startups, or registration timeouts.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleDependency Class](#)
- [OracleDependency Members](#)

## OracleNotificationRequest Class

An `OracleNotificationRequest` class represents a notification request to be subscribed in the database. It contains information about the request and the characteristics of the notification. Using the `OracleNotificationRequest` class, Oracle Data Provider for .NET can create the notification registration in the database.

**Class Inheritance**

```
System.Object
```

```
Oracle.DataAccess.Client.OracleNotificationRequest
```

**Declaration**

```
// C#
public sealed class OracleNotificationRequest
```

**Requirements**

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

*Not supported in a .NET stored procedure*

### Thread Safety

All public static methods are thread-safe, although methods do not guarantee thread safety.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleNotificationRequest Members](#)
- [OracleNotificationRequest Static Methods](#)
- [OracleNotificationRequest Properties](#)
- [OracleNotificationRequest Methods](#)

## OracleNotificationRequest Members

OracleNotificationRequest members are listed in the following tables.

### OracleNotificationRequest Static Method

The OracleNotificationRequest static method is listed in [Table 10-12](#).

**Table 10-12 OracleNotificationRequest Static Method**

Static Method	Description
Equals	Inherited from System.Object

### OracleNotificationRequest Properties

OracleNotificationRequest properties are listed in [Table 10-13](#).

**Table 10-13 OracleNotificationRequest Properties**

Properties	Description
<a href="#">IsNotifiedOnce</a>	Indicates whether or not the registration is to be removed upon notification
<a href="#">IsPersistent</a>	Indicates whether or not the notification message should be queued persistently in the database before delivery
<a href="#">Timeout</a>	Specifies the time that the registration remains alive
<a href="#">GroupingNotificationEnabled</a>	Specifies whether grouping notification is enabled or not
<a href="#">GroupingType</a>	Specifies the type of grouping notification
<a href="#">GroupingInterval</a>	Specifies the interval between grouping notifications, in seconds

## OracleNotificationRequest Methods

OracleNotificationRequest methods are listed in [Table 10-14](#).

**Table 10-14 OracleNotificationRequest Methods**

Methods	Description
Equals	Inherited from System.Object
GetHashCode	Inherited from System.Object
GetType	Inherited from System.Object
ToString	Inherited from System.Object

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleNotificationRequest Members](#)
- [OracleNotificationRequest Class](#)

## OracleNotificationRequest Static Methods

The OracleNotificationRequest static method is listed in [Table 10-15](#).

**Table 10-15 OracleNotificationRequest Static Method**

Static Method	Description
Equals	Inherited from System.Object

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleNotificationRequest Members](#)
- [OracleNotificationRequest Class](#)

## OracleNotificationRequest Properties

The OracleNotificationRequest properties are listed in [Table 10-16](#).

**Table 10-16 OracleNotificationRequest Properties**

Properties	Description
<a href="#">IsNotifiedOnce</a>	Indicates whether or not the registration is to be removed upon notification
<a href="#">IsPersistent</a>	Indicates whether or not the notification message should be queued persistently in the database before delivery
<a href="#">Timeout</a>	Specifies the time that the registration remains alive
<a href="#">GroupingNotificationEnabled</a>	Specifies whether grouping notification is enabled or not
<a href="#">GroupingType</a>	Specifies the type of grouping notification
<a href="#">GroupingInterval</a>	Specifies the interval between grouping notifications, in seconds

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleNotificationRequest Members](#)
- [OracleNotificationRequest Class](#)

## IsNotifiedOnce

This property indicates whether or not the registration is to be removed upon notification.

### Declaration

```
// C#  
public bool IsNotifiedOnce{get; set;}
```

### Property Value

A `bool` value that indicates whether or not the registration is to be removed upon notification.

### Remarks

The default value is `false` for AQ. This is different from change notification where the default value is `true`.

Modifying this property after the completion of a successful registration has no effect.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleNotificationRequest Members](#)
- [OracleNotificationRequest Class](#)

## IsPersistent

This property indicates whether or not the notification message should be queued persistently in the database until delivery.

### Declaration

```
// C#  
public bool IsPersistent{get; set;}
```

### Property Value

A `bool` value that indicates whether or not the notifications should be stored persistently in the database until delivery.

When the `IsPersistent` property is set to `True`, the message is queued persistently in the database and cannot be lost upon database failures or shutdowns. When the `IsPersistent` property is set to `False`, the message is stored in an in-memory queue before delivery and could be lost.

This property does not apply to `NotificationRegistration` which is always persistent.

This property only applies to the notification message after it has been sent.

### Remarks

The default value is `false`.

The database performs faster if the message is stored in an in-memory queue rather than a database queue.

Modifying this property after the completion of a successful registration has no effect.

This property is ignored for grouping notifications.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleNotificationRequest Members](#)
- [OracleNotificationRequest Class](#)

## Timeout

This property specifies the time, in seconds, that the registration remains alive.

### Declaration

```
// C#  
public long Timeout{get; set}
```

### Property Value

A `long` value that specifies the time, in seconds, that the registration remains alive. The valid values for the `Timeout` property are between 0 and 4294967295.

### Exceptions

`ArgumentOutOfRangeException` - The specified `Timeout` is invalid.

### Remarks

The default value is 0 (infinite) for AQ and 50000 for change notification. If the `Timeout` property is set to 0, then the registration does not expire.

If the registration is removed because the `Timeout` value has been reached, then the database sends a notification indicating the expiration.

Modifying this property after the completion of a successful registration has no effect.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleNotificationRequest Members](#)
- [OracleNotificationRequest Class](#)

## GroupingNotificationEnabled

This property specifies whether to group notifications together by time is enabled or not.

### Declaration

```
// C#  
public bool GroupingNotificationEnabled {get; set}
```

### Property Value

A `true` value indicates that grouping notification is enabled. A `false` value indicates that grouping notification is disabled.

### Remarks

The default value is `false`.

Modifying this property after the completion of a successful registration has no effect.

If enabled, then ODP.NET will group notifications together that occur during the same time period. The time period is defined by `OracleNotificationRequest.GroupingInterval`.

If disabled, then notifications will be generated immediately after the event that triggers them.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleNotificationRequest Members](#)
- [OracleNotificationRequest Class](#)

## GroupingType

This property specifies the type of grouping notification, which can summarize all notifications during the time period or only the last notification.

### Declaration

```
// C#  
public OracleAQNotificationGroupingType GroupingType {get; set;}
```

### Property Value

An `OracleAQNotificationGroupingType` enum value. The possible enum values are `OracleAQNotificationGroupingType.Summary` and `OracleAQNotificationGroupingType.Last`.

### Remarks

The default value is `OracleAQNotificationGroupingType.Summary`.

Modifying this property after the completion of a successful registration has no effect.

`OracleAQNotificationGroupingType.Summary` : All notifications in the group are summarized into a single notification.

#### Note:

The single notification does not include `ROWIDS`, even if `ROWID` information was requested to be returned.

`OracleAQNotificationGroupingType.Last` : Only the last notification in the group is published. The earlier ones discarded.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleNotificationRequest Members](#)
- [OracleNotificationRequest Class](#)

## GroupingInterval

This property specifies the interval of grouping notification in seconds. The group notifications are delivered at intervals specified by this property.

### Declaration

```
// C#
public int GroupingInterval {get; set}
```

### Property Value

An integer specifying the grouping interval in seconds.

### Remarks

If this value is 900, then notifications generated in the same 15 minute interval are grouped together into a single notification. The default value is 600 seconds.

The range of `GroupingInterval` is from 1 to `Int32.MaxValue`.

Modifying this property after the completion of a successful registration has no effect.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleNotificationRequest Members](#)
- [OracleNotificationRequest Class](#)

## OracleNotificationRequest Methods

`OracleNotificationRequest` methods are listed in [Table 10-17](#).

**Table 10-17 OracleNotificationRequest Methods**

Methods	Description
<code>Equals</code>	Inherited from <code>System.Object</code>
<code>GetHashCode</code>	Inherited from <code>System.Object</code>

**Table 10-17 (Cont.) OracleNotificationRequest Methods**

Methods	Description
GetType	Inherited from System.Object
ToString	Inherited from System.Object

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleNotificationRequest Members](#)
- [OracleNotificationRequest Class](#)

## OracleNotificationEventArgs Class

The `OracleNotificationEventArgs` class provides event data for a notification.

### Class Inheritance

`System.Object`

`System.EventArgs`

`Oracle.DataAccess.Client.OracleNotificationEventArgs`

### Declaration

```
// C#
public sealed class OracleNotificationEventArgs
```

### Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

*Not supported in a .NET stored procedure*

### Thread Safety

All public static methods are thread-safe, although methods do not guarantee thread safety.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleNotificationEventArgs Members](#)
- [OracleNotificationEventArgs Static Fields](#)
- [OracleNotificationEventArgs Static Methods](#)
- [OracleNotificationEventArgs Properties](#)
- [OracleNotificationEventArgs Methods](#)

## OracleNotificationEventArgs Members

OracleNotificationEventArgs members are listed in the following tables.

### OracleNotificationEventArgs Static Fields

The OracleNotificationEventArgs static field is listed in [Table 10-18](#).

**Table 10-18 OracleNotificationEventArgs Static Field**

Static Field	Description
Empty	Inherited from System.EventArgs

### OracleNotificationEventArgs Static Methods

The OracleNotificationEventArgs static method is listed in [Table 10-19](#).

**Table 10-19 OracleNotificationEventArgs Static Method**

Static Method	Description
Equals	Inherited from System.Object

### OracleNotificationEventArgs Properties

OracleNotificationEventArgs properties are listed in [Table 10-20](#).

**Table 10-20 OracleNotificationEventArgs Properties**

Properties	Description
<a href="#">Details</a>	Contains detailed information about the current notification
<a href="#">Info</a>	Indicates the database events for the notification

**Table 10-20 (Cont.) OracleNotificationEventArgs Properties**

Properties	Description
<a href="#">ResourceNames</a>	Indicates the database resources related to the current notification
<a href="#">Source</a>	Returns the database event source for the notification
<a href="#">Type</a>	Returns the database event type for the notification

**OracleNotificationEventArgs Methods**

OracleNotificationEventArgs methods are listed in [Table 10-21](#).

**Table 10-21 OracleNotificationEventArgs Methods**

Methods	Description
<code>Equals</code>	Inherited from <code>System.Object</code>
<code>GetHashCode</code>	Inherited from <code>System.Object</code>
<code>GetType</code>	Inherited from <code>System.Object</code>
<code>ToString</code>	Inherited from <code>System.Object</code>

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleNotificationEventArgs Class](#)

## OracleNotificationEventArgs Static Fields

The OracleNotificationEventArgs static field is listed in [Table 10-22](#).

**Table 10-22 OracleNotificationEventArgs Static Field**

Static Field	Description
<code>Empty</code>	Inherited from <code>System.EventArgs</code>

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleNotificationEventArgs Class](#)
- [OracleNotificationEventArgs Members](#)

## OracleNotificationEventArgs Static Methods

The `OracleNotificationEventArgs` static method is listed in [Table 10-23](#).

**Table 10-23 OracleNotificationEventArgs Static Method**

Static Method	Description
<a href="#">Equals</a>	Inherited from <code>System.Object</code>

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleNotificationEventArgs Class](#)
- [OracleNotificationEventArgs Members](#)

## OracleNotificationEventArgs Properties

`OracleNotificationEventArgs` properties are listed in [Table 10-24](#).

**Table 10-24 OracleNotificationEventArgs Properties**

Properties	Description
<a href="#">Details</a>	Contains detailed information about the current notification
<a href="#">Info</a>	Indicates the database events for the notification
<a href="#">ResourceNames</a>	Indicates the database resources related to the current notification
<a href="#">Source</a>	Returns the database event source for the notification
<a href="#">Type</a>	Returns the database event type for the notification

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleNotificationEventArgs Class](#)
- [OracleNotificationEventArgs Members](#)

### Details

This property contains detailed information about the current notification.

## Declaration

```
// C#
Public DataTable Details{get;}
```

## Property Value

A `DataTable` instance that contains detailed information about the current notification.

## Remarks

The returned `DataTable` object contains column data about the current notification in order as shown in [Table 10-25](#).

**Table 10-25** DataTable Object Column Data

Name	Type	Description
ResourceName	System.String	The resource name of the invalidated object in the format <Schema_name>.<object_name>
Info	OracleNotificationInfo	The information about the database event that occurs on a resource
Rowid	System.String	The rowid for the invalidated table row
QueryId	Int32	The CHANGE_NOTIFICATION_QUERY_ID

The `QueryId` column contains the `CHANGE_NOTIFICATION_QUERY_ID` that corresponds to the pseudo-column that may have been retrieved by a `SELECT` statement at the time of the query-based notification. Also, the `OracleDependency` object maintains all the `CHANGE_NOTIFICATION_QUERY_IDS` that are registered with it.

For Continuous Query Notification:

- The `Details` property indicates changes for each invalidated object in the notification in the data table.
- If `ROWID` information is requested, then the `ROWID` information is populated into the `Rowid` column. However, if many rows are modified in a table, then the whole table is invalidated, and `ROWID` information is not provided. Therefore, the `Rowid` column contains all `Null` values.
- If the database event is related to a DDL change of the table or a table drop, then the `Rowid` column is set to `Null`.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleNotificationEventArgs Class](#)
- [OracleNotificationEventArgs Members](#)

## Info

This property indicates the database events for the notification.

### Declaration

```
// C#  
public OracleNotificationInfo Info{get;}
```

### Property Value

An `OracleNotificationInfo` value that indicates the database event for the notification.

### Remarks

The `OracleNotificationInfo` value is an enumeration type. If several events are received from the invalidation message, the `Info` property is set to one of the `OracleNotificationInfo` enumeration values associated with the database events. For example, if a table has been altered and a new row has been inserted into another table, the `Info` property is set to either `OracleNotificationInfo.Altered` or `OracleNotificationInfo.Insert`.

To obtain more detailed information from the invalidation message, use the `Details` and the `ResourceNames` properties.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleNotificationEventArgs Class](#)
- [OracleNotificationEventArgs Members](#)
- ["Details"](#)
- ["ResourceNames"](#)
- ["OracleNotificationInfo Enumeration"](#)

## ResourceNames

This property indicates the database resources related to the current notification.

### Declaration

```
// C#  
public string[] ResourceNames{get;}
```

### Property Value

A string array that indicates the database resources related to the current notification.

## Remarks

For Continuous Query Notification, the `ResourceNames` property contains information about the invalidated object names in the format `<schema_name>.<object_name>`. To obtain more detailed information about the changes for invalidated objects, use the `Details` property.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleNotificationEventArgs Class](#)
- [OracleNotificationEventArgs Members](#)
- ["Details"](#)

## Source

This property returns the database event source for the notification.

### Declaration

```
// C#  
public OracleNotificationSource Source{get;}
```

### Property Value

The `OracleNotificationSource` value for the notification.

### Remarks

The `OracleNotificationSource` value is an enumeration type. If several event sources are received from the notification message, the `Source` property is set to one of the `OracleNotificationSource` enumeration values related to the database event source. For example, if a table has been altered (by the `ALTER TABLE` command) and a new row has been inserted into the same table, the `Source` property is set to either `OracleNotificationSource.Object` or `OracleNotificationSource.Data`.

For Continuous Query Notification:

- When the `Source` property is set to `OracleNotificationSource.Data`:
  - The `Info` property is set to one of the following:
    - \* `OracleNotificationInfo.Insert`
    - \* `OracleNotificationInfo.Delete`
    - \* `OracleNotificationInfo.Update`
  - The `ResourceNames` property is set, and the elements are set to the invalidated object names.

- The `Details` property contains detailed information on the change of each invalidated table.
- When the `Source` property is set to `OracleNotificationSource.Database`:
  - The `Info` property is set to one of the following:
    - \* `OracleNotificationInfo.Startup`
    - \* `OracleNotificationInfo.Shutdown`
    - \* `OracleNotificationInfo.Shutdown_Any`
    - \* `OracleNotificationInfo.Dropped`
- When the `Source` property is set to `OracleNotificationSource.Object`:
  - The `Info` property is set to either `OracleNotificationInfo.Altered` or `OracleNotificationInfo.Dropped`.
  - The `ResourceNames` property is set, and the array elements of the `ResourceNames` property are set to the object names that have been altered or dropped.
  - The `Details` property contains detailed information on the changes of the object.
- When the `Source` property is set to `OracleNotificationSource.Subscription`:
  - The `Info` property is set to the following:
    - \* `OracleNotificationInfo.End`

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleNotificationEventArgs Class](#)
- [OracleNotificationEventArgs Members](#)
- ["OracleNotificationSource Enumeration"](#)

## Type

This property returns the database event type for the notification.

### Declaration

```
// C#  
public OracleNotificationType Type {get;}
```

### Property Value

An `OracleNotificationType` enumeration value that represents the type of the database event notification.

## Remarks

The `OracleNotificationType` value is an enumeration type. If several event types are received from the notification message, then the `Type` property is set to one of the `OracleNotificationType` enumeration values related to the database event type.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleNotificationEventArgs Class](#)
- [OracleNotificationEventArgs Members](#)
- ["OracleNotificationType Enumeration"](#)

## OracleNotificationEventArgs Methods

`OracleNotificationEventArgs` methods are listed in [Table 10-26](#).

**Table 10-26 OracleNotificationEventArgs Methods**

Methods	Description
<code>Equals</code>	Inherited from <code>System.Object</code>
<code>GetHashCode</code>	Inherited from <code>System.Object</code>
<code>GetType</code>	Inherited from <code>System.Object</code>
<code>ToString</code>	Inherited from <code>System.Object</code>

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleNotificationEventArgs Class](#)
- [OracleNotificationEventArgs Members](#)

## OnChangeEventHandler Delegate

The `OnChangeEventHandler` delegate represents the signature of the method that handles the notification.

**Declaration**

```
// C#
public delegate void OnChangeEventHandler(object sender,
    OracleNotificationEventArgs args);
```

**Requirements**

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

*Not supported in a .NET stored procedure*

**Parameters**

- *sender*  
The source of the event.
- *args*  
The OracleNotificationEventArgs instance that contains the event data.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleNotificationEventArgs Class](#)
- [OracleNotificationEventArgs Members](#)

## OracleRowidInfo Enumeration

OracleRowidInfo enumeration values specify whether ROWID information is included as part of the ChangeNotificationEventArgs or not.

[Table 10-28](#) lists all the OracleRowidInfo enumeration values with a description of each enumerated value.

**Table 10-27 OracleRowidInfo Members**

Member Name	Description
Default	ROWID information is included only if <code>OracleCommand.AddRowid</code> property is set to true or if ROWID column is explicitly included in the query.
Include	ROWID information is included regardless of whether ROWID is included in the select-list of the query or not.
Exclude	ROWID information is not included regardless of whether ROWID is included in the select-list of the query or not.

**Requirements**

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

 **See Also:**

- "[Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces](#)"
- "[RowidInfo](#)"

## OracleNotificationType Enumeration

`OracleNotificationType` enumerated values specify the different types that cause the notification.

[Table 10-28](#) lists all the `OracleNotificationType` enumeration values with a description of each enumerated value.

**Table 10-28 OracleNotificationType Members**

Member Name	Description
Change	A change occurs in the database.
Subscribe	A change occurs in the subscription.
Query	A query-based change occurs in the database.

## Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>



### See Also:

"Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"

## OracleNotificationSource Enumeration

OracleNotificationSource enumerated values specify the different sources that cause notification.

Table 10-29 lists all the OracleNotificationSource enumeration values with a description of each enumerated value.

**Table 10-29 OracleNotificationSource Members**

Member Name	Description
Data	The data in a table has changed.
Database	A database event such as a database startup or shutdown occurs.
Object	A database object is altered or dropped.
Subscription	The subscription is changed.

## Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

**See Also:**

"Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"

## OracleNotificationInfo Enumeration

OracleNotificationInfo enumerated values specify the database event that causes the notification.

Table 10-30 lists all the OracleNotificationInfo enumeration values with a description of each enumerated value.

**Table 10-30 OracleNotificationInfo Members**

Member Name	Description
Insert	A row is inserted.
Delete	A row is deleted.
Update	A row is updated.
Startup	A database starts.
Shutdown	A database shuts down.
Shutdown_any	A database instance in a Real Application Cluster (Oracle RAC) environment shuts down.
Alter	An object is altered.
Drop	An object or database is dropped.
End	A registration is removed.
Error	A notification error occurs.

### Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

 **See Also:**

"Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"

# 11

## Oracle Data Provider for .NET Globalization Classes

This chapter describes the ODP.NET globalization classes.

This chapter contains these topics:

- [OracleGlobalization Class](#)

### OracleGlobalization Class

The `OracleGlobalization` class is used to obtain and set the Oracle globalization settings of the session, thread, and local computer (read-only).

#### Class Inheritance

`System.Object`

`Oracle.DataAccess.Client.OracleGlobalization`

#### Declaration

```
public sealed class OracleGlobalization : ICloneable, IDisposable
```

#### Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

#### Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

#### Remarks

An exception is thrown for invalid property values. All newly set property values are validated, except the `TimeZone` property.

Changing the `OracleGlobalization` object properties does not change the globalization settings of the session or the thread. Either the `SetSessionInfo` method of the

OracleConnection object or the SetThreadInfo method of the OracleGlobalization object must be called to alter the session's and thread's globalization settings, respectively.

### Example

```
// C#

using System;
using Oracle.DataAccess.Client;

class OracleGlobalizationSample
{
    static void Main()
    {
        // Get thread's globalization info
        OracleGlobalization glob = OracleGlobalization.GetThreadInfo();

        // Prints "glob.Language = AMERICAN"
        Console.WriteLine("glob.Language = " + glob.Language);

        // Set language on thread's globalization info
        glob.Language = "FRENCH";
        OracleGlobalization.SetThreadInfo(glob);
        OracleGlobalization.GetThreadInfo(glob);

        // Prints "glob.Language = FRENCH"
        Console.WriteLine("glob.Language = " + glob.Language);

        glob.Dispose();
    }
}
```



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleGlobalization Members](#)
- [OracleGlobalization Static Methods](#)
- [OracleGlobalization Properties](#)
- [OracleGlobalization Public Methods](#)
- [Oracle Database SQL Language Reference](#)
- [Oracle Database Globalization Support Guide](#)

## OracleGlobalization Members

OracleGlobalization members are listed in the following tables.

### OracleGlobalization Static Methods

The OracleGlobalization static methods are listed in [Table 11-1](#).

**Table 11-1 OracleGlobalization Static Methods**

Name	Description
<a href="#">GetClientInfo</a>	Returns an <code>OracleGlobalization</code> object that represents the Oracle globalization settings of the local computer (Overloaded) <i>Not Available in ODP.NET, Managed Driver and ODP.NET Core</i>
<a href="#">GetThreadInfo</a>	Returns or refreshes an <code>OracleGlobalization</code> instance that represents Oracle globalization settings of the current thread (Overloaded) <i>Not Available in ODP.NET, Managed Driver and ODP.NET Core</i>
<a href="#">SetThreadInfo</a>	Sets Oracle globalization parameters to the current thread <i>Not Available in ODP.NET, Managed Driver and ODP.NET Core</i>

**OracleGlobalization Properties**

The `OracleGlobalization` properties are listed in [Table 11-2](#).

**Table 11-2 OracleGlobalization Properties**

Name	Description
<a href="#">Calendar</a>	Specifies the calendar system
<a href="#">ClientCharacterSet</a>	Specifies a client character set <i>Not Available in ODP.NET, Managed Driver and ODP.NET Core</i>
<a href="#">Comparison</a>	Specifies a method of comparison for <code>WHERE</code> clauses and comparison in PL/SQL blocks
<a href="#">Currency</a>	Specifies the string to use as a local currency symbol for the L number format element
<a href="#">DateFormat</a>	Specifies the date format for Oracle <code>Date</code> type as a string
<a href="#">DateLanguage</a>	Specifies the language used to spell day and month names and date abbreviations
<a href="#">DualCurrency</a>	Specifies the dual currency symbol, such as <i>Euro</i> , for the U number format element
<a href="#">ISOCurrency</a>	Specifies the string to use as an international currency symbol for the C number format element
<a href="#">Language</a>	Specifies the default language of the database
<a href="#">LengthSemantics</a>	Enables creation of <code>CHAR</code> and <code>VARCHAR2</code> columns using either byte or character (default) length semantics
<a href="#">NCharConversionException</a>	Determines whether or not data loss during an implicit or explicit character type conversion reports an error
<a href="#">NumericCharacters</a>	Specifies the characters used for the decimal character and the group separator character for numeric values in strings
<a href="#">Sort</a>	Specifies the collating sequence for <code>ORDER BY</code> clause
<a href="#">Territory</a>	Specifies the name of the territory
<a href="#">TimeStampFormat</a>	Specifies the string format for <code>TimeStamp</code> types
<a href="#">TimeStampTZFormat</a>	Specifies the string format for <code>TimeStampTZ</code> types

**Table 11-2 (Cont.) OracleGlobalization Properties**

Name	Description
<a href="#">TimeZone</a>	Specifies the time zone region name

**OracleGlobalization Public Methods**

OracleGlobalization public methods are listed in [Table 11-3](#).

**Table 11-3 OracleGlobalization Public Methods**

Public Method	Description
<a href="#">Clone</a>	Creates a copy of an OracleGlobalization object
<a href="#">Dispose</a>	Releases any resources or memory allocated by the object

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleGlobalization Class](#)
- [OracleGlobalization Members](#)

## OracleGlobalization Static Methods

The OracleGlobalization static methods are listed in [Table 11-4](#).

**Table 11-4 OracleGlobalization Static Methods**

Name	Description
<a href="#">GetClientInfo</a>	Returns an OracleGlobalization object that represents the Oracle globalization settings of the local computer (Overloaded) <i>Not Available in ODP.NET, Managed Driver and ODP.NET Core</i>
<a href="#">GetThreadInfo</a>	Returns or refreshes an OracleGlobalization instance that represents Oracle globalization settings of the current thread (Overloaded) <i>Not Available in ODP.NET, Managed Driver and ODP.NET Core</i>
<a href="#">SetThreadInfo</a>	Sets Oracle globalization parameters to the current thread <i>Not Available in ODP.NET, Managed Driver and ODP.NET Core</i>

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleGlobalization Class](#)
- [OracleGlobalization Members](#)

## GetClientInfo

`GetClientInfo` returns an `OracleGlobalization` object instance that represents the Oracle globalization settings of the local computer.

**Overload List:**

- [GetClientInfo\(\)](#)  
This method returns an `OracleGlobalization` instance that represents the globalization settings of the local computer.
- [GetClientInfo\(OracleGlobalization\)](#)  
This method refreshes the provided `OracleGlobalization` object with the globalization settings of the local computer.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleGlobalization Class](#)
- [OracleGlobalization Members](#)

## GetClientInfo()

This method returns an `OracleGlobalization` instance that represents the globalization settings of the local computer.

**Declaration**

```
// C#  
public static OracleGlobalization GetClientInfo();
```

**Return Value**

An `OracleGlobalization` instance.

**Example**

```
// C#
```

```
using System;
using Oracle.DataAccess.Client;

class GetClientInfoSample
{
    static void Main()
    {
        // Get client's globalization info
        OracleGlobalization glob = OracleGlobalization.GetClientInfo();

        // Prints "glob.Language = AMERICAN"
        Console.WriteLine("glob.Language = " + glob.Language);

        glob.Dispose();
    }
}
```

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleGlobalization Class](#)
- [OracleGlobalization Members](#)

## GetClientInfo(OracleGlobalization)

This method refreshes the provided `OracleGlobalization` object with the globalization settings of the local computer.

### Declaration

```
// C#
public static void GetClientInfo(OracleGlobalization oraGlob);
```

### Parameters

- `oraGlob`

The `OracleGlobalization` object being updated.

### Example

```
// C#

using System;
using Oracle.DataAccess.Client;

class GetClientInfoSample
{
    static void Main()
    {
        // Get client's globalization info
        OracleGlobalization glob = OracleGlobalization.GetClientInfo();

        // Prints "glob.Language = AMERICAN"
```

```
Console.WriteLine("glob.Language = " + glob.Language);

// Get client's globalization info using overload
OracleGlobalization.GetClientInfo(glob);

// Prints "glob.Language = AMERICAN"
Console.WriteLine("glob.Language = " + glob.Language);

glob.Dispose();
}
}
```

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleGlobalization Class](#)
- [OracleGlobalization Members](#)

## GetThreadInfo

`GetThreadInfo` returns or refreshes an `OracleGlobalization` instance.

#### Overload List:

- [GetThreadInfo\(\)](#)  
This method returns an `OracleGlobalization` object instance of the current thread.
- [GetThreadInfo\(OracleGlobalization\)](#)  
This method refreshes the `OracleGlobalization` object instance with the globalization settings of the current thread.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleGlobalization Class](#)
- [OracleGlobalization Members](#)

## GetThreadInfo()

This method returns an `OracleGlobalization` instance of the current thread.

#### Declaration

```
// C#
public static OracleGlobalization GetThreadInfo();
```

## Return Value

An `OracleGlobalization` instance.

## Remarks

Initially, `GetThreadInfo()` returns an `OracleGlobalization` object that has the same property values as that returned by `GetClientInfo()`, unless the application changes it by invoking `SetThreadInfo()`.

## Example

```
// C#  
  
using System;  
using Oracle.DataAccess.Client;  
  
class GetThreadInfoSample  
{  
    static void Main()  
    {  
        // Get thread's globalization info  
        OracleGlobalization glob = OracleGlobalization.GetThreadInfo();  
  
        // Prints "glob.Language = AMERICAN"  
        Console.WriteLine("glob.Language = " + glob.Language);  
  
        // Get thread's globalization info using overloaded  
        OracleGlobalization.GetThreadInfo(glob);  
  
        // Prints "glob.Language = AMERICAN"  
        Console.WriteLine("glob.Language = " + glob.Language);  
  
        glob.Dispose();  
    }  
}
```

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleGlobalization Class](#)
- [OracleGlobalization Members](#)

## GetThreadInfo(OracleGlobalization)

This method refreshes the `OracleGlobalization` object with the globalization settings of the current thread.

### Declaration

```
// C#  
public static void GetThreadInfo(OracleGlobalization oraGlob);
```

## Parameters

- *oraGlob*

The OracleGlobalization object being updated.

## Remarks

Initially `GetThreadInfo()` returns an OracleGlobalization object that has the same property values as that returned by `GetClientInfo()`, unless the application changes it by invoking `SetThreadInfo()`.

## Example

```
// C#

using System;
using Oracle.DataAccess.Client;

class GetThreadInfoSample
{
    static void Main()
    {
        // Get thread's globalization info
        OracleGlobalization glob = OracleGlobalization.GetThreadInfo();

        // Prints "glob.Language = AMERICAN"
        Console.WriteLine("glob.Language = " + glob.Language);

        // Get thread's globalization info using overloaded
        OracleGlobalization.GetThreadInfo(glob);

        // Prints "glob.Language = AMERICAN"
        Console.WriteLine("glob.Language = " + glob.Language);

        glob.Dispose();
    }
}
```

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleGlobalization Class](#)
- [OracleGlobalization Members](#)

## SetThreadInfo

This method sets Oracle globalization parameters to the current thread.

### Declaration

```
// C#
public static void SetThreadInfo(OracleGlobalization oraGlob);
```

## Parameters

- *oraGlob*  
An OracleGlobalization object.

## Remarks

Any .NET string conversions to and from ODP.NET Types, as well as ODP.NET Type constructors, use the globalization property values where applicable. For example, when constructing an `OracleDate` structure from a .NET string, that string is expected to be in the format specified by the `OracleGlobalization.DateFormat` property of the thread.

## Example

```
// C#  
  
using System;  
using Oracle.DataAccess.Client;  
  
class SetThreadInfoSample  
{  
    static void Main()  
    {  
        // Get thread's globalization info  
        OracleGlobalization glob1 = OracleGlobalization.GetThreadInfo();  
  
        // Prints "glob1.Language = AMERICAN"  
        Console.WriteLine("glob1.Language = " + glob1.Language);  
  
        // Set language on thread's globalization info  
        glob1.Language = "FRENCH";  
        OracleGlobalization.SetThreadInfo(glob1);  
        OracleGlobalization glob2 = OracleGlobalization.GetThreadInfo();  
  
        // Prints "glob2.Language = FRENCH"  
        Console.WriteLine("glob2.Language = " + glob2.Language);  
  
        glob1.Dispose();  
        glob2.Dispose();  
    }  
}
```

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleGlobalization Class](#)
- [OracleGlobalization Members](#)

## OracleGlobalization Properties

The `OracleGlobalization` properties are listed in [Table 11-5](#).

**Table 11-5 OracleGlobalization Properties**

Name	Description
<a href="#">Calendar</a>	Specifies the calendar system
<a href="#">ClientCharacterSet</a>	Specifies a client character set <i>Not Available in ODP.NET, Managed Driver and ODP.NET Core</i>
<a href="#">Comparison</a>	Specifies a method of comparison for <code>WHERE</code> clauses and comparison in PL/SQL blocks
<a href="#">Currency</a>	Specifies the string to use as a local currency symbol for the L number format element
<a href="#">DateFormat</a>	Specifies the date format for Oracle <code>Date</code> type as a string
<a href="#">DateLanguage</a>	Specifies the language used to spell day and month names and date abbreviations
<a href="#">DualCurrency</a>	Specifies the dual currency symbol, such as <i>Euro</i> , for the U number format element
<a href="#">ISOCurrency</a>	Specifies the string to use as an international currency symbol for the C number format element
<a href="#">Language</a>	Specifies the default language of the database
<a href="#">LengthSemantics</a>	Enables creation of <code>CHAR</code> and <code>VARCHAR2</code> columns using either byte or character (default) length semantics
<a href="#">NCharConversionException</a>	Determines whether or not data loss during an implicit or explicit character type conversion reports an error
<a href="#">NumericCharacters</a>	Specifies the characters used for the decimal character and the group separator character for numeric values in strings
<a href="#">Sort</a>	Specifies the collating sequence for <code>ORDER BY</code> clause
<a href="#">Territory</a>	Specifies the name of the territory
<a href="#">TimeStampFormat</a>	Specifies the string format for <code>TimeStamp</code> types
<a href="#">TimeStampTZFormat</a>	Specifies the string format for <code>TimeStampTZ</code> types
<a href="#">TimeZone</a>	Specifies the time zone region name

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleGlobalization Class](#)
- [OracleGlobalization Members](#)

## Calendar

This property specifies the calendar system.

### Declaration

```
// C#  
public string Calendar {get; set;}
```

### Property Value

A string representing the Calendar.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

### Remarks

The default value is the `NLS_CALENDAR` setting of the local computer. This value is the same regardless of whether or not the `OracleGlobalization` object represents the settings of the client, thread, or session.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleGlobalization Class](#)
- [OracleGlobalization Members](#)

## ClientCharacterSet

This property specifies a client character set.

### Declaration

```
// C#  
public string ClientCharacterSet {get;}
```

### Property Value

A string that provides the name of the character set of the local computer.

### Remarks

The default value is the character set of the local computer.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleGlobalization Class](#)
- [OracleGlobalization Members](#)

## Comparison

This property represents a method of comparison for `WHERE` clauses and comparison in PL/SQL blocks.

### Declaration

```
// C#  
public string Comparison {get; set;}
```

### Property Value

A string that provides the name of the method of comparison.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

### Remarks

The default value is the `NLS_COMP` setting of the local computer.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleGlobalization Class](#)
- [OracleGlobalization Members](#)

## Currency

This property specifies the string to use as a local currency symbol for the L number format element.

### Declaration

```
// C#  
public string Currency {get; set;}
```

### Property Value

The string to use as a local currency symbol for the L number format element.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

### Remarks

The default value is the `NLS_CURRENCY` setting of the local computer.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleGlobalization Class](#)
- [OracleGlobalization Members](#)
- *Oracle Database SQL Language Reference* for further information on the L number format element

## DateFormat

This property specifies the date format for Oracle `Date` type as a string.

### Declaration

```
// C#  
public string DateFormat {get; set;}
```

### Property Value

The date format for Oracle `Date` type as a string

### Exceptions

`ObjectDisposedException` - The object is already disposed.

### Remarks

The default value is the `NLS_DATE_FORMAT` setting of the local computer.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleGlobalization Class](#)
- [OracleGlobalization Members](#)

## DateLanguage

This property specifies the language used to spell names of days and months, and date abbreviations (for example: a.m., p.m., AD, BC).

### Declaration

```
// C#  
public string DateLanguage {get; set;}
```

### Property Value

A string specifying the language.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

### Remarks

The default value is the `NLS_DATE_LANGUAGE` setting of the local computer.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleGlobalization Class](#)
- [OracleGlobalization Members](#)

## DualCurrency

This property specifies the dual currency symbol, such as *Euro*, for the U number format element.

### Declaration

```
// C#  
public string DualCurrency {get; set;}
```

### Property Value

A string that provides the dual currency symbol.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

### Remarks

The default value is the `NLS_DUAL_CURRENCY` setting of the local computer.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleGlobalization Class](#)
- [OracleGlobalization Members](#)
- *Oracle Database SQL Language Reference* for further information on the U number format element

## ISOCurrency

This property specifies the string to use as an international currency symbol for the C number format element.

### Declaration

```
// C#  
public string ISOCurrency {get; set;}
```

### Property Value

The string used as an international currency symbol.

### Exceptions

*ObjectDisposedException* - The object is already disposed.

### Remarks

The default value is the `NLS_ISO_CURRENCY` setting of the local computer.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleGlobalization Class](#)
- [OracleGlobalization Members](#)
- *Oracle Database SQL Language Reference* for further information on the C number format element

## Language

This property specifies the default language of the database.

### Declaration

```
// C#  
public string Language {get; set;}
```

### Property Value

The default language of the database.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

### Remarks

The default value is the `NLS_LANGUAGE` setting of the local computer.

`Language` is used for messages, day and month names, and sorting algorithms. It also determines `NLS_DATE_LANGUAGE` and `NLS_SORT` parameter values.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleGlobalization Class](#)
- [OracleGlobalization Members](#)

## LengthSemantics

This property indicates whether or not `CHAR` and `VARCHAR2` columns use byte or character (default) length semantics.

### Declaration

```
// C#  
public string LengthSemantics {get; set;}
```

### Property Value

A string that indicates either byte or character length semantics.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

### Remarks

The default value is the `NLS_LENGTH_SEMANTICS` setting of the local computer.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleGlobalization Class](#)
- [OracleGlobalization Members](#)

## NCharConversionException

This property determines whether or not data loss during an implicit or explicit character type conversion reports an error.

### Declaration

```
// C#  
public bool NCharConversionException {get; set;}
```

### Property Value

A string that indicates whether or not a character type conversion causes an error message.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

### Remarks

The default value of `NLS_NCHAR_CONV_EXCP` is `False`, unless it is overridden by a setting in the `INIT.ORA` file.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleGlobalization Class](#)
- [OracleGlobalization Members](#)

## NumericCharacters

This property specifies the characters used for the decimal character and the group separator character for numeric values in strings.

### Declaration

```
// C#  
public string NumericCharacters {get; set;}
```

**Property Value**

A string that represents the characters used.

**Exceptions**

`ObjectDisposedException` - The object is already disposed.

**Remarks**

The default value is the `NLS_NUMERIC_CHARACTERS` setting of the local computer.

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleGlobalization Class](#)
- [OracleGlobalization Members](#)

## Sort

This property specifies the collating sequence for `ORDER by` clause.

**Declaration**

```
// C#  
public string Sort {get; set;}
```

**Property Value**

A string that indicates the collating sequence.

**Exceptions**

`ObjectDisposedException` - The object is already disposed.

**Remarks**

The default value is the `NLS_SORT` setting of the local computer.

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleGlobalization Class](#)
- [OracleGlobalization Members](#)

## Territory

This property specifies the name of the territory.

### Declaration

```
// C#  
public string Territory {get; set;}
```

### Property Value

A string that provides the name of the territory.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

### Remarks

The default value is the `NLS_TERRITORY` setting of the local computer.

Changing this property changes other globalization properties.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleGlobalization Class](#)
- [OracleGlobalization Members](#)
- *Oracle Database Globalization Support Guide.*

## TimeStampFormat

This property specifies the string format for `TimeStamp` types.

### Declaration

```
// C#  
public string TimeStampFormat {get; set;}
```

### Property Value

The string format for `TimeStamp` types.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

### Remarks

The default value is the `NLS_TIMESTAMP_FORMAT` setting of the local computer.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleGlobalization Class](#)
- [OracleGlobalization Members](#)

## TimeStampTZFormat

This property specifies the string format for `TimeStampTZ` types.

### Declaration

```
// C#  
public string TimeStampTZFormat {get; set;}
```

### Property Value

The string format for `TimeStampTZ` types.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

### Remarks

The default value is the `NLS_TIMESTAMP_TZ_FORMAT` setting of the local computer.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleGlobalization Class](#)
- [OracleGlobalization Members](#)

## TimeZone

This property specifies the time zone region name or hour offset.

### Declaration

```
// C#  
public string TimeZone {get; set;}
```

### Property Value

The string represents the time zone region name or the time zone offset.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

### Remarks

The default value is the time zone region name of the local computer

`TimeZone` is only used when the thread constructs one of the `TimeStamp` structures. `TimeZone` has no effect on the session.

`TimeZone` can be either an hour offset, for example, 7:00, or a valid time zone region name that is provided in `V$TIMEZONE_NAMES`, such as US/Pacific. Time zone abbreviations are not supported.



#### Note:

PST is a time zone region name as well as a time zone abbreviation; therefore it is accepted by `OracleGlobalization`.

This property returns an empty string if the `OracleGlobalization` object is obtained using `GetSessionInfo()` or `GetSessionInfo(OracleGlobalization)`. Initially, by default, the time zone of the session is identical to the time zone of the thread. Therefore, given that the session time zone is not changed by invoking `ALTER SESSION` calls, the session time zone can be fetched from the client's globalization settings.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleGlobalization Class](#)
- [OracleGlobalization Members](#)

## OracleGlobalization Public Methods

`OracleGlobalization` public methods are listed in [Table 11-6](#).

**Table 11-6 OracleGlobalization Public Methods**

Public Method	Description
<a href="#">Clone</a>	Creates a copy of an <code>OracleGlobalization</code> object
<a href="#">Dispose</a>	Releases any resources or memory allocated by the object

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleGlobalization Class](#)
- [OracleGlobalization Members](#)

## Clone

This method creates a copy of an `OracleGlobalization` object.

### Declaration

```
// C#  
public object Clone();
```

### Return Value

An `OracleGlobalization` object.

### Implements

`ICloneable`

### Remarks

The cloned object has the same property values as that of the object being cloned.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleGlobalization Class](#)
- [OracleGlobalization Members](#)

## Dispose

This method releases any resources or memory allocated by the object.

### Declaration

```
// C#  
public void Dispose();
```

### Implements

`IDisposable`

## Remarks

The `Dispose` method also closes the `OracleGlobalization` object.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleGlobalization Class](#)
- [OracleGlobalization Members](#)

# 12

## Oracle Data Provider for .NET Failover Classes

This chapter describes the ODP.NET failover classes and enumerations.

This chapter contains these topics:

- [OracleFailoverEventArgs Class](#)
- [OracleFailoverEventHandler Delegate](#)
- [FailoverEvent Enumeration](#)
- [FailoverReturnCode Enumeration](#)
- [FailoverType Enumeration](#)

### OracleFailoverEventArgs Class

The `OracleFailoverEventArgs` class provides event data for the `OracleConnection.Failover` event. When database failover occurs, the `OracleConnection.Failover` event is triggered along with the `OracleFailoverEventArgs` object that stores the event data.

#### Class Inheritance

```
System.Object
    System.EventArgs
        Oracle.DataAccess.Client.OracleFailoverEventArgs
```

#### Declaration

```
// C#
public sealed class OracleFailoverEventArgs
```

#### Requirements

Provider	ODP.NET, Unmanaged Driver
Assembly	Oracle.DataAccess.dll
Namespace	Oracle.DataAccess.Client
.NET Framework	4.8

*Not supported in a .NET stored procedure*

#### Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

**Example (Oracle.DataAccess.Client only)**

```
// Transparent Application Failover (TAF) Setup
// Refer Oracle® Database Net Services Administrator's Guide

// C#

using System;
using System.Threading;
using Oracle.DataAccess.Client;
using Oracle.DataAccess.Types;

class FailoverSample
{
    static void Main(string[] args)
    {
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();

        // Register the event handler OnFailover
        con.Failover += new OracleFailoverEventHandler(OnFailover);

        Console.WriteLine("Wait for a failover for 5 seconds");
        Thread.Sleep(5000);

        con.Close();
        con.Dispose();
    }

    // TAF callback function
    static FailoverReturnCode OnFailover(object sender,
        OracleFailoverEventArgs eventArgs)
    {
        switch (eventArgs.FailoverEvent)
        {
            case FailoverEvent.Begin:
            {
                Console.WriteLine("FailoverEvent.Begin - Failover is starting");
                Console.WriteLine("FailoverType = " + eventArgs.FailoverType);
                break;
            }
            case FailoverEvent.End:
            {
                Console.WriteLine("FailoverEvent.End - Failover was successful");
                break;
            }
            case FailoverEvent.Reauth:
            {
                Console.WriteLine("FailoverEvent.Reauth - User reauthenticated");
                break;
            }
            case FailoverEvent.Error:
            {
                Console.WriteLine("FailoverEvent.Error - Failover was unsuccessful");

                // Sleep for 3 sec and Retry
                Thread.Sleep(3000);
                return FailoverReturnCode.Retry;
            }
        }
    }
}
```

```

        case FailoverEvent.Abort:
        {
            Console.WriteLine("FailoverEvent.Abort - Failover was unsuccessful");
            break;
        }
        default:
        {
            Console.WriteLine("Invalid FailoverEvent : " + eventArgs.FailoverEvent);
            break;
        }
    }
    return FailoverReturnCode.Success;
}
}

```

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleFailoverEventArgs Members](#)
- [OracleFailoverEventArgs Static Methods](#)
- [OracleFailoverEventArgs Properties](#)
- [OracleFailoverEventArgs Public Methods](#)
- ["OracleConnection Class"](#)
- *Oracle Database Net Services Administrator's Guide*

## OracleFailoverEventArgs Members

OracleFailoverEventArgs members are listed in the following tables.

### OracleFailoverEventArgs Static Methods

The OracleFailoverEventArgs static methods are listed in [Table 12-1](#).

**Table 12-1 OracleFailoverEventArgs Static Methods**

Methods	Description
Equals	Inherited from System.Object (Overloaded)

### OracleFailoverEventArgs Properties

The OracleFailoverEventArgs properties are listed in [Table 12-2](#).

**Table 12-2 OracleFailoverEventArgs Properties**

Name	Description
<a href="#">FailoverType</a>	Specifies the type of failover the client has requested

**Table 12-2 (Cont.) OracleFailoverEventArgs Properties**

Name	Description
<a href="#">FailoverEvent</a>	Indicates the state of the failover

### OracleFailoverEventArgs Public Methods

The `OracleFailoverEventArgs` public methods are listed in [Table 12-3](#).

**Table 12-3 OracleFailoverEventArgs Public Methods**

Name	Description
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)
<code>GetHashCode</code>	Inherited from <code>System.Object</code>
<code>GetType</code>	Inherited from <code>System.Object</code>
<code>ToString</code>	Inherited from <code>System.Object</code>

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleFailoverEventArgs Class](#)
- ["FailoverType Enumeration"](#)

## OracleFailoverEventArgs Static Methods

The `OracleFailoverEventArgs` static methods are listed in [Table 12-1](#).

**Table 12-4 OracleFailoverEventArgs Static Methods**

Methods	Description
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleFailoverEventArgs Class](#)
- [OracleFailoverEventArgs Members](#)

## OracleFailoverEventArgs Properties

The `OracleFailoverEventArgs` properties are listed in [Table 12-5](#).

**Table 12-5 OracleFailoverEventArgs Properties**

Name	Description
<a href="#">FailoverType</a>	Specifies the type of failover the client has requested
<a href="#">FailoverEvent</a>	Indicates the state of the failover

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleFailoverEventArgs Class](#)
- [OracleFailoverEventArgs Members](#)

## FailoverType

This property indicates the state of the failover.

### Declaration

```
// C#  
public FailoverType FailoverType {get;}
```

### Property Value

A `FailoverType` enumeration value.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleFailoverEventArgs Class](#)
- [OracleFailoverEventArgs Members](#)
- ["FailoverType Enumeration"](#)

## FailoverEvent

This property indicates the state of the failover.

**Declaration**

```
// C#
public FailoverEvent FailoverEvent {get;}
```

**Property Value**

A `FailoverEvent` enumerated value.

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleFailoverEventArgs Class](#)
- [OracleFailoverEventArgs Members](#)
- ["FailoverEvent Enumeration"](#)

## OracleFailoverEventArgs Public Methods

The `OracleFailoverEventArgs` public methods are listed in [Table 12-6](#).

**Table 12-6 OracleFailoverEventArgs Public Methods**

Name	Description
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)
<code>GetHashCode</code>	Inherited from <code>System.Object</code>
<code>GetType</code>	Inherited from <code>System.Object</code>
<code>ToString</code>	Inherited from <code>System.Object</code>

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleFailoverEventArgs Class](#)
- [OracleFailoverEventArgs Members](#)

## OracleFailoverEventHandler Delegate

The `OracleFailoverEventHandler` represents the signature of the method that handles the `OracleConnection.Failover` event.

## Declaration

```
// C#  
public delegate FailoverReturnCode OracleFailoverEventHandler(object sender,  
    OracleFailoverEventArgs eventArgs);
```

## Requirements

Provider	ODP.NET, Unmanaged Driver
Assembly	Oracle.DataAccess.dll
Namespace	Oracle.DataAccess.Client
.NET Framework	4.8

*Not supported in a .NET stored procedure*

## Parameter

- *sender*  
The source of the event.
- *eventArgs*  
The `OracleFailoverEventArgs` object that contains the event data.

## Return Type

An `int`.

## Remarks

To receive failover notifications, a callback function can be registered as follows:

```
ConObj.Failover += new OracleFailoverEventHandler(OnFailover);
```

The definition of the callback function `OnFailover` can be as follows:

```
public FailoverReturnCode OnFailover(object sender, OracleFailoverEventArgs eventArgs)
```

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleFailoverEventArgs Class](#)
- [OracleFailoverEventArgs Members](#)
- ["Failover"](#)

# FailoverEvent Enumeration

`FailoverEvent` enumerated values are used to specify the state of the failover.

Table 12-7 lists all the `FailoverEvent` enumeration values with a description of each enumerated value.

**Table 12-7 FailoverEvent Enumeration Values**

Member Names	Description
<code>FailoverEvent.Begin</code>	Indicates that failover has detected a lost connection and that failover is starting.
<code>FailoverEvent.End</code>	Indicates successful completion of failover.
<code>FailoverEvent.Abort</code>	Indicates that failover was unsuccessful, and there is no option of retrying.
<code>FailoverEvent.Error</code>	Indicates that failover was unsuccessful, and it gives the application the opportunity to handle the error and retry failover. The application can retry failover by returning <code>FailoverReturnCode.Retry</code> for the event notification.
<code>FailoverEvent.Reauth</code>	Indicates that a user handle has been reauthenticated. This applies to the situation where a client has multiple user sessions on a single server connection. During the initial failover, only the active user session is failed over. Other sessions are failed over when the application tries to use them. This is the value passed to the callback during these subsequent failovers.

No significant database operation should occur immediately after a `FailoverEvent.Begin` event. SQL and major database operations should wait until the `FailoverEvent.End` event. `FailoverEvent.Begin` is primarily used to reject failover or to trace it. `FailoverEvent.Begin` can also be used for non-database application operations, such as informing the end user a failover is in progress and to wait until it completes before proceeding. Transactions can be used in the `FailoverEvent.End` callback phase, such as to file fault tickets or audit. These transactions must be committed before the callback completes.

### Requirements

<b>Provider</b>	<b>ODP.NET, Unmanaged Driver</b>
<b>Assembly</b>	<code>Oracle.DataAccess.dll</code>
<b>Namespace</b>	<code>Oracle.DataAccess.Client</code>
<b>.NET Framework</b>	4.8

#### See Also:

- [FailoverEvent Enumeration](#)
- ["OracleFailoverEventArgs Class"](#)
- ["FailoverEvent"](#)
- *Oracle Real Application Clusters Administration and Deployment Guide*
- *Oracle Database Net Services Reference*

## FailoverReturnCode Enumeration

`FailoverReturnCode` enumerated values are passed back by the application to the ODP.NET provider to request a retry in case of a failover error, or to continue in case of a successful failover.

[Table 12-8](#) lists the `FailoverReturnCode` enumeration values with a description of each enumerated value.

**Table 12-8 FailoverReturnCode Enumeration Values**

Member Names	Description
<code>FailoverReturnCode.Retry</code>	Requests ODP.NET to retry failover in case <code>FailoverEvent.Error</code> is passed to the application
<code>FailoverReturnCode.Success</code>	Requests ODP.NET to proceed so that the application receive more notifications, if any

### Requirements

<b>Provider</b>	<b>ODP.NET, Unmanaged Driver</b>
<b>Assembly</b>	<code>Oracle.DataAccess.dll</code>
<b>Namespace</b>	<code>Oracle.DataAccess.Client</code>
<b>.NET Framework</b>	4.8



#### See Also:

- [FailoverEvent Enumeration](#)
- ["OracleFailoverEventArgs Class"](#)
- ["FailoverEvent"](#)
- *Oracle Real Application Clusters Administration and Deployment Guide*
- *Oracle Database Net Services Reference*

## FailoverType Enumeration

`FailoverType` enumerated values are used to indicate the type of failover event that was raised.

[Table 12-9](#) lists all the `FailoverType` enumeration values with a description of each enumerated value.

**Table 12-9 FailoverType Enumeration Values**

Member Names	Description
<code>FailoverType.Session</code>	Indicates that the user has requested only session failover
<code>FailoverType.Select</code>	Indicates that the user has requested select and session failover
<code>FailoverType.Auto</code>	Indicates that the user has requested Transparent Application Continuity

**Requirements**

<b>Provider</b>	<b>ODP.NET, Unmanaged Driver</b>
<b>Assembly</b>	<code>Oracle.DataAccess.dll</code>
<b>Namespace</b>	<code>Oracle.DataAccess.Client</code>
<b>.NET Framework</b>	4.8

 **See Also:**

- [FailoverEvent Enumeration](#)
- ["OracleFailoverEventArgs Class"](#)
- ["FailoverType"](#)
- *Oracle Real Application Clusters Administration and Deployment Guide*
- *Oracle Database Net Services Reference*

# 13

## Oracle Database Advanced Queuing Classes

This chapter describes the following Oracle Data Provider for .NET classes:

- [OracleAQAgent Class](#)
- [OracleAQDequeueOptions Class](#)
- [OracleAQEnqueueOptions Class](#)
- [OracleAQMessage Class](#)
- [OracleAQMessageAvailableEventArgs Class](#)
- [OracleAQMessageAvailableEventHandler Delegate](#)
- [OracleAQQueue Class](#)
- [OracleAQDequeueMode Enumeration](#)
- [OracleAQMessageDeliveryMode Enumeration](#)
- [OracleAQMessageState Enumeration](#)
- [OracleAQMessageType Enumeration](#)
- [OracleAQNavigationMode Enumeration](#)
- [OracleAQNotificationGroupingType Enumeration](#)
- [OracleAQNotificationType Enumeration](#)
- [OracleAQVisibilityMode Enumeration](#)

### OracleAQAgent Class

The `OracleAQAgent` class represents agents that may be senders or recipients of a message.

#### Class Inheritance

```
System.Object
    OracleAQAgent
```

#### Declaration

```
// C#
public sealed class OracleAQAgent
```

#### Requirements

Provider	ODP.NET, Unmanaged Driver
Assembly	Oracle.DataAccess.dll
Namespace	Oracle.DataAccess.Client
.NET Framework	4.8

### Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

### Remarks

An agent may be a consumer, another queue, or a consumer of another queue. The queue may be either local or remote. A remote queue is specified through a database link.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQAgent Members](#)
- [OracleAQAgent Constructors](#)
- [OracleAQAgent Properties](#)

## OracleAQAgent Members

`OracleAQAgent` members are listed in the following tables.

### OracleAQAgent Constructors

`OracleAQAgent` constructors are listed in [Table 13-1](#).

**Table 13-1 OracleAQAgent Constructors**

Constructor	Description
<a href="#">OracleAQAgent Constructors</a>	Instantiates a new instance of the <code>OracleAQAgent</code> class (Overloaded).

### OracleAQAgent Properties

`OracleAQAgent` properties are listed in [Table 13-2](#).

**Table 13-2 OracleAQAgent Properties**

Property	Description
<a href="#">Address</a>	Specifies the address of the agent.
<a href="#">Name</a>	Specifies the name of the agent.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQAgent Class](#)

## OracleAQAgent Constructors

`OracleAQAgent` constructors instantiate new instances of the `OracleAQAgent` class.

**Overload List:**

- [OracleAQAgent \(string\)](#)  
This constructor instantiates the `OracleAQAgent` class using the specified name.
- [OracleAQAgent \(string, string\)](#)  
This constructor instantiates the `OracleAQAgent` class using the specified name and address.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQAgent Class](#)
- [OracleAQAgent Members](#)

### OracleAQAgent (string)

This constructor instantiates the `OracleAQAgent` class using the specified name.

**Declaration**

```
// C#  
public OracleAQAgent(string name);
```

**Parameters**

- *name*  
The name of the agent.

**Exceptions**

`ArgumentNullException` - The *name* parameter is null.

`ArgumentException` - The *name* parameter is empty.

## Remarks

The agent name signifies the name of a producer or consumer of a message. In the context of functionality exposed by `Listen`, an agent name corresponds to the name of a consumer for which a message is expected on a multiconsumer queue. It may also be set on a message to signify sender identification or intended recipients of the message.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQAgent Class](#)
- [OracleAQAgent Members](#)

## OracleAQAgent (string, string)

This constructor instantiates the `OracleAQAgent` class using the specified name and address.

### Declaration

```
// C#  
public OracleAQAgent(string name, string address);
```

### Parameters

- *name*  
The name of the agent.
- *address*  
The address is of the form `[schema.]queue[@dblink]`.

### Exceptions

`ArgumentNullException` - The *address* parameter is `null`.

`ArgumentException` - The *address* parameter is empty.

### Remarks

The agent name signifies the name of a producer or consumer of a message. In the context of functionality exposed by `Listen`, an agent name corresponds to the name of a consumer for which a message is expected on a multiconsumer queue.

The *name* parameter can be specified as `null` in this constructor. In such a scenario, the agent only has an *address*.

The *address* parameter signifies the name of the queue against which this agent listens for new messages. The *address* represents a queue at a local or remote

database. The validity of the *address* is not checked implicitly. The exceptions due to wrong *address* are thrown only during database operations such as `Listen`.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQAgent Class](#)
- [OracleAQAgent Members](#)

## OracleAQAgent Properties

`OracleAQAgent` properties are listed in [Table 13-3](#).

**Table 13-3 OracleAQAgent Properties**

Property	Description
<a href="#">Address</a>	Specifies the address of the agent.
<a href="#">Name</a>	Specifies the name of the agent.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQAgent Class](#)
- [OracleAQAgent Members](#)

## Address

This instance property specifies the address of the agent.

### Declaration

```
// C#  
public string Address {get; }
```

### Property Value

A `string` that specifies the agent address.

### Remarks

The address represents a queue at a local or remote database. The default value is `null`. The address of the agent is of the form `[schema.]queue[@dblink]`. The string length can be up to 128 characters.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQAgent Class](#)
- [OracleAQAgent Members](#)

## Name

This instance property specifies the name of the agent.

### Declaration

```
// C#  
public string Name {get; }
```

### Property Value

A string.

### Remarks

The default is `null`. The string length can be up to 30 characters. A non-`null` value implies that this agent name either corresponds to a consumer name in a multiconsumer queue, or a recipient as specified in message properties.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQAgent Class](#)
- [OracleAQAgent Members](#)

## OracleAQDequeueOptions Class

An `OracleAQDequeueOptions` object represents the options available when dequeuing a message from an `OracleAQQueue` object.

### Class Inheritance

```
System.Object  
    OracleAQDequeueOptions
```

### Declaration

```
// C#  
public sealed class OracleAQDequeueOptions : ICloneable
```

## Requirements

<b>Provider</b>	<b>ODP.NET, Unmanaged Driver</b>
<b>Assembly</b>	Oracle.DataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client
<b>.NET Framework</b>	4.8

## Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQDequeueOptions Members](#)
- [OracleAQDequeueOptions Constructor](#)
- [OracleAQDequeueOptions Properties](#)
- [OracleAQDequeueOptions Public Methods](#)

## OracleAQDequeueOptions Members

OracleAQDequeueOptions members are listed in the following tables.

### OracleAQDequeueOptions Constructor

The OracleAQDequeueOptions constructor is listed in [Table 13-4](#).

**Table 13-4 OracleAQDequeueOptions Constructor**

Constructor	Description
<a href="#">OracleAQDequeueOptions Constructor</a>	Instantiates a new instance of the OracleAQDequeueOptions class

### OracleAQDequeueOptions Properties

OracleAQDequeueOptions properties are listed in [Table 13-5](#).

**Table 13-5 OracleAQDequeueOptions Properties**

Property	Description
<a href="#">ConsumerName</a>	Specifies the consumer name for which to dequeue the message

**Table 13-5 (Cont.) OracleAQDequeueOptions Properties**

Property	Description
<a href="#">Correlation</a>	Specifies the correlation identifier of the message to be dequeued
<a href="#">DeliveryMode</a>	Specifies the expected delivery mode of the message being dequeued
<a href="#">DequeueMode</a>	Specifies the locking behavior associated with the dequeue operation
<a href="#">MessageId</a>	Specifies the message identifier of the message to be dequeued
<a href="#">NavigationMode</a>	Specifies the position of the message that will be retrieved
<a href="#">ProviderSpecificType</a>	Specifies whether the payload of a dequeued message is provided as an ODP.NET specific type or a .NET type
<a href="#">Visibility</a>	Specifies whether or not the new message is dequeued as part of the current transaction
<a href="#">Wait</a>	Specifies the wait time, in seconds, for a message that matches the search criteria

**OracleAQDequeueOptions Public Methods**

OracleAQDequeueOptions public methods are listed in [Table 13-6](#).

**Table 13-6 OracleAQDequeueOptions Public Methods**

Public Method	Description
<a href="#">Clone</a>	Creates a copy of an OracleAQDequeueOptions object.

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQDequeueOptions Class](#)

## OracleAQDequeueOptions Constructor

The OracleAQDequeueOptions constructor creates an instance of the OracleAQDequeueOptions class and sets all its properties to their default values.

**Declaration**

```
// C#
public OracleAQDequeueOptions();
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQDequeueOptions Class](#)
- [OracleAQDequeueOptions Members](#)

## OracleAQDequeueOptions Properties

OracleAQDequeueOptions properties are listed in [Table 13-7](#).

**Table 13-7 OracleAQDequeueOptions Properties**

Property	Description
<a href="#">ConsumerName</a>	Specifies the consumer name for which to dequeue the message
<a href="#">Correlation</a>	Specifies the correlation identifier of the message to be dequeued
<a href="#">DeliveryMode</a>	Specifies the expected delivery mode of the message being dequeued
<a href="#">DequeueMode</a>	Specifies the locking behavior associated with the dequeue operation
<a href="#">MessageId</a>	Specifies the message identifier of the message to be dequeued
<a href="#">NavigationMode</a>	Specifies the position of the message that will be retrieved
<a href="#">ProviderSpecificType</a>	Specifies whether the payload of a dequeued message is provided as an ODP.NET specific type or a .NET type
<a href="#">Visibility</a>	Specifies whether or not the new message is dequeued as part of the current transaction
<a href="#">Wait</a>	Specifies the wait time, in seconds, for a message that matches the search criteria

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQDequeueOptions Class](#)
- [OracleAQDequeueOptions Members](#)

### ConsumerName

This instance property specifies the consumer name for which to dequeue the message.

**Declaration**

```
// C#  
public string ConsumerName {get;set;}
```

**Property Value**

A string.

**Remarks**

The `ConsumerName` property only accesses those messages that match the consumer name. If a queue is not set up for multiple consumers, then this field should be set to null.

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQDequeueOptions Class](#)
- [OracleAQDequeueOptions Members](#)

## Correlation

This instance property specifies the correlation identifier of the message to be dequeued.

**Declaration**

```
// C#  
public string Correlation {get;set;}
```

**Property Value**

A string.

**Remarks**

This property specifies the identification of the message to be dequeued. Special pattern matching characters, such as the percent sign (%) and the underscore (\_) can be used. If more than one message satisfies the pattern, then the order of dequeuing is undetermined.

The maximum length of `Correlation` is 128.

`MessageId` and `Correlation` are two independent identifiers. While `MessageId` is unique for a message, a group of messages can be assigned the same `Correlation`. Also, pattern matching is possible only with `Correlation`.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQDequeueOptions Class](#)
- [OracleAQDequeueOptions Members](#)

## DeliveryMode

This instance property specifies the expected delivery mode of the message being dequeued.

### Declaration

```
// C#  
public OracleAQMessageDeliveryMode DeliveryMode {get;set;}
```

### Property Value

An `OracleAQMessageDeliveryMode` enumerated value.

### Remarks

This property specifies the type of messages to be dequeued. It can be set to dequeue either persistent or buffered messages, or both from a queue. The following values are valid:

- `OracleAQMessageDeliveryMode.Persistent`
- `OracleAQMessageDeliveryMode.Buffered`
- `OracleAQMessageDeliveryMode.PersistentOrBuffered`

The default value is `OracleAQMessageDeliveryMode.Persistent`.

Buffered messaging is supported in all queue tables created with a database compatibility level of 8.1 or higher.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQDequeueOptions Class](#)
- [OracleAQDequeueOptions Members](#)

## DequeueMode

This instance property specifies the locking behavior associated with the dequeue operation.

### Declaration

```
// C#  
public OracleAQDequeueMode DequeueMode {get;set;}
```

### Property Value

An OracleAQDequeueMode enumerated value.

### Exceptions

ArgumentOutOfRangeException - The specified DequeueMode value is invalid.

### Remarks

The default value is OracleAQDequeueMode.Remove.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQDequeueOptions Class](#)
- [OracleAQDequeueOptions Members](#)

## MessageId

This instance property specifies the message identifier of the message to be dequeued.

### Declaration

```
// C#  
public byte[] MessageId {get;set;}
```

### Property Value

A byte[ ].

### Remarks

The dequeue operation succeeds only if the message ID of the message being dequeued matches with the message ID specified.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQDequeueOptions Class](#)
- [OracleAQDequeueOptions Members](#)

## NavigationMode

This instance property specifies the position of the message that will be retrieved.

### Declaration

```
// C#  
public OracleAQNavigationMode NavigationMode {get;set;}
```

### Property Value

An `OracleAQNavigationMode` enumerated value.

### Exceptions

`ArgumentOutOfRangeException` - The specified `NavigationMode` value is invalid.

### Remarks

The default value is `OracleAQNavigationMode.NextMessage`.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQDequeueOptions Class](#)
- [OracleAQDequeueOptions Members](#)

## ProviderSpecificType

This property specifies whether the payload of a dequeued message is provided as an `ODP.NET` specific type or a `.NET` type.

### Declaration

```
// C#  
public bool ProviderSpecificType {get;set;}
```

### Property Value

A `bool`.

## Remarks

The default value of this property is `false`. For a discussion of how this property affects payload type, refer to ["MessageType"](#) under the `OracleAQQueue` class.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQDequeueOptions Class](#)
- [OracleAQDequeueOptions Members](#)
- ["MessageType"](#)

## Visibility

This instance property specifies whether or not the new message is dequeued as part of the current transaction.

### Declaration

```
// C#  
public OracleAQVisibilityMode Visibility {get;set;}
```

### Property Value

An `OracleAQVisibilityMode` enumerated value.

### Exceptions

`ArgumentOutOfRangeException` - The `Visibility` value specified is invalid.

### Remarks

The default value is `OracleAQVisibilityMode.OnCommit`. You must use transactions when using the default value for this property. This ensures that applications do not lose messages and the messages are appropriately removed from the queue after the dequeue operation is successful. If transactions are not used when using the default visibility mode of `OracleAQVisibilityMode.OnCommit`, then messages are not removed from the queue.

Using the alternative visibility mode value, `OracleAQVisibilityMode.Immediate` can eliminate the need to create, commit, and rollback a transaction. However, if an error occurs during the dequeue operation, then the message may be lost.

The visibility parameter is ignored when `DequeueMode` is set to `OracleAQDequeueMode.Browse`.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQDequeueOptions Class](#)
- [OracleAQDequeueOptions Members](#)

## Wait

This instance property specifies the wait time, in seconds, for a message that matches the search criteria.

### Declaration

```
// C#  
public int Wait {get;set;}
```

### Property Value

Any positive integer value or 0 or -1.

### Exceptions

`ArgumentOutOfRangeException` - The specified `Wait` value is invalid.

### Remarks

The default value is -1, which implies an infinite wait. The following values are valid:

- Positive integer: Wait time in seconds.
- -1: Wait forever.
- 0: Do not wait.

A value of less than -1 raises an `ArgumentOutOfRangeException`.

This parameter is ignored if messages in the same group are being dequeued.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQDequeueOptions Class](#)
- [OracleAQDequeueOptions Members](#)

## OracleAQDequeueOptions Public Methods

The `OracleAQDequeueOptions` public method is listed in [Table 13-8](#).

**Table 13-8 OracleAQDequeueOptions Public Methods**

Public Method	Description
<a href="#">Clone</a>	Creates a copy of an <code>OracleAQDequeueOptions</code> object

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQDequeueOptions Class](#)
- [OracleAQDequeueOptions Members](#)

## Clone

This method creates a copy of an `OracleAQDequeueOptions` object.

### Declaration

```
// C#  
public object Clone();
```

### Return Value

An `OracleAQDequeueOptions` object.

### Implements

`ICloneable`.

### Remarks

The cloned object has the same property values as the object being cloned.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQDequeueOptions Class](#)
- [OracleAQDequeueOptions Members](#)

## OracleAQEnqueueOptions Class

The `OracleAQEnqueueOptions` class represents the options available when enqueueing a message to an `OracleAQQueue`.

## Class Inheritance

System.Object

OracleAQEnqueueOptions

## Declaration

```
// C#
public sealed class OracleAQEnqueueOptions : ICloneable
```

## Requirements

<b>Provider</b>	<b>ODP.NET, Unmanaged Driver</b>
<b>Assembly</b>	Oracle.DataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client
<b>.NET Framework</b>	4.8

## Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQEnqueueOptions Members](#)
- [OracleAQEnqueueOptions Constructor](#)
- [OracleAQEnqueueOptions Properties](#)
- [OracleAQEnqueueOptions Public Methods](#)

## OracleAQEnqueueOptions Members

The OracleAQEnqueueOptions members are listed in the following tables.

### OracleAQEnqueueOptions Constructor

OracleAQEnqueueOptions constructor is listed in [Table 13-9](#).

**Table 13-9 OracleAQEnqueueOptions Constructor**

Constructor	Description
<a href="#">OracleAQEnqueueOptions Constructor</a>	Instantiates a new instance of the OracleAQEnqueueOptions class.

## OracleAQEnqueueOptions Properties

OracleAQEnqueueOptions properties are listed in [Table 13-10](#).

**Table 13-10 OracleAQEnqueueOptions Properties**

Property	Description
<a href="#">DeliveryMode</a>	Specifies the delivery mode of the message being enqueued.
<a href="#">Visibility</a>	Specifies whether or not the new message is enqueued as part of the current transaction.

## OracleAQEnqueueOptions Public Methods

The OracleAQEnqueueOptions public method is listed in [Table 13-11](#).

**Table 13-11 OracleAQEnqueueOptions Public Methods**

Public Method	Description
<a href="#">Clone</a>	Creates a copy of an OracleAQEnqueueOptions object.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQEnqueueOptions Class](#)

## OracleAQEnqueueOptions Constructor

This constructor creates an instance of the OracleAQEnqueueOptions class with default property values.

### Declaration

```
// C#  
public OracleAQEnqueueOptions();
```



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQEnqueueOptions Class](#)
- [OracleAQEnqueueOptions Members](#)

## OracleAQEnqueueOptions Properties

OracleAQEnqueueOptions properties are listed in [Table 13-12](#).

**Table 13-12 OracleAQEnqueueOptions Properties**

Property	Description
<a href="#">DeliveryMode</a>	Specifies the delivery mode of the message being enqueued.
<a href="#">Visibility</a>	Specifies whether or not the new message is enqueued as part of the current transaction.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQEnqueueOptions Class](#)
- [OracleAQEnqueueOptions Members](#)

## DeliveryMode

This instance property specifies the delivery mode of the message being enqueued.

### Declaration

```
// C#  
public OracleAQMessageDeliveryMode DeliveryMode {get;set;}
```

### Exceptions

[ArgumentOutOfRangeException](#) - The specified [Visibility](#) value is invalid.

### Remarks

The valid values can be any of the following enumerated values:

- `OracleAQMessageDeliveryMode.Persistent`
- `OracleAQMessageDeliveryMode.Buffered`

The default is `OracleAQMessageDeliveryMode.Persistent`.

`OracleAQMessageDeliveryMode.PersistentOrBuffered` cannot be set on this property.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQEnqueueOptions Class](#)
- [OracleAQEnqueueOptions Members](#)

## Visibility

This instance property specifies whether or not the new message is enqueued as part of the current transaction.

### Declaration

```
// C#  
public OracleAQVisibilityMode Visibility {get;set;}
```

### Property Value

An `OracleAQVisibilityMode` enumerated value.

### Exceptions

`ArgumentOutOfRangeException` - The specified `Visibility` value is invalid.

### Remarks

The default value is `OracleAQVisibilityMode.OnCommit`. You must use transactions when using the default value. If transactions are not used when using the default visibility mode of `OracleAQVisibilityMode.OnCommit`, then messages are not enqueued to the queue.

Using the alternative visibility mode value, `OracleAQVisibilityMode.Immediate` eliminates the need to use a transaction. The queue is not affected in case the enqueue operation fails. The message does not get enqueued to the queue for such cases.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQEnqueueOptions Class](#)
- [OracleAQEnqueueOptions Members](#)

## OracleAQEnqueueOptions Public Methods

`OracleAQEnqueueOptions` public method is listed in [Table 13-13](#).

**Table 13-13 OracleAQEnqueueOptions Public Methods**

Public Method	Description
<a href="#">Clone</a>	Creates a copy of an <code>OracleAQEnqueueOptions</code> object.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQEnqueueOptions Class](#)
- [OracleAQEnqueueOptions Members](#)

## Clone

This method creates a copy of an `OracleAQEnqueueOptions` object.

### Declaration

```
// C#  
public object Clone();
```

### Return Value

An `OracleAQEnqueueOptions` object.

### Implements

`ICloneable`.

### Remarks

The cloned object has the same property values as that of the object being cloned.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQEnqueueOptions Class](#)
- [OracleAQEnqueueOptions Members](#)

## OracleAQMessage Class

An `OracleAQMessage` object represents a message to be enqueued and dequeued.

## Class Inheritance

System.Object

OracleAQMessage

## Declaration

```
// C#  
public sealed class OracleAQMessage
```

## Requirements

<b>Provider</b>	<b>ODP.NET, Unmanaged Driver</b>
<b>Assembly</b>	Oracle.DataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client
<b>.NET Framework</b>	4.8

## Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

## Remarks

An `OracleAQMessage` object consists of control information (metadata) and Payload (data). The control information is exposed by various properties on the `OracleAQMessage` object and is used by Oracle Database Advanced Queuing to manage messages. The payload is the information stored in the queue.

### Note:

An instance of `OracleAQMessage` cannot be re-used across multiple operations of `OracleAQQueue` public method `Enqueue()` or `EnqueueArray()`, if the payload is an `XmlReader`. This is a direct consequence of the forward-only semantics of the `XmlReader`, as an `Enqueue()` or `EnqueueArray()` operation internally invokes a read operation on the `XmlReader` to extract the data to be enqueued.

### See Also:

- "Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"
- [OracleAQMessage Members](#)
- [OracleAQMessage Constructors](#)
- [OracleAQMessage Properties](#)

## OracleAQMessage Members

OracleAQMessage members are listed in the following tables.

### OracleAQMessage Constructor

OracleAQMessage constructors are listed in [Table 13-14](#).

**Table 13-14 OracleAQMessage Constructors**

Constructor	Description
<a href="#">OracleAQMessage Constructors</a>	Instantiates a new instance of the OracleAQMessage class (Overloaded).

### OracleAQMessage Properties

OracleAQMessage properties are listed in [Table 13-15](#).

**Table 13-15 OracleAQMessage Properties**

Property	Description
<a href="#">Correlation</a>	Specifies an identification for the message.
<a href="#">Delay</a>	Specifies the duration, in seconds, after which an enqueued message is available for dequeuing.
<a href="#">DeliveryMode</a>	Specifies the delivery mode of the dequeued message.
<a href="#">DequeueAttempts</a>	Returns the number of attempts that have been made to dequeue the message.
<a href="#">EnqueueTime</a>	Specifies the time when the message was enqueued.
<a href="#">ExceptionQueue</a>	Specifies the name of the queue that the message should be moved to if it cannot be processed successfully.
<a href="#">Expiration</a>	Specifies the duration, in seconds, for which an enqueued message is available for dequeuing.
<a href="#">MessageId</a>	Returns the message identifier.
<a href="#">OriginalMessageId</a>	Specifies the identifier of the message in the last queue that generated this message.
<a href="#">Payload</a>	Specifies the payload of the message.
<a href="#">Priority</a>	Specifies the priority of the message.
<a href="#">Recipients</a>	Specifies the list of recipients that overrides the default queue subscribers.
<a href="#">SenderId</a>	Identifies the original sender of the message.
<a href="#">State</a>	Specifies the state of the message at the time of dequeue.
<a href="#">TransactionGroup</a>	Specifies the transaction group for the dequeued message.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQMessage Class](#)

## OracleAQMessage Constructors

OracleAQMessage constructors create new instances of the OracleAQMessage class.

**Overload List:**

- [OracleAQMessage\(\)](#)  
This constructor instantiates the OracleAQMessage class.
- [OracleAQMessage\(Object\)](#)  
This constructor instantiates the OracleAQMessage class using the object provided as the payload.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQMessage Class](#)
- [OracleAQMessage Members](#)

## OracleAQMessage()

This constructor instantiates the OracleAQMessage class.

**Declaration**

```
// C#  
public OracleAQMessage();
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQMessage Class](#)
- [OracleAQMessage Members](#)

## OracleAQMessage(Object)

This constructor instantiates the `OracleAQMessage` class using the `Object` provided as the *payload*.

### Declaration

```
// C#  
public OracleAQMessage(Object payload);
```

### Parameters

- *payload*

An `Object` specifying *payload*. It can be one of the following types:

- `byte[]`
- `IOracleCustomType`
- `OracleBinary`
- `OracleXmlType`
- `String`
- `XmlReader`

### Exceptions

`ArgumentException` - The specified *payload* value is of invalid type.

### Remarks

The ODP.NET AQ implementation currently does not support user defined types with LOB attributes. It also does not support other variants of user defined types such as `VARRAY` and nested tables, as Oracle Database AQ does not support them inherently.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQMessage Class](#)
- [OracleAQMessage Members](#)

## OracleAQMessage Properties

`OracleAQMessage` properties are listed in [Table 13-16](#).

**Table 13-16 OracleAQMessage Properties**

Property	Description
<a href="#">Correlation</a>	Specifies an identification for the message.
<a href="#">Delay</a>	Specifies the duration, in seconds, after which an enqueued message is available for dequeuing.
<a href="#">DeliveryMode</a>	Specifies the delivery mode of the dequeued message.
<a href="#">DequeueAttempts</a>	Returns the number of attempts that have been made to dequeue the message.
<a href="#">EnqueueTime</a>	Specifies the time when the message was enqueued.
<a href="#">ExceptionQueue</a>	Specifies the name of the queue that the message should be moved to if it cannot be processed successfully.
<a href="#">Expiration</a>	Specifies the duration, in seconds, for which an enqueued message is available for dequeuing.
<a href="#">MessageId</a>	Returns the message identifier.
<a href="#">OriginalMessageId</a>	Specifies the identifier of the message in the last queue that generated this message.
<a href="#">Payload</a>	Specifies the payload of the message.
<a href="#">Priority</a>	Specifies the priority of the message.
<a href="#">Recipients</a>	Specifies the list of recipients that overrides the default queue subscribers.
<a href="#">SenderId</a>	Identifies the original sender of the message.
<a href="#">State</a>	Specifies the state of the message at the time of dequeue.
<a href="#">TransactionGroup</a>	Specifies the transaction group for the dequeued message.

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQMessage Class](#)
- [OracleAQMessage Members](#)

## Correlation

This instance property specifies an identification for the message.

**Declaration**

```
// C#
public string Correlation {get;set;}
```

**Property Value**

A `string` that specifies the identification for the message.

## Remarks

The producer of a message can set this property at the time of enqueueing. The consumer can then use this identification to dequeue specific messages by setting the `Correlation` property of an `OracleAQDequeueOptions` object. For more information regarding dequeuing messages based on `Correlation`, refer to "[Correlation](#)" under the `OracleAQDequeueOptions` class.

### See Also:

- "[Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces](#)"
- [OracleAQMessage Class](#)
- [OracleAQMessage Members](#)
- "[Correlation](#)"

## Delay

This instance property specifies the duration, in seconds, after which an enqueued message is available for dequeuing.

### Declaration

```
// C#  
public int Delay {get;set;}
```

### Property Value

An `integer` that indicates the number of seconds after which an enqueued message is available for dequeuing.

### Exceptions

`ArgumentException` - The value specified is less than 0.

### Remarks

This property delays the immediate consumption of an enqueued message. The following are valid values for this property:

- Positive integer - Indicates the delay in seconds.
- 0 - indicates that the message is immediately available for dequeuing.

The default value is 0. The `Delay` property is not supported with buffered messaging.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQMessage Class](#)
- [OracleAQMessage Members](#)

## DeliveryMode

This instance property specifies the delivery mode of the dequeued message.

### Declaration

```
// C#  
public OracleAQMessageDeliveryMode DeliveryMode {get;}
```

### Property Value

An `OracleAQMessageDeliveryMode` **enumerated value** (`OracleAQMessageDeliveryMode.Persistent` or `OracleAQMessageDeliveryMode.Buffered`).

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQMessage Class](#)
- [OracleAQMessage Members](#)

## DequeueAttempts

This instance property returns the number of attempts that have been made to dequeue the message.

### Declaration

```
// C#  
public int DequeueAttempts {get;}
```

### Property Value

An `integer` that indicates the number of dequeue attempts.

### Remarks

This property is available in an `OracleAQMessage` after the message has been dequeued from a queue.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQMessage Class](#)
- [OracleAQMessage Members](#)

## EnqueueTime

This instance property specifies the time when the message was enqueued.

### Declaration

```
// C#  
public DateTime EnqueueTime {get;}
```

### Property Value

A `DateTime` object.

### Remarks

This property is available after the message is dequeued. It provides the enqueue time of a dequeued message.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQMessage Class](#)
- [OracleAQMessage Members](#)

## ExceptionQueue

This instance property specifies the name of the queue that the message should be moved to if it cannot be processed successfully.

### Declaration

```
// C#  
public string ExceptionQueue {get;set;}
```

### Property Value

The name of the queue that a message should be moved to if it cannot be processed successfully. The default value is `null`.

## Remarks

This property specifies the queue that a message should be moved to if the message has expired or if the number of unsuccessful dequeue attempts have exceeded the `max_retries` value for the queue.

If this property is not set or the specified exception queue name does not exist, then the default exception queue associated with the queue table is used.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQMessage Class](#)
- [OracleAQMessage Members](#)

## Expiration

This instance property specifies the duration, in seconds, for which an enqueued message is available for dequeuing.

### Declaration

```
// C#  
public int Expiration {get;set;}
```

### Property Value

An `integer` that specifies the number of seconds an enqueued message is available for dequeuing.

### Exceptions

`ArgumentException` - The value specified is less than -1.

### Remarks

The value specified is an offset from the value specified in the `Delay` property.

The following are valid values for the property:

- Positive integer - Indicates the expiration in seconds.
- -1 - Indicates that the message never expires.

The default value is -1. When a message expires, the message moves from the `READY` state to the `EXPIRED` state.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQMessage Class](#)
- [OracleAQMessage Members](#)

## MessageId

This instance property returns the message identifier.

### Declaration

```
// C#  
public byte[] MessageId {get;}
```

### Property Value

A `byte[]` that specifies the message identifier.

### Remarks

This property is available after an enqueue or dequeue operation. Dequeued buffered messages have a `null` value for `MessageId`.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQMessage Class](#)
- [OracleAQMessage Members](#)

## OriginalMessageId

This instance property specifies the identifier of the message in the last queue that generated this message.

### Declaration

```
// C#  
public byte[] OriginalMessageId {get;}
```

### Property Value

A `byte[]` that specifies the original message identifier.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQMessage Class](#)
- [OracleAQMessage Members](#)

## Payload

This instance property specifies the payload of the message.

### Declaration

```
// C#  
public Object Payload {get;set;}
```

### Property Value

An `Object` that specifies the payload of the message.

### Exceptions

`ArgumentException` - The specified object is not one of the allowed types.

### Remarks

For a complete discussion of various payload types, refer to "[MessageType](#)" under the `OracleAQQueue` class.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQMessage Class](#)
- [OracleAQMessage Members](#)
- ["MessageType"](#)

## Priority

This instance property specifies the priority of the message.

### Declaration

```
// C#  
public int Priority {get;set;}
```

**Property Value**

An `integer` that specifies the priority of the message.

**Remarks**

The default value is 0. In order to take effect, this property must be set prior to enqueueing the message.

Smaller values indicate higher priority for the message. Negative values may also be used.

The priority of an enqueued message is useful for priority-based dequeuing.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQMessage Class](#)
- [OracleAQMessage Members](#)

## Recipients

This instance property specifies the list of recipients that overrides the default queue subscribers.

**Declaration**

```
// C#  
public OracleAQAgent[] Recipients {get; set}
```

**Property Value**

An `OracleAQAgent[]`.

**Remarks**

This recipient list is valid only for messages being enqueued to multiconsumer queues. The list of recipients is not returned with the message at the time of dequeuing.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQMessage Class](#)
- [OracleAQMessage Members](#)

## SenderId

This instance property identifies the original sender of the message.

### Declaration

```
// C#  
public OracleAQAgent SenderId {get; set;}
```

### Property Value

An `OracleAQAgent` object.

### Remarks

Sender identification is supported in all queue tables created with a database compatibility level of 8.1 or higher.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQMessage Class](#)
- [OracleAQMessage Members](#)

## State

This instance property specifies the state of the message at the time of dequeue.

### Declaration

```
// C#  
public OracleAQMessageState State {get;}
```

### Property Value

An `OracleAQMessageState` enumerated value.

### Remarks

This property is available after the message is dequeued.

The state of buffered messages dequeued by specifying `Correlation` under `dequeue` options is always `OracleAQMessageState.Ready`.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQMessage Class](#)
- [OracleAQMessage Members](#)

## TransactionGroup

This instance property specifies the transaction group for the dequeued message.

### Declaration

```
// C#  
public string TransactionGroup {get;}
```

### Property Value

A string that specifies the transaction group.

### Remarks

This property is set only after the call to `DequeueArray`. This property is supported only when using Oracle Database 10g database or higher.

Messages belonging to one queue can be grouped to form a set that can only be consumed by one user at a time. This requires that the queue be created in a queue table that is enabled for message grouping. All messages belonging to a group must be created in the same transaction. Also, all messages created in one transaction belong to the same group.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQMessage Class](#)
- [OracleAQMessage Members](#)

## OracleAQMessageAvailableEventArgs Class

The `OracleAQMessageAvailableEventArgs` class provides event data for the `OracleAQQueue.MessageAvailable` event.

### Class Inheritance

`System.Object`

`System.EventArgs`

```
Oracle.DataAccess.Client.OracleAQMessageAvailableEventArgs
```

### Declaration

```
// C#
public sealed class OracleAQMessageAvailableEventArgs
```

### Requirements

<b>Provider</b>	<b>ODP.NET, Unmanaged Driver</b>
<b>Assembly</b>	Oracle.DataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client
<b>.NET Framework</b>	4.8

### Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

### Remarks

This class cannot be inherited.

For detailed information on all the inherited properties and methods, please read the documentation provided by Microsoft's .NET Documentation.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQMessageAvailableEventArgs Members](#)
- [OracleAQMessageAvailableEventArgs Constructor](#)
- [OracleAQMessageAvailableEventArgs Properties](#)

## OracleAQMessageAvailableEventArgs Members

OracleAQMessageAvailableEventArgs members are listed in the following tables.

### OracleAQMessageAvailableEventArgs Constructor

OracleAQMessageAvailableEventArgs properties are listed in [Table 13-17](#)

**Table 13-17 OracleAQMessageAvailableEventArgs Constructor**

Property	Description
<a href="#">OracleAQMessageAvailableEventArgs Constructor</a>	Instantiates a new instance of the OracleAQMessageAvailableEventArgs class.

## OracleAQMessageAvailableEventArgs Properties

OracleAQMessageAvailableEventArgs properties are listed in [Table 13-18](#).

**Table 13-18 OracleAQMessageAvailableEventArgs Properties**

Property	Description
<a href="#">AvailableMessages</a>	Specifies the number of messages that raised this notification.
<a href="#">ConsumerName</a>	Provides the name of the consumer for which the message is available for dequeuing.
<a href="#">Correlation</a>	Provides the user-defined identifier of the message.
<a href="#">Delay</a>	Specifies the duration, in seconds, after which an enqueued message is available for dequeuing.
<a href="#">DeliveryMode</a>	Specifies the delivery mode of the message.
<a href="#">EnqueueTime</a>	Specifies the time when the message was enqueued.
<a href="#">ExceptionQueue</a>	Specifies the name of the queue that the message is moved to if it cannot be processed successfully.
<a href="#">Expiration</a>	Specifies the duration, in seconds, for which an enqueued message is available for dequeuing before expiring.
<a href="#">MessageId</a>	Returns an array of message identifiers.
<a href="#">NotificationType</a>	Indicates the type of notification such as regular, grouping, or timeout.
<a href="#">OriginalMessageId</a>	Specifies the ID of the message, in the last queue, that generated this message.
<a href="#">Priority</a>	Specifies the priority of the message.
<a href="#">QueueName</a>	Indicates the name of the queue that contains the message to be dequeued.
<a href="#">SenderId</a>	Identifies the original sender of the message.
<a href="#">State</a>	Specifies the state of the message.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQMessageAvailableEventArgs Class](#)

## OracleAQMessageAvailableEventArgs Constructor

This constructor creates an instance of the `OracleAQMessageAvailableEventArgs` class with default property values.

### Declaration

```
// C#  
public OracleAQMessageAvailableEventArgs();
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQMessageAvailableEventArgs Class](#)
- [OracleAQMessageAvailableEventArgs Members](#)

## OracleAQMessageAvailableEventArgs Properties

OracleAQMessageAvailableEventArgs properties are listed in [Table 13-19](#).

**Table 13-19 OracleAQMessageAvailableEventArgs Properties**

Property	Description
<a href="#">AvailableMessages</a>	Specifies the number of messages that raised this notification.
<a href="#">ConsumerName</a>	Provides the name of the consumer for which the message is available for dequeuing.
<a href="#">Correlation</a>	Provides the user-defined identifier of the message.
<a href="#">Delay</a>	Specifies the duration, in seconds, after which an enqueued message is available for dequeuing.
<a href="#">DeliveryMode</a>	Specifies the delivery mode of the message.
<a href="#">EnqueueTime</a>	Specifies the time when the message was enqueued.
<a href="#">ExceptionQueue</a>	Specifies the name of the queue that the message is moved to if it cannot be processed successfully.
<a href="#">Expiration</a>	Specifies the duration, in seconds, for which an enqueued message is available for dequeuing before expiring.
<a href="#">MessageId</a>	Returns an array of message identifiers.
<a href="#">NotificationType</a>	Indicates the type of notification such as regular, grouping, or timeout.
<a href="#">OriginalMessageId</a>	Specifies the ID of the message, in the last queue, that generated this message.
<a href="#">Priority</a>	Specifies the priority of the message.
<a href="#">QueueName</a>	Indicates the name of the queue that contains the message to be dequeued.
<a href="#">SenderId</a>	Identifies the original sender of the message.
<a href="#">State</a>	Specifies the state of the message.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQMessageAvailableEventArgs Class](#)
- [OracleAQMessageAvailableEventArgs Members](#)

## AvailableMessages

This instance property specifies the number of messages that raised this notification.

### Declaration

```
// C#  
public int AvailableMessages{get;}
```

### Property Value

An integer indicating the number of messages that raised this notification.

### Remarks

The property value is 1 for a regular notification type. The notification type can be specified using the `OracleAQQueue.Notification` property.

This property is not relevant if the `NotificationType` is `OracleAQNotificationType.Timeout`.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQMessageAvailableEventArgs Class](#)
- [OracleAQMessageAvailableEventArgs Members](#)

## ConsumerName

This property provides the name of the consumer for which the message is available for dequeuing.

### Declaration

```
// C#  
public string ConsumerName {get;}
```

### Property Value

A string that identifies the name of the consumer.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQMessageAvailableEventArgs Class](#)
- [OracleAQMessageAvailableEventArgs Members](#)

## Correlation

This instance property specifies the identification for the message.

### Declaration

```
// C#  
public string Correlation {get;}
```

### Property Value

A *string* that specifies the identification for the message.

### Remarks

This property specifies the correlation of the message for which the notification is raised. The consumer can then use this identification to dequeue specific messages by setting the "[Correlation](#)" property of the `OracleAQDequeueOptions` object.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQMessageAvailableEventArgs Class](#)
- [OracleAQMessageAvailableEventArgs Members](#)
- ["Correlation"](#)

## Delay

This instance property specifies the duration, in seconds, after which an enqueued message is available for dequeuing.

### Declaration

```
// C#  
public int Delay {get;}
```

### Property Value

An *integer* that indicates the duration, in seconds, after which an enqueued message is available for dequeuing.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQMessageAvailableEventArgs Class](#)
- [OracleAQMessageAvailableEventArgs Members](#)

## DeliveryMode

This instance property specifies the delivery mode of the message.

### Declaration

```
// C#  
public OracleAQMessageDeliveryMode DeliveryMode {get;}
```

### Property Value

An `OracleAQMessageDeliveryMode` enumerated value.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQMessageAvailableEventArgs Class](#)
- [OracleAQMessageAvailableEventArgs Members](#)

## EnqueueTime

This instance property specifies the time when the message was enqueued.

### Declaration

```
// C#  
public DateTime EnqueueTime {get;}
```

### Property Value

A `DateTime` object.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQMessageAvailableEventArgs Class](#)
- [OracleAQMessageAvailableEventArgs Members](#)

## ExceptionQueue

This instance property specifies the name of the queue that the message is moved to if it cannot be processed successfully.

### Declaration

```
// C#  
public string ExceptionQueue {get;}
```

### Property Value

The name of the queue that a message to is moved if it cannot be processed successfully.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQMessageAvailableEventArgs Class](#)
- [OracleAQMessageAvailableEventArgs Members](#)

## Expiration

This instance property specifies the duration, in seconds, for which an enqueued message is available for dequeuing before expiring.

### Declaration

```
// C#  
public int Expiration {get;}
```

### Property Value

An `integer` that specifies the duration, in seconds, for which an enqueued message is available for dequeuing.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQMessageAvailableEventArgs Class](#)
- [OracleAQMessageAvailableEventArgs Members](#)

## MessageId

This instance property returns an array of message identifiers.

### Declaration

```
// C#  
public byte[][] MessageId{get;}
```

### Property Value

A `byte[][]` that specifies the message identifiers received as part of the notification.

### Remarks

This property specifies the message identifiers of the messages that raise the notification.

The size of the `MessageId` array is 1 for regular notifications. The size of the `MessageId` array is 1 for grouping notifications if the notification grouping type is `OracleAQNotificationGroupingType.Last`. This property is not relevant if the `NotificationType` is `OracleAQNotificationType.Timeout`.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQMessageAvailableEventArgs Class](#)
- [OracleAQMessageAvailableEventArgs Members](#)

## NotificationType

This property indicates the type of notification such as regular, grouping, or timeout.

### Declaration

```
// C#  
public OracleAQNotificationType NotificationType {get;}
```

### Property Value

An `OracleAQNotificationType` enum value.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQMessageAvailableEventArgs Class](#)
- [OracleAQMessageAvailableEventArgs Members](#)

## OriginalMessageId

This property specifies the ID of the message, in the last queue, that generated this message.

### Declaration

```
// C#  
public byte[] OriginalMessageId {get;}
```

### Property Value

A `byte[]` that specifies the original message ID.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQMessageAvailableEventArgs Class](#)
- [OracleAQMessageAvailableEventArgs Members](#)

## Priority

This instance property specifies the priority of the message.

### Declaration

```
// C#  
public int Priority {get;}
```

### Property Value

An `integer` that specifies the priority of the message.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQMessageAvailableEventArgs Class](#)
- [OracleAQMessageAvailableEventArgs Members](#)

## QueueName

This property indicates the name of the queue that contains the message to be dequeued.

### Declaration

```
// C#  
public string QueueName {get;}
```

### Property Value

A string.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQMessageAvailableEventArgs Class](#)
- [OracleAQMessageAvailableEventArgs Members](#)

## SenderId

This property identifies the original sender of the message.

### Declaration

```
// C#  
public OracleAQAgent SenderId {get;}
```

### Property Value

An `OracleAQAgent` object.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQMessageAvailableEventArgs Class](#)
- [OracleAQMessageAvailableEventArgs Members](#)

## State

This instance property specifies the state of the message.

### Declaration

```
// C#  
public OracleAQMessageState State {get;}
```

### Property Value

An `OracleAQMessageState` enumerated value.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQMessageAvailableEventArgs Class](#)
- [OracleAQMessageAvailableEventArgs Members](#)

## OracleAQMessageAvailableEventHandler Delegate

The `OracleAQMessageAvailableEventHandler` delegate represents the signature of the method that handles the `OracleAQQueue.MessageAvailable` event.

### Declaration

```
// C#  
public delegate void OracleAQMessageAvailableEventHandler (object  
    sender, OracleAQMessageAvailableEventArgs eventArgs);
```

### Parameters

- *sender*  
The source of the event.
- *eventArgs*  
The `OracleAQMessageAvailableEventArgs` object that contains the event data.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- ["MessageAvailable Event"](#)

## OracleAQQueue Class

An `OracleAQQueue` object represents a queue.

### Class Inheritance

`System.Object`

`OracleAQQueue`

### Declaration

```
// C#  
public class OracleAQQueue : IDisposable
```

### Requirements

<b>Provider</b>	<b>ODP.NET, Unmanaged Driver</b>
<b>Assembly</b>	<code>Oracle.DataAccess.dll</code>
<b>Namespace</b>	<code>Oracle.DataAccess.Client</code>
<b>.NET Framework</b>	4.8

### Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

### Remarks

A queue is a repository of messages and may either be a user queue, or an exception queue. A user queue is for normal message processing. A message is moved from a user queue to an exception queue if it cannot be retrieved and processed for some reason.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Members](#)
- [OracleAQQueue Constructors](#)
- [OracleAQQueue Static Methods](#)
- [OracleAQQueue Properties](#)
- [OracleAQQueue Public Methods](#)
- [OracleAQQueue Events](#)

## OracleAQQueue Members

OracleAQQueue members are listed in the following tables.

### OracleAQQueue Constructors

OracleAQQueue constructors are listed in [Table 13-20](#).

**Table 13-20 OracleAQQueue Constructors**

Constructor	Description
<a href="#">OracleAQQueue Constructors</a>	Instantiate a new instance of the OracleAQQueue class (Overloaded).

### OracleAQQueue Static Methods

The OracleAQQueue static method is listed in [Table 13-21](#).

**Table 13-21 OracleAQQueue Static Methods**

Static Method	Description
<a href="#">Listen</a>	Listens for messages on one or more queues for one or more consumers, as specified in the array of OracleAQAgent objects (Overloaded).

### OracleAQQueue Properties

OracleAQQueue properties are listed in [Table 13-22](#).

**Table 13-22 OracleAQQueue Properties**

Property	Description
<a href="#">Connection</a>	Specifies the OracleConnection object associated with the queue.

**Table 13-22 (Cont.) OracleAQQueue Properties**

Property	Description
<a href="#">DequeueOptions</a>	Specifies the dequeuing options to use when dequeuing a message from a queue.
<a href="#">EnqueueOptions</a>	Specifies the enqueueing options used to enqueue a message to a queue.
<a href="#">MessageType</a>	Specifies the type of queue table associated with this queue.
<a href="#">Name</a>	Returns the name of the queue.
<a href="#">Notification</a>	Specifies the various notification options for notifications that are registered using the <code>MessageAvailable</code> event.
<a href="#">NotificationConsumers</a>	Specifies the array of consumers, for a multiconsumer queue, that are to be notified asynchronously for any incoming messages on the queue.
<a href="#">UdtTypeName</a>	Specifies the type name on which the queue and the corresponding queue table is based if the <code>MessageType</code> is <code>OracleAQMessageType.UDT</code> .

**OracleAQQueue Public Methods**

The `OracleAQQueue` public methods are listed in [Table 13-23](#).

**Table 13-23 OracleAQQueue Public Methods**

Public Method	Description
<a href="#">Dequeue</a>	Dequeues messages from queues (Overloaded).
<a href="#">DequeueArray</a>	Dequeues multiple messages from queues (Overloaded).
<a href="#">Dispose</a>	Releases any resources or memory allocated by the object
<a href="#">Enqueue</a>	Enqueues messages to queues (Overloaded).
<a href="#">EnqueueArray</a>	Enqueues multiple messages to a queue (Overloaded).
<a href="#">Listen</a>	Listens for messages on the queue on behalf of <code>listenConsumers</code> (Overloaded).

**OracleAQQueue Events**

The `OracleAQQueue` event is listed in [Table 13-24](#).

**Table 13-24 OracleAQQueue Events**

Event Name	Description
<a href="#">MessageAvailable Event</a>	Notifies when a message is available in the queue for <code>NotificationConsumers</code> .

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Class](#)

## OracleAQQueue Constructors

`OracleAQQueue` constructors create new instances of the `OracleAQQueue` class.

**Overload List:**

- [OracleAQQueue\(string\)](#)  
This constructor takes a queue name to initialize a queue object.
- [OracleAQQueue\(string, OracleConnection\)](#)  
This constructor takes a queue name and connection to initialize a queue object. The connection does not need be open during the queue object construction.
- [OracleAQQueue\(string, OracleConnection, OracleAQMessageType\)](#)  
This constructor takes a queue name, connection, and message type enumeration to initialize a queue object.
- [OracleAQQueue\(string, OracleConnection, OracleAQMessageType, string\)](#)  
This constructor takes a queue name, connection, message type enumeration, and UDT type name to initialize a queue object.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Class](#)
- [OracleAQQueue Members](#)

### OracleAQQueue(string)

This constructor takes a queue name to initialize a queue object.

**Declaration**

```
// C#  
public OracleAQQueue(string name);
```

**Parameters**

- *name*  
The name of the queue as specified in the database.

## Exceptions

`ArgumentNullException` - The queue name is null.

`ArgumentException` - The queue name is empty.

## Remarks

The operation of creating an `OracleAQQueue` object does not involve checking for the existence of the queue in the database.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Class](#)
- [OracleAQQueue Members](#)

## OracleAQQueue(string, OracleConnection)

This constructor takes a queue name and connection to initialize a queue object. The connection does not need to be open during the queue object construction.

### Declaration

```
// C#  
public OracleAQQueue(string name, OracleConnection con);
```

### Parameters

- *name*  
Name of the queue as specified in the database.
- *con*  
An `OracleConnection` object that connects to the queue.

### Exceptions

`ArgumentNullException` - Either the connection is null or queue name is null.

`ArgumentException` - Queue name is empty.

### Remarks

The connection can be accessed using the `Connection` property, and it must be opened before calling any operational APIs such as `Enqueue` and `Dequeue`.

Creating an `OracleAQQueue` object does not check for the existence of the queue in the database.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Class](#)
- [OracleAQQueue Members](#)

## OracleAQQueue(string, OracleConnection, OracleAQMessageType)

This constructor takes a queue name, connection and message type enumeration to initialize a queue object. The connection does not need to be open during the queue object construction.

### Declaration

```
// C#  
public OracleAQQueue(string name, OracleConnection con, OracleAQMessageType  
    messageType);
```

### Parameters

- *name*  
The name of the queue as specified in the database.
- *con*  
An `OracleConnection` object that is used to connect to the queue.
- *messageType*  
An `OracleAQMessageType` enumeration specifying the type of the message that is enqueued or dequeued from this queue.

### Exceptions

`ArgumentNullException` - Either the connection is `null` or queue name is `null`.

`ArgumentException` - Queue name is empty or the specified message type is not valid.

### Remarks

Creating an `OracleAQQueue` object does not check for the existence of the queue in the database.

You need to set the `UdtTypeName` property before using the queue object if the `messageType` is a UDT. Another approach is to create a queue using the other constructor overload by supplying the `udtTypeName`.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Class](#)
- [OracleAQQueue Members](#)

## OracleAQQueue(string, OracleConnection, OracleAQMessageType, string)

This constructor takes a queue name, connection, message type enumeration, and UDT type name to initialize a queue object. The connection does not need to be open during the queue object construction.

### Declaration

```
// C#  
public OracleAQQueue(string name, OracleConnection con, OracleAQMessageType  
    messageType, string udtTypeName);
```

### Parameters

- *name*  
The name of the queue as specified in the database.
- *con*  
An `OracleConnection` object that is used to connect to the queue.
- *messageType*  
An `OracleAQMessageType` enumeration specifying the type of the message that is enqueued or dequeued from this queue.
- *udtTypeName*  
The name of the database object type used if the `messageType` is UDT. The `udtTypeName` parameter represents the type on which the queue is based.

### Exceptions

`ArgumentNullException` - The connection is `null` or the queue name is `null`.

`ArgumentException` - The queue name is empty or the specified `messageType` is not valid.

### Remarks

Creating an `OracleAQQueue` object does not check for the existence of the queue in the database.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Class](#)
- [OracleAQQueue Members](#)

## OracleAQQueue Static Methods

`OracleAQQueue` static methods are listed in [Table 13-25](#).

**Table 13-25 OracleAQQueue Static Methods**

Static Method	Description
<a href="#">Listen</a>	Listens for messages on one or more queues for one or more consumers, as specified in the array of <code>OracleAQAgent</code> objects (Overloaded).

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Class](#)
- [OracleAQQueue Members](#)

## Listen

`Listen` methods listen for messages on one or more queues for one or more consumers as specified in the array of `OracleAQAgent` objects.

### Overload list

- [Listen\(OracleConnection, OracleAQAgent\[ \]\)](#)  
This static method listens for messages on one or more queues for one or more consumers as specified in the array of `OracleAQAgent` objects.
- [Listen\(OracleConnection, OracleAQAgent\[ \], int\)](#)  
This static method listens for messages on one or more queues for one or more consumers as specified in the array of `OracleAQAgent` objects. It also specifies a wait time.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Class](#)
- [OracleAQQueue Members](#)

## Listen(OracleConnection, OracleAQAgent[ ])

This static method listens for messages on one or more queues for one or more consumers as specified in the array of `OracleAQAgent` objects.

### Declaration

```
// C#  
public static OracleAQAgent Listen(OracleConnection con, OracleAQAgent[]  
    listenConsumers);
```

### Parameters

- `con`  
An `OracleConnection` instance.
- `listenConsumers`  
The array of consumers being listened for. The name of the `OracleAQAgent` object must be `null` or empty for single consumer queues.

### Return Value

An `OracleAQAgent` object.

### Exceptions

`ArgumentNullException` - The `con` or `listenConsumers` parameter is null.

`InvalidOperationException` - The connection is not open.

### Remarks

`Listen` is useful in situations where one needs to monitor multiple queues until a message is available for a consumer in one of the queues. The `Name` property of the `OracleAQAgent` object represents the name of the consumer and the `Address` property represents the name of the queue.

This call blocks the calling thread until there is a message ready for consumption for a consumer in the list. It returns an `OracleAQAgent` object which specifies the consumer and queue for which a message is ready to be dequeued.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Class](#)
- [OracleAQQueue Members](#)

## Listen(OracleConnection, OracleAQAgent[ ], int)

This static method listens for messages on one or more queues for one or more consumers as specified in the array of `OracleAQAgent` objects. The `Name` property of the `OracleAQAgent` object represents the name of the consumer and the `Address` property of the `OracleAQAgent` object represents the name of the queue.

In case of timeout, this method returns `null`.

### Declaration

```
// C#  
public static OracleAQAgent Listen(OracleConnection con, OracleAQAgent[]  
    listenConsumers, int waitTime);
```

### Parameters

- `con`  
An `OracleConnection` instance.
- `listenConsumers`  
The array of consumers being listened for. The name of the `OracleAQAgent` object must be `null` or empty for single consumer queues.
- `waitTime`  
Wait time in seconds.

### Return Value

An `OracleAQAgent` object.

### Exceptions

`ArgumentNullException` - The `con` or `listenConsumers` parameter is null.

`InvalidOperationException` - The connection is not open.

`ArgumentException` - `waitTime` is less than -1.

### Remarks

`Listen` is useful in situations where one needs to monitor multiple queues until a message is available for a consumer in one of the queues. The `Name` property of the `OracleAQAgent` object represents the name of the consumer and the `Address` property of the `OracleAQAgent` object represents the name of the queue.

A *waitTime* of `-1` implies an infinite wait time.

This call blocks the calling thread until there is a message ready for consumption for a consumer in the list. It returns an `OracleAQAgent` object which specifies the consumer and queue for which a message is ready to be dequeued.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Class](#)
- [OracleAQQueue Members](#)

## OracleAQQueue Properties

`OracleAQQueue` properties are listed in [Table 13-26](#).

**Table 13-26 OracleAQQueue Properties**

Property	Description
<a href="#">Connection</a>	Specifies the <code>OracleConnection</code> object associated with the queue.
<a href="#">DequeueOptions</a>	Specifies the dequeuing options to use when dequeuing a message from a queue.
<a href="#">EnqueueOptions</a>	Specifies the enqueueing options used to enqueue a message to a queue.
<a href="#">MessageType</a>	Specifies the type of queue table associated with this queue.
<a href="#">Name</a>	Returns the name of the queue.
<a href="#">Notification</a>	Specifies the various notification options for notifications that are registered using the <code>MessageAvailable</code> event.
<a href="#">NotificationConsumers</a>	Specifies the array of consumers, for a multiconsumer queue, that are to be notified asynchronously for any incoming messages on the queue.
<a href="#">UdtTypeName</a>	Specifies the type name on which the queue and the corresponding queue table is based if the <code>MessageType</code> is <code>OracleAQMessageType.UDT</code> .

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Class](#)
- [OracleAQQueue Members](#)

## Connection

This property specifies the `OracleConnection` object associated with the queue.

### Declaration

```
// C#  
public OracleConnection Connection {get; set;}
```

### Property Value

An `OracleConnection` object that indicates the connection associated with the queue.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

### Remarks

This connection must be opened before calling methods like `Enqueue` and `Dequeue`.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Class](#)
- [OracleAQQueue Members](#)

## DequeueOptions

This instance property specifies the dequeuing options to use when dequeuing a message from a queue.

### Declaration

```
// C#  
public OracleAQDequeueOptions DequeueOptions {get; set}
```

### Property Value

An `OracleAQDequeueOptions` object.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

### Remarks

The default value is an `OracleAQDequeueOptions` object with default property values. Setting this property to `null` resets all dequeue options to their default values.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Class](#)
- [OracleAQQueue Members](#)

## EnqueueOptions

This instance property specifies the enqueueing options used to enqueue a message to a queue.

### Declaration

```
// C#  
public OracleAQEnqueueOptions EnqueueOptions {get; set;}
```

### Property Value

An `OracleAQEnqueueOptions` object.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

### Remarks

The default value is an `OracleAQEnqueueOptions` object with default property values. Setting this property to `null` resets all enqueue options to their default values.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Class](#)
- [OracleAQQueue Members](#)

## MessageType

This instance property specifies the type of queue table associated with this queue.

### Declaration

```
// C#  
public OracleAQMessageType MessageType {get; set;}
```

### Property Value

An `OracleAQMessageType` enumerated value.

## Exceptions

`ArgumentOutOfRangeException` - The type value specified is invalid.

`ObjectDisposedException` - The object is already disposed.

## Remarks

The `MessageType` property also dictates the type of message payloads that are enqueued or dequeued from the queue. It is possible to enqueue a variety of payloads depending on the `MessageType`. ODP.NET supports RAW, user-defined type, and XML data type payloads. It does not support other data types, such as Java Message Service data types.

[Table 13-27](#) lists the allowed payload types for various message types.

**Table 13-27 Message Types and Payloads**

<code>OracleAQQueue.MessageType</code>	Allowed <code>OracleAQMessage.Payload</code> type to Enqueue
<code>OracleAQMessageType.Raw</code>	<code>OracleBinary</code> , <code>byte[]</code>
<code>OracleAQMessageType.Xml</code>	<code>OracleXmlType</code> , <code>XmlReader</code> , <code>String</code> (well-formed XML, else exception is raised)
<code>OracleAQMessageType.UDT</code>	UDT Custom Object

[Table 13-28](#) lists the payload types for dequeued messages.

**Table 13-28 Payload Types for Dequeued Messages**

<code>OracleAQQueue.MessageType</code>	<code>DequeueOptions.ProviderSpecificType</code>	<code>OracleAQMessage.Payload</code> of dequeued message
<code>OracleAQMessageType.Xml</code>	true	<code>OracleXmlType</code>
<code>OracleAQMessageType.Xml</code>	false	<code>XmlReader</code>
<code>OracleAQMessageType.Raw</code>	true	<code>OracleBinary</code>
<code>OracleAQMessageType.Raw</code>	false	<code>Byte[]</code>
<code>OracleAQMessageType.UDT</code>	N.A.	UDT Custom Object

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Class](#)
- [OracleAQQueue Members](#)

## Name

This instance property returns the name of the queue.

### Declaration

```
// C#  
public string Name {get;}
```

### Property Value

A string that indicates the name of the queue.

### Exceptions

`ObjectDisposedException` - The object is already disposed.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Class](#)
- [OracleAQQueue Members](#)

## Notification

This instance property specifies the various notification options for notifications that are registered using the `MessageAvailable` event.

### Declaration

```
// C#  
public OracleNotificationRequest Notification {get;}
```

### Property Value

Specifies an `OracleNotificationRequest` object whose properties can be changed to alter the notification behavior.

### Remarks

This property can be used to change various notification options. The notification options must be changed before registering with the `MessageAvailable` event. This property can be modified again only after unregistering from the `MessageAvailable` event.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Class](#)
- [OracleAQQueue Members](#)

## NotificationConsumers

This instance property specifies the array of consumers, for a multiconsumer queue, that are to be notified asynchronously for any incoming messages on the queue.

### Declaration

```
// C#  
public string[] NotificationConsumers {get; set;}
```

### Property Value

Specifies an array of consumer name strings for which the notifications are delivered.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - `MessageAvailable` registration is active.

### Remarks

The consumer names must be in uppercase. This functionality only supports queues with uppercase names.

The list of consumers is used in the `MessageAvailable` event. The list must be set before registering for the event. This property cannot be modified after registering for the `MessageAvailable` event. This property can be modified again only after unregistering from `MessageAvailable` event.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Class](#)
- [OracleAQQueue Members](#)

## UdtTypeName

This instance property specifies the type name on which the queue and the corresponding queue table is based if the `MessageType` is `OracleAQMessageType.UDT`.

**Declaration**

```
// C#
public string UdtTypeName {get; set;}
```

**Property Value**

Specifies the Oracle user-defined type name if the `MessageType` is `OracleAQMessageType.UDT`.

**Exceptions**

`ObjectDisposedException` - The object is already disposed.

**Remarks**

The `UdtTypeName` property corresponds to the user-defined type name of the payload. This property must always be specified if the payload is a user-defined type. This property need not be set for other payload types.

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Class](#)
- [OracleAQQueue Members](#)

## OracleAQQueue Public Methods

`OracleAQQueue` public methods are listed in [Table 13-29](#).

**Table 13-29 OracleAQQueue Public Methods**

Public Method	Description
<a href="#">Dequeue</a>	Dequeues messages from queues (Overloaded).
<a href="#">DequeueArray</a>	Dequeues multiple messages from queues (Overloaded).
<a href="#">Dispose</a>	Releases any resources or memory allocated by the object
<a href="#">Enqueue</a>	Enqueues messages to queues (Overloaded).
<a href="#">EnqueueArray</a>	Enqueues multiple messages to a queue (Overloaded).
<a href="#">Listen</a>	Listens for messages on the queue on behalf of <code>listenConsumers</code> (Overloaded).

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Class](#)
- [OracleAQQueue Members](#)

## Dequeue

Dequeue methods dequeue messages from queues.

### Overload List

- [Dequeue\(\)](#)  
This instance method dequeues messages from a queue using the `DequeueOptions` for the instance.
- [Dequeue\(OracleAQDequeueOptions\)](#)  
This instance method dequeues messages from a queue using the supplied dequeue options.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Class](#)
- [OracleAQQueue Members](#)

## Dequeue()

This instance method is used to dequeue a message from a queue using the `DequeueOptions` for the instance.

### Declaration

```
// C#  
public OracleAQMessage Dequeue();
```

### Return Value

An `OracleAQMessage` instance representing the dequeued message.

### Exceptions

`InvalidOperationException` - The connection is not open.

`ObjectDisposedException` - The object is already disposed.

`OracleException` - In case of timeout, an exception is thrown with the message, `ORA-25228: timeout or end-of-fetch during message dequeue from queue_name`. Timeout may happen if `DequeueOptions.Wait` is set to a value other than `-1`.

### Remarks

The `MessageType` property must be set appropriately before calling this function. If the `MessageType` is `OracleAQMessageType.UDT`, then the `UdtTypeName` property must also be set.

Dequeued buffered messages always have `null` `MessageId` values.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Class](#)
- [OracleAQQueue Members](#)

## Dequeue(OracleAQDequeueOptions)

This instance method dequeues messages from a queue using the supplied dequeue options.

### Declaration

```
// C#  
public OracleAQMessage Dequeue(OracleAQDequeueOptions dequeueOptions);
```

### Parameters

- `dequeueOptions`  
An `OracleAQDequeueOptions` object.

### Return Value

An `OracleAQMessage` instance representing the dequeued message.

### Exceptions

`InvalidOperationException` - The connection is not open.

`ObjectDisposedException` - The object is already disposed.

`OracleException` - In case of timeout, an exception is thrown with the message, `ORA-25228: timeout or end-of-fetch during message dequeue from queue_name`. Timeout may happen if `DequeueOptions.Wait` is set to a value other than `-1`.

### Remarks

If the supplied `dequeueOptions` object is `null`, then the dequeue options default values are used. The queue object's `DequeueOptions` property is ignored for this operation.

Calling this method does not change the `DequeueOptions` property of the queue.

The `MessageType` property must be set appropriately before calling this function. If the `MessageType` is `OracleAQMessageType.UDT`, then the `UdtTypeName` property must also be set.

Dequeued buffered messages always have null `MessageId` values.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Class](#)
- [OracleAQQueue Members](#)

## DequeueArray

`DequeueArray` methods dequeue multiple messages from queues.

### Overload List

- [DequeueArray\(int\)](#)  
This instance method dequeues multiple messages from a queue using the `DequeueOptions` of the instance.
- [DequeueArray\(int, OracleAQDequeueOptions\)](#)  
This instance method dequeues multiple messages from a queue using the supplied dequeue options.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Class](#)
- [OracleAQQueue Members](#)

## DequeueArray(int)

This instance method dequeues multiple messages from a queue using the `DequeueOptions` of the instance.

### Declaration

```
// C#  
public OracleAQMessage[] DequeueArray(int dequeueCount);
```

### Parameters

- `dequeueCount`

An integer specifying the numbers of messages to dequeue.

### Return Value

An array of `OracleAQMessage` instances representing the dequeued messages.

### Exceptions

`ArgumentOutOfRangeException` - `dequeueCount` is less than or equal to 0.

`InvalidOperationException` - The connection is not open.

`ObjectDisposedException` - The object is already disposed.

`OracleException` - In case of timeout, an exception is thrown with the message, `ORA-25228: timeout or end-of-fetch during message dequeue from queue_name`. Timeout may happen if `DequeueOptions.Wait` is set to a value other than -1.

### Remarks

This method is supported for Oracle Database 10g and higher releases.

The `MessageType` property must be set appropriately before calling this function. If the `MessageType` is `OracleAQMessageType.UDT`, then the `UdtTypeName` property must be set as well.

The size of the returned array may be less than the `dequeueCount`. It depends on the actual number of messages present in the queue.

For database versions earlier than Oracle Database 12c Release 2 (12.2), the `MessageId` property of persistent `OracleAQMessage` objects retrieved using `DequeueArray` is always `null`.

Dequeued buffered messages always have `null MessageId` values irrespective of the database version.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Class](#)
- [OracleAQQueue Members](#)

## DequeueArray(int, OracleAQDequeueOptions)

This instance method dequeues multiple messages from a queue using the supplied dequeue options.

### Declaration

```
// C#  
public OracleAQMessage[] DequeueArray(int dequeueCount, OracleAQDequeueOptions  
dequeueOptions);
```

### Parameters

- `dequeueCount`  
An integer specifying the numbers of messages to dequeue.
- `dequeueOptions`  
An `OracleAQDequeueOptions` object.

### Return Value

An array of `OracleAQMessage` instances representing the dequeued messages.

### Exceptions

`ArgumentOutOfRangeException` - `dequeueCount` is less than or equal to 0.

`InvalidOperationException` - The connection is not open.

`ObjectDisposedException` - The object is already disposed.

`OracleException` - In case of timeout, an exception is thrown with the message, `ORA-25228: timeout or end-of-fetch during message dequeue from queue_name`. Timeout may happen if `DequeueOptions.Wait` is set to a value other than `-1`.

### Remarks

This method is supported for Oracle Database 10g Release 1 (10.1) and higher releases. Calling this method does not change the `DequeueOptions` property of the queue.

If the supplied `dequeueOptions` object is `null`, then the dequeue options default values are used. The `DequeueOptions` property of the queue object is ignored in this operation.

The `MessageType` property must be set appropriately before calling this function. If the `MessageType` is `OracleAQMessageType.UDT`, then the `UdtTypeName` property must be set as well.

The size of the returned array may be less than the `dequeueCount`. It depends on the actual number of messages present in the queue.

For database versions earlier than Oracle Database 12c Release 2 (12.2), the `MessageId` property of persistent `OracleAQMessage` objects retrieved using `DequeueArray` is always `null`.

Dequeued buffered messages always have `null MessageId` values irrespective of the database version.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Class](#)
- [OracleAQQueue Members](#)

## Dispose

This method releases any resources or memory allocated by the object.

### Declaration

```
// C#  
public void Dispose();
```

### Implements

IDisposable.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Class](#)
- [OracleAQQueue Members](#)

## Enqueue

Enqueue instance methods enqueue messages to queues.

### Overload List

- [Enqueue\(OracleAQMessage\)](#)  
This instance method enqueues messages to a queue using the `EnqueueOptions` of the instance.
- [Enqueue\(OracleAQMessage, OracleAQEnqueueOptions\)](#)  
This instance method enqueues messages to a queue using the supplied enqueue options.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Class](#)
- [OracleAQQueue Members](#)

## Enqueue(OracleAQMessage)

This instance method enqueues messages to a queue using the `EnqueueOptions` of the instance.

### Declaration

```
// C#  
public void Enqueue(OracleAQMessage message);
```

### Parameters

- `message`  
An `OracleAQMessage` object.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The connection is not open.

`ArgumentNullException` - The message parameter is null.

`ArgumentException` - The message payload is `OracleXmlType` and the connection used to create `OracleXmlType` is different from the queue's connection.

### Remarks

`MessageId` of the enqueued message is populated after the call to `Enqueue` completes. Enqueued buffered messages always have null `MessageId` values.

The `MessageType` property needs to be set appropriately before calling this function. If the `MessageType` is `OracleAQMessageType.UDT`, then the `UdtTypeName` property must be set as well.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Class](#)
- [OracleAQQueue Members](#)

## Enqueue(OracleAQMessage, OracleAQEnqueueOptions)

This instance method enqueues messages to a queue using the supplied enqueue options.

### Declaration

```
// C#  
public void Enqueue(OracleAQMessage message, OracleAQEnqueueOptions enqueueOptions);
```

### Parameters

- *message*  
An OracleAQMessage object.
- *enqueueOptions*  
An OracleAQEnqueueOptions object.

### Exceptions

ObjectDisposedException - The object is already disposed.

InvalidOperationException - The connection is not open.

ArgumentNullException - The message parameter is null.

ArgumentException - The message payload is OracleXmlType and the connection used to create OracleXmlType is different from the queue's connection.

### Remarks

If the supplied enqueueOptions object is null, then the enqueue options default values are used. The EnqueueOptions property of the queue object is ignored in this operation.

The MessageId of the enqueued message is populated after the call to Enqueue completes. Enqueued buffered messages always have null MessageId values. Calling this method does not change the EnqueueOptions property of the queue.

The MessageType property must be set appropriately before calling this function. If the MessageType is OracleAQMessageType.UDT, then the UdtTypeName property must also be set.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Class](#)
- [OracleAQQueue Members](#)

## EnqueueArray

EnqueueArray instance methods enqueue multiple messages to a queue.

### Overload List

- [EnqueueArray\(OracleAQMessage\[ \]\)](#)  
This instance method enqueues multiple messages to a queue using the `EnqueueOptions` of the instance.
- [EnqueueArray\(OracleAQMessage\[ \], OracleAQEnqueueOptions\)](#)  
This instance method enqueues multiple messages to a queue using the supplied enqueue options.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Class](#)
- [OracleAQQueue Members](#)

## EnqueueArray(OracleAQMessage[ ])

This instance method enqueues multiple messages to a queue using the `EnqueueOptions` of the instance.

### Declaration

```
// C#  
public int EnqueueArray(OracleAQMessage[] messages);
```

### Parameters

- *messages*  
An array of `OracleAQMessage` objects.

### Return Value

An integer representing the number of messages actually enqueued.

### Exceptions

`ArgumentNullException` - The message parameter is null.

`ArgumentException` - At least one of the `OracleAQMessage[]` elements is null, or at least one of the `OracleAQMessage[]` elements has a payload of `OracleXmlType`, which is created using a connection that is different from the queue's connection.

`InvalidOperationException` - The `OracleAQMessage` array is empty or the connection is not open.

`ObjectDisposedException` - The object is already disposed.

## Remarks

This method is supported by Oracle Database 10g and higher releases. The `MessageId` properties of the enqueued messages are populated after the call to `Enqueue` completes. Enqueued buffered messages always have `null` `MessageId` values.

The `MessageType` property must be set appropriately before calling this function. If the `MessageType` is `OracleAQMessageType.UDT`, then the `UdtTypeName` property must also be set.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Class](#)
- [OracleAQQueue Members](#)

## EnqueueArray(OracleAQMessage[ ], OracleAQEnqueueOptions)

This instance method enqueues multiple messages to a queue using the supplied enqueue options.

### Declaration

```
// C#
public int EnqueueArray(OracleAQMessage[] messages, OracleAQEnqueueOptions
    enqueueOptions);
```

### Parameters

- *messages*  
An array of `OracleAQMessage` objects.
- *enqueueOptions*  
An `OracleAQEnqueueOptions` object.

### Return Value

An integer representing the number of messages actually enqueued.

### Exceptions

`ArgumentNullException` - The message parameter is `null`.

`ArgumentException` - At least one of the `OracleAQMessage[]` elements is `null`, or at least one of the `OracleAQMessage[]` elements has a payload of `OracleXmlType`, which is created using a connection that is different from the queue's connection.

`InvalidOperationException` - The `OracleAQMessage` array is empty or the connection is not open.

`ObjectDisposedException` - The object is already disposed.

## Remarks

This method is supported by Oracle Database 10g and higher releases. `MessageId` properties of the enqueued messages are populated after the call to `Enqueue` completes. Enqueued buffered messages always have `null` `MessageId` values. Calling this method does not change the `EnqueueOptions` property of the queue.

If the supplied `enqueueOptions` object is `null`, then the enqueue options default values are used. The `EnqueueOptions` property of the queue object is ignored in this operation.

The `MessageType` property must be set appropriately before calling this function. If the `MessageType` is `OracleAQMessageType.UDT`, then the `UdtTypeName` property must also be set.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Class](#)
- [OracleAQQueue Members](#)

## Listen

Listen methods listen for messages on the queue on behalf of `listenConsumers`.

### Overload List

- [Listen\(string\[\]\)](#)  
This method listens for messages on the queue on behalf of `listenConsumers`.
- [Listen \(string\[\], int\)](#)  
This method listens for messages on behalf of `listenConsumers` for a specified time.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Class](#)
- [OracleAQQueue Members](#)

## Listen(string[])

This method listens for messages on the queue on behalf of `listenConsumers`.

## Declaration

```
// C#  
public string Listen(string[] listenConsumers);
```

## Parameters

- *listenConsumers*

An array of consumers to listen for on this queue. This parameter should be `null` in case of single consumer queues.

## Return Value

A string.

## Exceptions

`InvalidOperationException` - The connection is not open.

`ObjectDisposedException` - The object is already disposed.

## Remarks

This call blocks the calling thread until there is a message ready for consumption for a consumer in the `listenConsumers` array. It returns a string representing the consumer name for which the message is ready.

`Listen` is useful in situations that require waiting until a message is available in the queue for consumers whose names are specified in `listenConsumers`.

## Example

The following example demonstrates using the `Listen` method. The first part of the example performs the requisite database setup for the database user, `SCOTT`. The second part of the example demonstrates how a thread can listen and wait until a message is enqueued.

```
-- Part I: Database setup required for this demo  
  
-----  
-- SQL to grant appropriate privilege to database user, SCOTT  
-----  
SQL> ALTER USER SCOTT ACCOUNT UNLOCK IDENTIFIED BY Pwd4Sct;  
User altered.  
GRANT ALL ON DBMS_AQADM TO scott;  
  
-----  
-- PLSQL to create queue-table and queue and start queue for SCOTT  
-----  
BEGIN  
  DBMS_AQADM.CREATE_QUEUE_TABLE(  
    queue_table=>'scott.test_q_tab',  
    queue_payload_type=>'RAW',  
    multiple_consumers=>FALSE);  
  
  DBMS_AQADM.CREATE_QUEUE(  
    queue_name=>'scott.test_q',  
    queue_table=>'scott.test_q_tab');  
  
  DBMS_AQADM.START_QUEUE(queue_name=>'scott.test_q');
```

```
END;
/

-----
-- PLSQL to stop queue and drop queue & queue-table from SCOTT
-----

BEGIN
  DBMS_AQADM.STOP_QUEUE('scott.test_q');

  DBMS_AQADM.DROP_QUEUE(
    queue_name => 'scott.test_q',
    auto_commit => TRUE);

  DBMS_AQADM.DROP_QUEUE_TABLE(
    queue_table => 'scott.test_q_tab',
    force => FALSE,
    auto_commit => TRUE);
END;
/
-- End of Part I, database setup.

//Part II: Demonstrates using the Listen method
//C#
using System;
using System.Text;
using Oracle.DataAccess.Client;
using Oracle.DataAccess.Types;
using System.Threading;

namespace ODPSample
{
  /// <summary>
  /// Demonstrates how a thread can listen and wait until a message is enqueued.
  /// Once a message is enqueued, the listening thread returns from the
  /// blocked Listen() method invocation and dequeues the message.
  /// </summary>
  class EnqueueDequeue
  {
    static bool s_bListenReturned = false;

    static void Main(string[] args)
    {
      // Create connection
      string constr = "user id=scott;password=Pwd4Sct;data source=oracle";
      OracleConnection con = new OracleConnection(constr);

      // Create queue
      OracleAQQueue queue = new OracleAQQueue("scott.test_q", con);

      try
      {
        // Open connection
        con.Open();

        // Set message type for the queue
        queue.MessageType = OracleAQMessageType.Raw;

        // Spawning a thread which will listen for a message
        ThreadStart ts = new ThreadStart(TestListen);
        Thread t = new Thread(ts);
        t.Start();
      }
    }
  }
}
```

```
System.Threading.Thread.Sleep(2000);

// Begin transaction for enqueue
OracleTransaction txn = con.BeginTransaction();

// Prepare message and RAW payload
OracleAQMessage enqMsg = new OracleAQMessage();
byte[] bytePayload = { 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 };
enqMsg.Payload = bytePayload;

// Prepare to Enqueue
queue.EnqueueOptions.Visibility = OracleAQVisibilityMode.OnCommit;

Console.WriteLine("[Main Thread]   Enqueuing a message...");
Console.WriteLine("[Main Thread]   Enqueued Message Payload       : "
    + ByteArrayToString(enqMsg.Payload as byte[]));
Console.WriteLine();

// Enqueue message
queue.Enqueue(enqMsg);

// Enqueue transaction commit
txn.Commit();

// Loop till Listen returns
while (!s_bListenReturned)
    System.Threading.Thread.Sleep(1000);
}
catch (Exception e)
{
    Console.WriteLine("Error: {0}", e.Message);
}
finally
{
    // Close/Dispose objects
    queue.Dispose();
    con.Close();
    con.Dispose();
}
}

static void TestListen()
{
    // Create connection
    string constr = "user id=scott;password=Pwd4Sct;data source=oracle";
    OracleConnection conListen = new OracleConnection(constr);

    // Create queue
    OracleAQQueue queueListen = new OracleAQQueue("scott.test_q", conListen);

    try
    {
        // Open the connection for Listen thread.
        // Connection blocked on Listen thread can not be used for other DB
        // operations
        conListen.Open();

        // Set message type for the queue
        queueListen.MessageType = OracleAQMessageType.Raw;
    }
}
```

```
// Listen
queueListen.Listen(null);

Console.WriteLine("[Listen Thread] Listen returned... Dequeuing...");

// Begin txn for Dequeue
OracleTransaction txn = conListen.BeginTransaction();

// Prepare to Dequeue
queueListen.DequeueOptions.Visibility = OracleAQVisibilityMode.OnCommit;
queueListen.DequeueOptions.Wait = 10;

// Dequeue message
OracleAQMessage deqMsg = queueListen.Dequeue();
Console.WriteLine("[Listen Thread] Dequeued Message Payload      : "
    + ByteArrayToString(deqMsg.Payload as byte[]));

// Dequeue txn commit
txn.Commit();

// Allow the main thread to exit
s_bListenReturned = true;
}
catch (Exception e)
{
    Console.WriteLine("Error: {0}", e.Message);
}
finally
{
    // Close/Dispose objects
    queueListen.Dispose();
    conListen.Close();
    conListen.Dispose();
}
}

// Function to convert byte[] to string
static private string ByteArrayToString(byte[] byteArray)
{
    StringBuilder sb = new StringBuilder();
    for (int n = 0; n < byteArray.Length; n++)
    {
        sb.Append((int.Parse(byteArray[n].ToString()).ToString("X"));
    }
    return sb.ToString();
}
}
}
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Class](#)
- [OracleAQQueue Members](#)

## Listen (string[], int)

This method listens for messages on behalf of `listenConsumers` for a specified time.

### Declaration

```
// C#  
public string Listen(string[] listenConsumers, int waitTime);
```

### Parameters

- `listenConsumers`  
Array of consumers for which to listen on this queue.
- `waitTime`  
Wait time in seconds.

### Return Value

A `string`

### Exceptions

`InvalidOperationException` - The connection is not open.

`ArgumentException` - `waitTime` is less than -1.

`ObjectDisposedException` - The object is already disposed.

### Remarks

`Listen` is useful in situations that require waiting until a message is available in the queue for consumers whose names are specified in `listenConsumers`.

This call blocks the calling thread until there is a message ready for consumption for a consumer in the `listenConsumers` array. It returns a `string` representing the consumer name for which the message is ready. The method returns `null` if a timeout occurs.

The `listenConsumers` parameter should be `null` for single consumer queues. An empty string is returned in such cases.

A `waitTime` of -1 implies infinite wait time.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Class](#)
- [OracleAQQueue Members](#)

## OracleAQQueue Events

The OracleAQQueue event is listed in [Table 13-30](#).

**Table 13-30 OracleAQQueue Events**

Event Name	Description
<a href="#">MessageAvailable Event</a>	Notifies when a message is available in the queue for NotificationConsumers.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Class](#)
- [OracleAQQueue Members](#)

## MessageAvailable Event

This event is notified when a message is available in the queue for NotificationConsumers.

### Declaration

```
// C#  
public event OracleAQMessageAvailableEventHandler MessageAvailable;
```

### Event Data

The event handler receives an OracleAQMessageAvailableEventArgs object.

### Exceptions

InvalidOperationException - The connection is not open.

### Remarks

Asynchronous notification is supported in all queue tables created with a database compatibility level of 8.1 or higher.

In order to receive the notification about message availability, the client must create an OracleAQMessageAvailableEventHandler delegate to listen to this event. The delegate should be added to this event only after setting the NotificationConsumers and Notification properties.

The notification registration takes place after the first delegate is added to the event. The notification is unregistered when the last delegate is removed from the event. Notifications set on an OracleAQQueue object get cancelled automatically when the object gets disposed.

Oracle Data Provider for .NET opens a port to listen for notifications. HA events, load balancing, and continuous query notification features also share the same port. This port can be configured centrally by setting the database notification port in an application or Web configuration file. The following example code specifies a port number of 1200:

```
<configuration>
  <oracle.dataaccess.client>
    <settings>
      <add name="DbNotificationPort" value="1200"/>
    </settings>
  </oracle.dataaccess.client>
</configuration>
```

If the configuration file does not exist or the db notification port is not specified, then ODP.NET uses a valid and random port number. The configuration file may also request for a random port number by specifying a db notification port value of -1.

The notification listener, which runs in the same application domain as ODP.NET, uses the specified port number to listen to notifications from the database. A notification listener gets created when the application registers with `OracleAQQueue.MessageAvailable` event. One notification listener can listen to all notification types. Only one notification listener is created for each application domain.

### Example

The following example demonstrates application notification. The first part of the example performs the requisite database setup for the database user, SCOTT. The second part of the example demonstrates how an application is notified when a message is available in the queue.

```
-- Part I: Database setup required for this demo

-----
-- SQL to grant appropriate privilege to database user, SCOTT
-----
SQL> ALTER USER SCOTT ACCOUNT UNLOCK IDENTIFIED BY Pwd4Sct;
User altered.
SQL> GRANT ALL ON DBMS_AQADM TO scott;

-----
-- PLSQL to create queue-table and queue and start queue for SCOTT
-----
BEGIN
  DBMS_AQADM.CREATE_QUEUE_TABLE(
    queue_table=>'scott.test_q_tab',
    queue_payload_type=>'RAW',
    multiple_consumers=>FALSE);

  DBMS_AQADM.CREATE_QUEUE(
    queue_name=>'scott.test_q',
    queue_table=>'scott.test_q_tab');

  DBMS_AQADM.START_QUEUE(queue_name=>'scott.test_q');
END;
/

-----
-- PLSQL to stop queue and drop queue & queue-table from SCOTT
-----
BEGIN
```

```
DBMS_AQADM.STOP_QUEUE('scott.test_q');

DBMS_AQADM.DROP_QUEUE(
    queue_name => 'scott.test_q',
    auto_commit => TRUE);

DBMS_AQADM.DROP_QUEUE_TABLE(
    queue_table => 'scott.test_q_tab',
    force => FALSE,
    auto_commit => TRUE);
END;
/
-- End of Part I, database setup.

//Part II: Demonstrates application notification
//C#
using System;
using System.Text;
using Oracle.DataAccess.Client;
using Oracle.DataAccess.Types;

namespace ODPSample
{
    /// <summary>
    /// Demonstrates how the application can be notified when a message is
    /// available in a queue.
    /// </summary>
    class Notification
    {
        static bool isNotified = false;

        static void Main(string[] args)
        {
            // Create connection
            string constr = "user id=scott;password=Pwd4Sct;data source=oracle";
            OracleConnection con = new OracleConnection(constr);

            // Create queue
            OracleAQQueue queue = new OracleAQQueue("scott.test_q", con);

            try
            {
                // Open connection
                con.Open();

                // Set message type for the queue
                queue.MessageType = OracleAQMessageType.Raw;

                // Add the event handler to handle the notification. The
                // MsgReceived method will be invoked when a message is enqueued
                queue.MessageAvailable +=
                    new OracleAQMessageAvailableEventHandler(Notification.MsgReceived);

                Console.WriteLine("Notification registered...");

                // Begin txn for enqueue
                OracleTransaction txn = con.BeginTransaction();

                Console.WriteLine("Now enqueueing message...");

                // Prepare message and RAW payload
```

```
OracleAQMessage enqMsg = new OracleAQMessage();
byte[] bytePayload = { 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 };
enqMsg.Payload = bytePayload;

// Prepare to Enqueue
queue.EnqueueOptions.Visibility = OracleAQVisibilityMode.OnCommit;

// Enqueue message
queue.Enqueue(enqMsg);

Console.WriteLine("Enqueued Message Payload      : "
    + ByteArrayToString(enqMsg.Payload as byte[]));
Console.WriteLine("MessageId of Enqueued Message : "
    + ByteArrayToString(enqMsg.MessageId));
Console.WriteLine();

// Enqueue txn commit
txn.Commit();

// Loop while waiting for notification
while (isNotified == false)
{
    System.Threading.Thread.Sleep(2000);
}
}
catch (Exception e)
{
    Console.WriteLine("Error: {0}", e.Message);
}
finally
{
    // Close/Dispose objects
    queue.Dispose();
    con.Close();
    con.Dispose();
}
}

static void MsgReceived(object src, OracleAQMessageAvailableEventArgs arg)
{
    try
    {
        Console.WriteLine("Notification Received...");
        Console.WriteLine("QueueName : {0}", arg.QueueName);
        Console.WriteLine("Notification Type : {0}", arg.NotificationType);

        //following type-cast to "byte[]" is required only for .NET 1.x
        byte[] notifiedMsgId = (byte[]) arg.MessageId[0];
        Console.WriteLine("MessageId of Notified Message : "
            + ByteArrayToString(notifiedMsgId));
        isNotified = true;
    }
    catch (Exception e)
    {
        Console.WriteLine("Error: {0}", e.Message);
    }
}

// Function to convert byte[] to string
static private string ByteArrayToString(byte[] byteArray)
{
```

```

StringBuilder sb = new StringBuilder();
for (int n = 0; n < byteArray.Length; n++)
{
    sb.Append((int.Parse(byteArray[n].ToString()).ToString("X"));
}
return sb.ToString();
}
}
}

```



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleAQQueue Class](#)
- [OracleAQQueue Members](#)

## OracleAQDequeueMode Enumeration

[Table 13-31](#) lists all the `OracleAQDequeueMode` enumeration values with a description of each enumerated value.

**Table 13-31 OracleAQDequeueMode Members**

Member Name	Description
Browse	Reads the message without acquiring any lock on the message. This is equivalent to a <code>SELECT</code> statement.
Locked	Reads and obtains a write lock on the message. The lock lasts for the duration of the transaction. This is equivalent to a <code>SELECT FOR UPDATE</code> statement.
Remove	Reads the message and updates or deletes it. This is the default. The message can be retained in the queue table based on the retention properties
RemoveNoData	Confirms receipt of the message but does not deliver the actual message content.

#### Requirements

<b>Provider</b>	<b>ODP.NET, Unmanaged Driver</b>
<b>Assembly</b>	<code>Oracle.DataAccess.dll</code>
<b>Namespace</b>	<code>Oracle.DataAccess.Client</code>
<b>.NET Framework</b>	4.8

 See Also:

- "Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"
- "OracleAQDequeueOptions Class"
- "DequeueMode"

## OracleAQMessageDeliveryMode Enumeration

The `OracleAQMessageDeliveryMode` enumeration type specifies the delivery mode of the message.

Table 13-32 lists all the `OracleAQMessageDeliveryMode` enumeration values with a description of each enumerated value.

**Table 13-32 OracleAQMessageDeliveryMode Members**

Member Name	Description
<code>Buffered</code>	<p>Indicates a buffered message.</p> <p>Both enqueue and dequeue buffered messaging operations must be in <code>IMMEDIATE</code> visibility mode. This means that these operations cannot be part of another transaction. You cannot specify <code>delay</code> when enqueueing buffered messages.</p> <p>Dequeuing applications can choose to dequeue persistent messages only, buffered messages only, or both types.</p> <p>Buffered messages can be queried using the <code>AQ\$Queue_Table_Name</code> view. These messages appear with states, <code>IN-MEMORY</code> or <code>SPIILLED</code>.</p> <p>Transaction grouping queues and array enqueues are not supported for buffered messages in Oracle Database 11g release 1 (11.1) . One can still use the array enqueue procedure to enqueue buffered messages, but the array size must be set to 1. Array dequeue is not supported for buffered messaging, but one can still use the array dequeue procedure by setting array size to 1.</p> <p>Buffered messaging is faster than persistent messaging. Use buffered messaging for applications that do not require the reliability and transaction support of Oracle Database AQ persistent messaging.</p>
<code>Persistent</code>	<p>Indicates a persistent message.</p> <p>Persistent messaging ensures reliability and support transactions. It is slower than buffered messaging.</p>
<code>PersistentOrBuffered</code>	<p>Indicates a persistent or buffered message.</p> <p>This is used with <code>Dequeue ()</code> when a consumer wants to dequeue a message irrespective of whether it is <code>Persistent</code> or <code>Buffered</code>.</p>

### Requirements

<b>Provider</b>	<b>ODP.NET, Unmanaged Driver</b>
<b>Assembly</b>	<code>Oracle.DataAccess.dll</code>

<b>Provider</b>	<b>ODP.NET, Unmanaged Driver</b>
<b>Namespace</b>	Oracle.DataAccess.Client
<b>.NET Framework</b>	4.8



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- ["OracleAQDequeueOptions Class"](#)
- ["DeliveryMode"](#)

## OracleAQMessageState Enumeration

The `OracleAQMessageState` enumeration type identifies the state of the message at the time of dequeue.

[Table 13-33](#) lists all the `OracleAQMessageState` enumeration values with a description of each enumerated value.

**Table 13-33 OracleAQMessageState Members**

Member Name	Description
Expired	Indicates that the message has been moved to the exception queue.
Processed	Indicates that the message has been processed and retained.
Ready	Indicates that the message is ready to be processed.
Waiting	Indicates that the message delay has not been reached.

#### Requirements

<b>Provider</b>	<b>ODP.NET, Unmanaged Driver</b>
<b>Assembly</b>	Oracle.DataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client
<b>.NET Framework</b>	4.8

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- ["OracleAQMessage Class"](#)
- ["State"](#)

## OracleAQMessageType Enumeration

The `OracleAQMessageType` enumeration type specifies the message payload type.

[Table 13-34](#) lists all the `OracleAQMessageType` enumeration values with a description of each enumerated value.

**Table 13-34 OracleAQMessageType Members**

Member Name	Description
Raw	Indicates the Raw message type. The data type of the payload must be either <code>OracleBinary</code> or <code>byte[]</code> to enqueue the message.
Udt	Indicates the Oracle UDT message type. The ODP.NET AQ implementation currently does not support user defined types with LOB attributes. It also does not support other variants of user defined types such as VARRAY and nested tables, as Oracle Database AQ does not support them inherently.
Xml	Indicates the XML message type. The data type of the payload must be <code>OracleXmlType</code> , <code>XmlReader</code> , or <code>String</code> in order to enqueue the message. If the data type is <code>String</code> , it must be well-formed XML, else an exception is raised when enqueueing the message.

### Requirements

<b>Provider</b>	<b>ODP.NET, Unmanaged Driver</b>
<b>Assembly</b>	<code>Oracle.DataAccess.dll</code>
<b>Namespace</b>	<code>Oracle.DataAccess.Client</code>
<b>.NET Framework</b>	4.8

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- ["OracleAQQueue Class"](#)
- ["OracleAQQueue Constructors"](#)
- ["MessageType"](#)

## OracleAQNavigationMode Enumeration

Table 13-35 lists all the `OracleAQNavigationMode` enumeration values with a description of each enumerated value.

**Table 13-35 OracleAQNavigationMode Members**

Member Name	Description
<code>FirstMessage</code>	Retrieves the first message that is available and matches the search criteria. This resets the position to the beginning of the queue.
<code>FirstMessageMultiGroup</code>	Indicates that a call to <code>DequeueArray</code> resets the position to the beginning of the queue, and dequeues messages that are available and match the search criteria. Messages are dequeued till the <code>dequeueCount</code> limit is reached. The dequeued messages can belong to different transaction groups.  You can use the <code>OracleAQMessage.TransactionGroup</code> property to distinguish between messages from different transaction groups. All messages from the same transaction group have the same value for the <code>OracleAQMessage.TransactionGroup</code> property.
<code>NextMessage</code>	Retrieves the next message that is available and matches the search criteria. If the previous message belongs to a message group, AQ retrieves the next available message that matches the search criteria and belongs to the message group.
<code>NextMessageMultiGroup</code>	Indicates that a call to <code>DequeueArray</code> dequeues the next set of messages that are available and match the search criteria. Messages are dequeued till the <code>dequeueCount</code> limit is reached. The dequeued messages can belong to different transaction groups.  You can use the <code>OracleAQMessage.TransactionGroup</code> property to distinguish between messages from different transaction groups. All messages from the same transaction group have the same value for the <code>OracleAQMessage.TransactionGroup</code> property.
<code>NextTransaction</code>	Skips the remainder of the current transaction group (if any) and retrieves the first message of the next transaction group.

**Requirements**

<b>Provider</b>	<b>ODP.NET, Unmanaged Driver</b>
<b>Assembly</b>	Oracle.DataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client
<b>.NET Framework</b>	4.8

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- ["OracleAQDequeueOptions Class"](#)
- ["NavigationMode"](#)

## OracleAQNotificationGroupingType Enumeration

The `OracleAQNotificationGroupingType` enumeration type specifies the notification grouping type.

[Table 13-36](#) lists all the `OracleAQNotificationGroupingType` enumeration values with a description of each enumerated value.

**Table 13-36 OracleAQNotificationGroupingType Members**

Member Name	Description
Last	Indicates that only details of the last message in the notification group are provided.
Summary	Indicates that the Summary of all messages in the notification group is provided.

**Requirements**

<b>Provider</b>	<b>ODP.NET, Unmanaged Driver</b>
<b>Assembly</b>	Oracle.DataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client
<b>.NET Framework</b>	4.8

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- ["OracleNotificationRequest Class"](#)

## OracleAQNotificationType Enumeration

The `OracleAQNotificationType` enumeration type specifies the notification type of the received notification.

[Table 13-37](#) lists all the `OracleAQNotificationType` enumeration values with a description of each enumerated value.

**Table 13-37 OracleAQNotificationType Members**

Member Name	Description
Group	Indicates that the received notification is a grouping notification.
Regular	Indicates that the received notification is a regular notification.
Timeout	Indicates that the received notification is raised due to a timeout.

### Requirements

<b>Provider</b>	<b>ODP.NET, Unmanaged Driver</b>
<b>Assembly</b>	<code>Oracle.DataAccess.dll</code>
<b>Namespace</b>	<code>Oracle.DataAccess.Client</code>
<b>.NET Framework</b>	4.8

 See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)

## OracleAQVisibilityMode Enumeration

[Table 13-38](#) lists all the `OracleAQVisibilityMode` enumeration values with a description of each enumerated value.

**Table 13-38 OracleAQVisibilityMode Members**

Member Name	Description
<code>Immediate</code>	Indicates that the enqueue or dequeue operation is not part of the current transaction. The operation constitutes a transaction of its own.
<code>OnCommit</code>	Indicates that the enqueue or dequeue operation is part of the current transaction. This is the default case.

**Requirements**

<b>Provider</b>	<b>ODP.NET, Unmanaged Driver</b>
<b>Assembly</b>	<code>Oracle.DataAccess.dll</code>
<b>Namespace</b>	<code>Oracle.DataAccess.Client</code>
<b>.NET Framework</b>	4.8

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)

# Oracle Data Provider for .NET Types Classes

This chapter describes the large object and `REF CURSOR` objects provided by Oracle Data Provider for .NET.

This chapter contains these topics:

- ODP.NET Types (ODP.NET LOB objects) consisting of these object classes:
  - [OracleBFile Class](#)
  - [OracleBlob Class](#)
  - [OracleClob Class](#)
- [OracleRefCursor Class](#)

All offsets are 0-based for all ODP.NET LOB object parameters.

## OracleBFile Class

An `OracleBFile` is an object that has a reference to `BFILE` data. It provides methods for performing operations on `BFILES`.



### Note:

`OracleBFile` is supported for applications running against Oracle8.x and later.

### Class Inheritance

```
System.Object
    System.MarshalByRefObject
        System.IO.Stream
            Oracle.DataAccess.Types.OracleBFile
```

### Declaration

```
// C#
public sealed class OracleBFile : Stream, ICloneable, INullable
```

### Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

### Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

### Remarks

OracleBFile is supported for applications running against Oracle8.x and later.

### Example

```
// Database Setup, if you have not done so yet.
/* Log on as DBA (SYS or SYSTEM) that has CREATE ANY DIRECTORY privilege.

CREATE OR REPLACE DIRECTORY MYDIR AS 'C:\TEMP';

*/

// C#

using System;
using Oracle.DataAccess.Client;
using Oracle.DataAccess.Types;

class OracleBFileSample
{
    static void Main()
    {
        // Create MYDIR directory object as indicated previously and create a file
        // MyFile.txt with the text ABCDABC under C:\TEMP directory.
        // Note that the byte representation of the ABCDABC is 65666768656667

        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();

        OracleBFile bFile = new OracleBFile(con, "MYDIR", "MyFile.txt");

        // Open the OracleBFile
        bFile.OpenFile();

        // Read 7 bytes into readBuffer, starting at buffer offset 0
        byte[] readBuffer = new byte[7];
        int bytesRead = bFile.Read(readBuffer, 0, 7);

        // Prints "bytesRead = 7"
        Console.WriteLine("bytesRead = " + bytesRead);

        // Prints "readBuffer = 65666768656667"
```

```

Console.Write("readBuffer = ");
for(int index = 0; index < readBuffer.Length; index++)
{
    Console.Write(readBuffer[index]);
}
Console.WriteLine();

// Search for the 2nd occurrence of a byte pattern {66,67}
// starting from byte offset 1 in the OracleBFile
byte[] pattern = new byte[2] {66, 67};
long posFound = bFile.Search(pattern, 1, 2);

// Prints "posFound = 6"
Console.WriteLine("posFound = " + posFound);

// Close the OracleBFile
bFile.CloseFile();

bFile.Close();
bFile.Dispose();

con.Close();
con.Dispose();
}
}

```

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Members](#)
- [OracleBFile Constructors](#)
- [OracleBFile Static Fields](#)
- [OracleBFile Static Methods](#)
- [OracleBFile Instance Properties](#)
- [OracleBFile Instance Methods](#)

## OracleBFile Members

OracleBFile members are listed in the following tables.

### OracleBFile Constructors

OracleBFile constructors are listed in [Table 14-1](#).

**Table 14-1 OracleBFile Constructors**

Constructor	Description
<a href="#">OracleBFile Constructors</a>	Creates an instance of the OracleBFile class (Overloaded)

## OracleBFile Static Fields

OracleBFile static fields are listed in [Table 14-2](#).

**Table 14-2 OracleBFile Static Fields**

Field	Description
<a href="#">MaxSize</a>	The static field holds the maximum number of bytes a BFILE can hold, which is 4,294,967,295 ( $2^{32} - 1$ ) bytes
<a href="#">Null</a>	Represents a null value that can be assigned to the value of an OracleBFile instance

## OracleBFile Static Methods

OracleBFile static methods are listed in [Table 14-3](#).

**Table 14-3 OracleBFile Static Methods**

Methods	Description
<a href="#">Equals</a>	Inherited from <code>System.Object</code> (Overloaded)

## OracleBFile Instance Properties

OracleBFile instance properties are listed in [Table 14-4](#).

**Table 14-4 OracleBFile Instance Properties**

Properties	Description
<a href="#">CanRead</a>	Indicates whether or not the LOB stream can be read
<a href="#">CanSeek</a>	Indicates whether or not forward and backward seek operations can be performed
<a href="#">CanWrite</a>	Indicates whether or not the LOB object supports writing
<a href="#">Connection</a>	Indicates the connection used to read from a BFILE
<a href="#">DirectoryName</a>	Indicates the directory alias of the BFILE
<a href="#">FileExists</a>	Indicates whether or not the specified BFILE exists
<a href="#">FileName</a>	Indicates the name of the BFILE
<a href="#">IsEmpty</a>	Indicates whether the BFILE is empty or not
<a href="#">IsNull</a>	Indicates whether or not the current instance has a null value
<a href="#">IsOpen</a>	Indicates whether the BFILE has been opened by this instance or not
<a href="#">Length</a>	Indicates the size of the BFILE data in bytes
<a href="#">Position</a>	Indicates the current read position in the LOB stream

**Table 14-4 (Cont.) OracleBFile Instance Properties**

Properties	Description
<a href="#">Value</a>	Returns the data, starting from the first byte in BFILE, as a byte array

**OracleBFile Instance Methods**

OracleBFile instance methods are listed in [Table 14-5](#).

**Table 14-5 OracleBFile Instance Methods**

Methods	Description
BeginRead	Inherited from <code>System.IO.Stream</code>
BeginWrite	<i>Not Supported</i>
<a href="#">Clone</a>	Creates a copy of an OracleBFile object
<a href="#">Close</a>	Closes the current stream and releases any resources associated with the stream
<a href="#">CloseFile</a>	Closes the BFILE referenced by the current BFILE instance
<a href="#">Compare</a>	Compares data referenced by the two OracleBFiles
CreateObjRef	Inherited from <code>System.MarshalByRefObject</code>
<a href="#">CopyTo</a>	Copies data as specified (Overloaded)
<a href="#">Dispose</a>	Releases resources allocated by this object
EndRead	Inherited from <code>System.IO.Stream</code>
EndWrite	<i>Not Supported</i>
Equals	Inherited from <code>System.Object</code> (Overloaded)
<a href="#">Flush</a>	<i>Not Supported</i>
<a href="#">FlushAsync</a>	<i>Not Supported</i>
GetHashCode	Inherited from <code>System.Object</code>
GetLifetimeService	Inherited from <code>System.MarshalByRefObject</code>
GetType	Inherited from <code>System.Object</code>
InitializeLifetimeService	Inherited from <code>System.MarshalByRefObject</code>
<a href="#">IsEqual</a>	Compares the LOB references
<a href="#">OpenFile</a>	Opens the BFILE specified by the <code>FileName</code> and <code>DirectoryName</code>
<a href="#">Read</a>	Reads a specified amount of bytes from the OracleBFile instance and populates the buffer
ReadByte	Inherited from <code>System.IO.Stream</code>
<a href="#">Search</a>	Searches for a binary pattern in the current instance of an OracleBFile
<a href="#">Seek</a>	Sets the position on the current LOB stream

Table 14-5 (Cont.) OracleBFile Instance Methods

Methods	Description
<a href="#">SetLength</a>	<i>Not Supported</i>
<code>ToString</code>	Inherited from <code>System.Object</code>
<a href="#">Write</a>	<i>Not Supported</i>
<code>WriteByte</code>	<i>Not Supported</i>

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Members](#)

## OracleBFile Constructors

OracleBFile constructors create new instances of the OracleBFile class.

**Overload List:**

- [OracleBFile\(OracleConnection\)](#)  
This constructor creates an instance of the OracleBFile class with an OracleConnection object.
- [OracleBFile\(OracleConnection, string, string\)](#)  
This constructor creates an instance of the OracleBFile class with an OracleConnection object, the location of the BFILE, and the name of the BFILE.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

### OracleBFile(OracleConnection)

This constructor creates an instance of the OracleBFile class with an OracleConnection object.

## Declaration

```
// C#  
public OracleBFile(OracleConnection con);
```

## Parameters

- *con*  
The `OracleConnection` object.

## Exceptions

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

## Remarks

The connection must be opened explicitly by the application. `OracleBFile` does not open the connection implicitly.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## OracleBFile(OracleConnection, string, string)

This constructor creates an instance of the `OracleBFile` class with an `OracleConnection` object, the location of the `BFILE`, and the name of the `BFILE`.

## Declaration

```
// C#  
public OracleBFile(OracleConnection con, string directoryName, string  
    fileName);
```

## Parameters

- *con*  
The `OracleConnection` object.
- *directoryName*  
The directory alias created by the `CREATE DIRECTORY SQL` statement.
- *fileName*  
The name of the external LOB.

## Exceptions

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

## Remarks

The `OracleConnection` must be opened explicitly by the application. `OracleBFile` does not open the connection implicitly.

To initialize a `BFILE` column using an `OracleBFile` instance as an input parameter of a SQL `INSERT` statement, `directoryName` and `fileName` must be properly set.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## OracleBFile Static Fields

`OracleBFile` static fields are listed in [Table 14-6](#).

**Table 14-6 OracleBFile Static Fields**

Field	Description
<a href="#">MaxSize</a>	The static field holds the maximum number of bytes a <code>BFILE</code> can hold, which is 4,294,967,295 ( $2^{32} - 1$ ) bytes
<a href="#">Null</a>	Represents a null value that can be assigned to the value of an <code>OracleBFile</code> instance

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## MaxSize

This static field holds the maximum number of bytes a `BFILE` can hold, which is 4,294,967,295 ( $2^{32} - 1$ ) bytes.

### Declaration

```
// C#  
public static readonly Int64 MaxSize = 4294967295;
```

### Remarks

This field is useful in code that checks whether or not the operation exceeds the maximum length allowed.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## Null

This static field represents a null value that can be assigned to the value of an `OracleBFile` instance.

### Declaration

```
// C#  
public static readonly OracleBFile Null;
```



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## OracleBFile Static Methods

`OracleBFile` static methods are listed in [Table 14-7](#).

**Table 14-7 OracleBFile Static Methods**

Methods	Description
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## OracleBFile Instance Properties

OracleBFile instance properties are listed in [Table 14-8](#).

**Table 14-8 OracleBFile Instance Properties**

Properties	Description
<a href="#">CanRead</a>	Indicates whether or not the LOB stream can be read
<a href="#">CanSeek</a>	Indicates whether or not forward and backward seek operations can be performed
<a href="#">CanWrite</a>	Indicates whether or not the LOB object supports writing
<a href="#">Connection</a>	Indicates the connection used to read from a BFILE
<a href="#">DirectoryName</a>	Indicates the directory alias of the BFILE
<a href="#">FileExists</a>	Indicates whether or not the specified BFILE exists
<a href="#">FileName</a>	Indicates the name of the BFILE
<a href="#">IsEmpty</a>	Indicates whether the BFILE is empty or not
<a href="#">IsNull</a>	Indicates whether or not the current instance has a null value
<a href="#">IsOpen</a>	Indicates whether the BFILE has been opened by this instance or not
<a href="#">Length</a>	Indicates the size of the BFILE data in bytes
<a href="#">Position</a>	Indicates the current read position in the LOB stream
<a href="#">Value</a>	Returns the data, starting from the first byte in BFILE, as a byte array

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

### CanRead

Overrides `Stream`

This instance property indicates whether or not the LOB stream can be read.

### Declaration

```
// C#  
public override bool CanRead{get;}
```

### Property Value

If the LOB stream can be read, returns `true`; otherwise, returns `false`.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## CanSeek

Overrides `Stream`

This instance property indicates whether or not forward and backward seek operations can be performed.

### Declaration

```
// C#  
public override bool CanSeek{get;}
```

### Property Value

If forward and backward seek operations can be performed, returns `true`; otherwise, returns `false`.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## CanWrite

Overrides `Stream`

This instance property indicates whether or not the LOB object supports writing.

### Declaration

```
// C#  
public override bool CanWrite{get;}
```

### Property Value

BFILE is read only.

### Remarks

BFILE is read-only, therefore, the boolean value is always `false`.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## Connection

This instance property indicates the connection used to read from a BFILE.

### Declaration

```
// C#  
public OracleConnection Connection {get;}
```

### Property Value

An object of `OracleConnection`.

### Exceptions

`ObjectDisposedException` - The object is already disposed.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## DirectoryName

This instance property indicates the directory alias of the BFILE.

### Declaration

```
// C#  
public string DirectoryName {get;set;}
```

### Property Value

A string.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The value of the `DirectoryName` changed while the BFILE is open.

### Remarks

The maximum length of a `DirectoryName` is 30 bytes.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## FileExists

This instance property indicates whether or not the BFILE specified by the `DirectoryName` and `FileName` exists.

### Declaration

```
// C#  
public bool FileExists {get;}
```

### Property Value

bool

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

### Remarks

Unless a connection, file name, and directory name are provided, this property is set to `false` by default.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## FileName

This instance property indicates the name of the BFILE.

### Declaration

```
// C#  
public string FileName {get;set}
```

### Property Value

A string that contains the BFILE name.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The value of the `DirectoryName` changed while the BFILE is open.

### Remarks

The maximum length of a `FileName` is 255 bytes.

Changing the `FileName` property while the BFILE object is opened causes an exception.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## IsEmpty

This instance property indicates whether the BFILE is empty or not.

### Declaration

```
// C#  
public bool IsEmpty {get;}
```

### Property Value

bool

### Exceptions

`ObjectDisposedException` - The object is already disposed.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## IsNull

This property indicates whether or not the current instance has a null value.

### Declaration

```
// C#  
public bool IsNull{get;}
```

### Property Value

Returns `true` if the current instance has a null value; otherwise, returns `false`.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## IsOpen

This instance property indicates whether the `BFILE` has been opened by this instance or not.

### Declaration

```
// C#  
public bool IsOpen {get;}
```

### Property Value

A bool.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## Length

Overrides `Stream`

This instance property indicates the size of the `BFILE` data in bytes.

### Declaration

```
// C#  
public override Int64 Length {get;}
```

### Property Value

`Int64`

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## Position

Overrides `Stream`

This instance property indicates the current read position in the LOB stream.

### Declaration

```
// C#  
public override Int64 Position{get; set;}
```

### Property Value

An `Int64` value that indicates the read position.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

`ArgumentOutOfRangeException` - The value is less than 0.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## Value

This instance property returns the data, starting from the first byte in `BFILE`, as a byte array.

### Declaration

```
// C#  
public byte[] Value{get;}
```

### Property Value

A byte array.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

### Remarks

The length of data is bound by the maximum length of the byte array. The current value of the `Position` property is not used or changed.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## OracleBFile Instance Methods

OracleBFile instance methods are listed in [Table 14-9](#).

**Table 14-9 OracleBFile Instance Methods**

Methods	Description
BeginRead	Inherited from <code>System.IO.Stream</code>
BeginWrite	<i>Not Supported</i>
<a href="#">Clone</a>	Creates a copy of an OracleBFile object
<a href="#">Close</a>	Closes the current stream and releases any resources associated with the stream
<a href="#">CloseFile</a>	Closes the BFILE referenced by the current BFILE instance
<a href="#">Compare</a>	Compares data referenced by the two OracleBFiles
CreateObjRef	Inherited from <code>System.MarshalByRefObject</code>
<a href="#">CopyTo</a>	Copies data as specified (Overloaded)
<a href="#">Dispose</a>	Releases resources allocated by this object
EndRead	Inherited from <code>System.IO.Stream</code>
EndWrite	<i>Not Supported</i>
Equals	Inherited from <code>System.Object</code> (Overloaded)
<a href="#">Flush</a>	<i>Not Supported</i>
<a href="#">FlushAsync</a>	<i>Not Supported</i>
GetHashCode	Inherited from <code>System.Object</code>
GetLifetimeService	Inherited from <code>System.MarshalByRefObject</code>
GetType	Inherited from <code>System.Object</code>
InitializeLifetimeService	Inherited from <code>System.MarshalByRefObject</code>
<a href="#">IsEqual</a>	Compares the LOB references
<a href="#">OpenFile</a>	Opens the BFILE specified by the <code>FileName</code> and <code>DirectoryName</code>
<a href="#">Read</a>	Reads a specified amount of bytes from the OracleBFile instance and populates the buffer
ReadByte	Inherited from <code>System.IO.Stream</code>

**Table 14-9 (Cont.) OracleBFile Instance Methods**

Methods	Description
<a href="#">Search</a>	Searches for a binary pattern in the current instance of an OracleBFile
<a href="#">Seek</a>	Sets the position on the current LOB stream
<a href="#">SetLength</a>	<i>Not Supported</i>
<a href="#">ToString</a>	Inherited from <code>System.Object</code>
<a href="#">Write</a>	<i>Not Supported</i>
<a href="#">WriteByte</a>	<i>Not Supported</i>

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## Clone

This instance method creates a copy of an `OracleBFile` object.

### Declaration

```
// C#  
public object Clone();
```

### Return Value

An `OracleBFile` object.

### Implements

`ICloneable`

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

### Remarks

The cloned object has the same property values as that of the object being cloned.

**Example**

```
// Database Setup, if you have not done so yet.
/* Log on as DBA (SYS or SYSTEM) that has CREATE ANY DIRECTORY privilege.

CREATE OR REPLACE DIRECTORY MYDIR AS 'C:\TEMP';

*/

// C#

using System;
using Oracle.DataAccess.Client;
using Oracle.DataAccess.Types;

class CloneSample
{
    static void Main()
    {
        // Create MYDIR directory object as indicated above and create a file
        // MyFile.txt with the text ABCDABC under C:\TEMP directory.
        // Note that the byte representation of the ABCDABC is 65666768656667

        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();

        OracleBFile bFile1 = new OracleBFile(con, "MYDIR", "MyFile.txt");

        // Open the OracleBFile
        bFile1.OpenFile();

        // Prints "bFile1.Position = 0"
        Console.WriteLine("bFile1.Position = " + bFile1.Position);

        // Set the Position before calling Clone()
        bFile1.Position = 1;

        // Clone the OracleBFile
        OracleBFile bFile2 = (OracleBFile) bFile1.Clone();

        // Open the OracleBFile
        bFile2.OpenFile();

        // Prints "bFile2.Position = 1"
        Console.WriteLine("bFile2.Position = " + bFile2.Position);

        // Close the OracleBFile
        bFile1.CloseFile();

        bFile1.Close();
        bFile1.Dispose();

        // Close the Cloned OracleBFile
        bFile2.CloseFile();

        bFile2.Close();
        bFile2.Dispose();

        con.Close();
    }
}
```

```
        con.Dispose();  
    }  
}
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## Close

Overrides `Stream`

This instance method closes the current stream and releases any resources associated with it.

### Declaration

```
// C#  
public override void Close();
```

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## CloseFile

This instance method closes the `BFILE` referenced by the current `BFILE` instance.

### Declaration

```
// C#  
public void CloseFile();
```

## Remarks

No error is returned if the `BFILE` exists, but is not opened.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## Compare

This instance method compares data referenced by the two `OracleBFiles`.

### Declaration

```
// C#  
public int Compare(Int64 src_offset, OracleBFile obj, Int64 dst_offset,  
    Int64 amount);
```

### Parameters

- *src\_offset*  
The offset of the current instance.
- *obj*  
The provided `OracleBFile` object.
- *dst\_offset*  
The offset of the `OracleBFile` object.
- *amount*  
The number of bytes to compare.

### Return Value

Returns a number that is:

- Less than zero: if the `BFILE` data of the current instance is less than that of the provided `BFILE` data.
- Zero: if both the `BFILES` store the same data.
- Greater than zero: if the `BFILE` data of the current instance is greater than that of the provided `BFILE` data.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

InvalidOperationException - The OracleConnection is not open or has been closed during the lifetime of the object.

ArgumentOutOfRangeException - The *src\_offset*, the *dst\_offset*, or the *amount* is less than 0.

### Remarks

The provided object and the current instance must be using the same connection, that is, the same OracleConnection object.

The BFILE needs to be opened using OpenFile before the operation.

### Example

```
// Database Setup, if you have not done so yet.
/* Log on as DBA (SYS or SYSTEM) that has CREATE ANY DIRECTORY privilege.

CREATE OR REPLACE DIRECTORY MYDIR AS 'C:\TEMP';

*/

// C#

using System;
using Oracle.DataAccess.Client;
using Oracle.DataAccess.Types;

class CompareSample
{
    static void Main()
    {
        // Create MYDIR directory object as indicated previously and create a file
        // MyFile.txt with the text ABCDABC under C:\TEMP directory.
        // Note that the byte representation of the ABCDABC is 65666768656667

        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();

        OracleBFile bFile1 = new OracleBFile(con, "MYDIR", "MyFile.txt");
        OracleBFile bFile2 = new OracleBFile(con, "MYDIR", "MyFile.txt");

        // Open the OracleBFiles
        bFile1.OpenFile();
        bFile2.OpenFile();

        // Compare 2 bytes from the 1st byte of bFile1 and
        // the 5th byte of bFile2 onwards
        int result = bFile1.Compare(1, bFile2, 5, 2);

        // Prints "result = 0" (Indicates the data is identical)
        Console.WriteLine("result = " + result);

        // Close the OracleBFiles
        bFile1.CloseFile();
        bFile2.CloseFile();

        bFile1.Close();
        bFile1.Dispose();
    }
}
```

```
bFile2.Close();  
bFile2.Dispose();  
  
con.Close();  
con.Dispose();  
}  
}
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## CopyTo

`CopyTo` copies data from the current instance to the provided object.

### Overload List:

- [CopyTo\(OracleBlob\)](#)  
This instance method copies data from the current instance to the provided `OracleBlob` object.
- [CopyTo\(OracleBlob, Int64\)](#)  
This instance method copies data from the current `OracleBFile` instance to the provided `OracleBlob` object with the specified destination offset.
- [CopyTo\(Int64, OracleBlob, Int64, Int64\)](#)  
This instance method copies data from the current `OracleBFile` instance to the provided `OracleBlob` object with the specified source offset, destination offset, and character amounts.
- [CopyTo\(OracleClob\)](#)  
This instance method copies data from the current `OracleBFile` instance to the provided `OracleClob` object.
- [CopyTo\(OracleClob, Int64\)](#)  
This instance method copies data from the current `OracleBFile` instance to the provided `OracleClob` object with the specified destination offset.
- [CopyTo\(Int64, OracleClob, Int64, Int64\)](#)  
This instance method copies data from the current `OracleBFile` instance to the provided `OracleClob` object with the specified source offset, destination offset, and amount of characters.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## CopyTo(OracleBlob)

This instance method copies data from the current instance to the provided `OracleBlob` object.

### Declaration

```
// C#  
public Int64 CopyTo(OracleBlob obj);
```

### Parameters

- *obj*  
The `OracleBlob` object to which the data is copied.

### Return Value

The return value is the amount copied.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - This exception is thrown if any of the following conditions exist:

- The `OracleConnection` is not open or has been closed during the lifetime of the object.
- The LOB object parameter has a different connection than the object.

### Remarks

The provided object and the current instance must be using the same connection; that is, the same `OracleConnection` object.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## CopyTo(OracleBlob, Int64)

This instance method copies data from the current `OracleBFile` instance to the provided `OracleBlob` object with the specified destination offset.

### Declaration

```
// C#  
public Int64 CopyTo(OracleBlob obj, Int64 dst_offset);
```

### Parameters

- `obj`  
The `OracleBlob` object to which the data is copied.
- `dst_offset`  
The offset (in bytes) at which the `OracleBlob` object is copied.

### Return Value

The return value is the amount copied.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`ArgumentOutOfRangeException` - The `dst_offset` is less than 0.

`InvalidOperationException` - This exception is thrown if any of the following conditions exist:

- The `OracleConnection` is not open or has been closed during the lifetime of the object.
- The LOB object parameter has a different connection than the object.

### Remarks

If the `dst_offset` is beyond the end of the `OracleBlob` data, spaces are written into the `OracleBlob` until the `dst_offset` is met.

The offsets are 0-based. No character conversion is performed by this operation.

The provided object and the current instance must be using the same connection; that is, the same `OracleConnection` object.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## CopyTo(Int64, OracleBlob, Int64, Int64)

This instance method copies data from the current `OracleBFile` instance to the provided `OracleBlob` object with the specified source offset, destination offset, and character amounts.

### Declaration

```
// C#  
public Int64 CopyTo(Int64 src_offset, OracleBlob obj, Int64 dst_offset,  
    Int64 amount);
```

### Parameters

- *src\_offset*  
The offset (in bytes) in the current instance, from which the data is read.
- *obj*  
An `OracleBlob` object to which the data is copied.
- *dst\_offset*  
The offset (in bytes) to which the `OracleBlob` object is copied.
- *amount*  
The amount of data to be copied.

### Return Value

The return value is the amount copied.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`ArgumentOutOfRangeException` - The *src\_offset*, the *dst\_offset*, or the *amount* is less than 0.

`InvalidOperationException` - This exception is thrown if any of the following conditions exist:

- The `OracleConnection` is not open or has been closed during the lifetime of the object.
- The LOB object parameter has a different connection than the object.

### Remarks

If the *dst\_offset* is beyond the end of the `OracleBlob` data, spaces are written into the `OracleBlob` until the *dst\_offset* is met.

The offsets are 0-based. No character conversion is performed by this operation.

The provided object and the current instance must be using the same connection; that is, the same `OracleConnection` object.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## CopyTo(OracleClob)

This instance method copies data from the current `OracleBFile` instance to the provided `OracleClob` object.

### Declaration

```
// C#  
public Int64 CopyTo(OracleClob obj);
```

### Parameters

- *obj*

The `OracleClob` object to which the data is copied.

### Return Value

The return value is the amount copied.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - This exception is thrown if any of the following conditions exist:

- The `OracleConnection` is not open or has been closed during the lifetime of the object.
- The LOB object parameter has a different connection than the object.

### Remarks

The provided object and the current instance must be using the same connection, that is, the same `OracleConnection` object.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## CopyTo(OracleClob, Int64)

This instance method copies data from the current `OracleBFile` instance to the provided `OracleClob` object with the specified destination offset.

### Declaration

```
// C#  
public Int64 CopyTo(OracleClob obj, Int64 dst_offset);
```

### Parameters

- *obj*  
The `OracleClob` object that the data is copied to.
- *dst\_offset*  
The offset (in characters) at which the `OracleClob` object is copied to.

### Return Value

The amount copied.

### Exceptions

#### Exceptions

`ObjectDisposedException` - The object is already disposed.

`ArgumentOutOfRangeException` - The *dst\_offset* is less than 0.

`InvalidOperationException` - This exception is thrown if any of the following conditions exist:

- The `OracleConnection` is not open or has been closed during the lifetime of the object.
- The LOB object parameter has a different connection than the object.

### Remarks

If the *dst\_offset* is beyond the end of the `OracleClob` data, spaces are written into the `OracleClob` until the *dst\_offset* is met.

The offsets are 0-based. No character conversion is performed by this operation.

The provided object and the current instance must be using the same connection, that is, the same `OracleConnection` object.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## CopyTo(Int64, OracleClob, Int64, Int64)

This instance method copies data from the current `OracleBFile` instance to the provided `OracleClob` object with the specified source offset, destination offset, and amount of characters.

### Declaration

```
// C#  
public Int64 CopyTo(Int64 src_offset, OracleClob obj, Int64 dst_offset,  
    Int64 amount);
```

### Parameters

- *src\_offset*  
The offset (in characters) in the current instance, from which the data is read.
- *obj*  
An `OracleClob` object that the data is copied to.
- *dst\_offset*  
The offset (in characters) at which the `OracleClob` object is copied to.
- *amount*  
The amount of data to be copied.

### Return Value

The return value is the amount copied.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`ArgumentOutOfRangeException` - The *src\_offset*, the *dst\_offset*, or the *amount* is less than 0.

`InvalidOperationException` - This exception is thrown if any of the following conditions exist:

- The `OracleConnection` is not open or has been closed during the lifetime of the object.
- The LOB object parameter has a different connection than the object.

### Remarks

If the *dst\_offset* is beyond the end of the current `OracleClob` data, spaces are written into the `OracleClob` until the *dst\_offset* is met.

The offsets are 0-based. No character conversion is performed by this operation.

The provided object and the current instance must be using the same connection, that is, the same `OracleConnection` object.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## Dispose

This instance method releases resources allocated by this object.

### Declaration

```
// C#  
public void Dispose();
```

### Implements

IDisposable

### Remarks

Although some properties can still be accessed, their values may not be accountable. Since resources are freed, method calls may lead to exceptions. The object cannot be reused after being disposed.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## Flush

This method is not supported.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## FlushAsync

This method is not supported.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## IsEqual

This instance method compares the LOB references.

### Declaration

```
// C#  
public bool IsEqual(OracleBFile obj);
```

### Parameters

- *obj*  
The provided `OracleBFile` object.

### Return Value

Returns `true` if the current `OracleBFile` and the provided `OracleBFile` object refer to the same external LOB. Returns `false` otherwise.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

### Remarks

Note that this method can return `true` even if the two `OracleBFile` objects return `false` for `==` or `Equals()` since two different `OracleBFile` instances can refer to the same external LOB.

The provided object and the current instance must be using the same connection; that is, the same `OracleConnection` object.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## OpenFile

This instance method opens the BFILE specified by the `FileName` and `DirectoryName`.

### Declaration

```
// C#  
public void OpenFile();
```

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

### Remarks

Many operations, such as `Compare()`, `CopyTo()`, `Read()`, and `Search()` require that the BFILE be opened using `OpenFile` before the operation.

Calling `OpenFile` on an opened BFILE is not operational.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## Read

Overrides `Stream`

This instance method reads a specified amount of bytes from the `OracleBFile` instance and populates the `buffer`.

### Declaration

```
// C#  
public override int Read(byte[] buffer, int offset, int count);
```

## Parameters

- *buffer*  
The byte array buffer to be populated.
- *offset*  
The offset of the byte array buffer to be populated.
- *count*  
The amount of bytes to read.

## Return Value

The return value indicates the number of bytes read from the `BFILE`, that is, the external LOB.

## Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

`ArgumentOutOfRangeException` - Either the *offset* or the *count* parameter is less than 0 or the *offset* is greater than or equal to the `buffer.Length` or the *offset* and the *count* together are greater than `buffer.Length`.

## Remarks

The LOB data is read starting from the position specified by the `Position` property.

## Example

```
// Database Setup, if you have not done so yet.
/* Log on as DBA (SYS or SYSTEM) that has CREATE ANY DIRECTORY privilege.

CREATE OR REPLACE DIRECTORY MYDIR AS 'C:\TEMP';

*/

// C#

using System;
using Oracle.DataAccess.Client;
using Oracle.DataAccess.Types;

class ReadSample
{
    static void Main()
    {
        // Create MYDIR directory object as indicated previously and create a file
        // MyFile.txt with the text ABCDABC under C:\TEMP directory.
        // Note that the byte representation of the ABCDABC is 65666768656667

        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();
    }
}
```

```
OracleBFile bFile = new OracleBFile(con, "MYDIR", "MyFile.txt");

// Open the OracleBFile
bFile.OpenFile();

// Read 7 bytes into readBuffer, starting at buffer offset 0
byte[] readBuffer = new byte[7];
int bytesRead = bFile.Read(readBuffer, 0, 7);

// Prints "bytesRead = 7"
Console.WriteLine("bytesRead = " + bytesRead);

// Prints "readBuffer = 65666768656667"
Console.Write("readBuffer = ");
for(int index = 0; index < readBuffer.Length; index++)
{
    Console.Write(readBuffer[index]);
}
Console.WriteLine();

// Close the OracleBFile
bFile.CloseFile();

bFile.Close();
bFile.Dispose();

con.Close();
con.Dispose();
}
}
```



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## Search

This instance method searches for a binary pattern in the current instance of an `OracleBFile`.

### Declaration

```
// C#
public int Search(byte[] val, Int64 offset, Int64 nth);
```

### Parameters

- *val*  
The binary pattern being searched for.
- *offset*  
The 0-based offset (in bytes) starting from which the `OracleBFile` is searched.

- *nth*

The specific occurrence (1-based) of the match for which the offset is returned.

### Return Value

Returns the absolute *offset* of the start of the matched pattern (in bytes) for the *nth* occurrence of the match. Otherwise, 0 is returned.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

`ArgumentOutOfRangeException` - Either the *offset* is less than 0 or *nth* is less than or equal to 0 or *val.Length* is greater than 16383 or *nth* is greater than or equal to `OracleBFile.MaxValue` or *offset* is greater than or equal to `OracleBFile.MaxValue`.

### Remarks

The limit of the search pattern is 16383 bytes.

### Example

```
// Database Setup, if you have not done so yet.
/* Log on as DBA (SYS or SYSTEM) that has CREATE ANY DIRECTORY privilege.

CREATE OR REPLACE DIRECTORY MYDIR AS 'C:\TEMP';

*/

// C#

using System;
using Oracle.DataAccess.Client;
using Oracle.DataAccess.Types;

class SearchSample
{
    static void Main()
    {
        // Create MYDIR directory object as indicated previously and create a file
        // MyFile.txt with the text ABCDABC under C:\TEMP directory.
        // Note that the byte representation of the ABCDABC is 65666768656667

        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();

        OracleBFile bFile = new OracleBFile(con, "MYDIR", "MyFile.txt");

        // Open the OracleBFile
        bFile.OpenFile();

        // Search for the 2nd occurrence of a byte pattern {66,67}
        // starting from byte offset 1 in the OracleBFile
        byte[] pattern = new byte[2] {66, 67};
        long posFound = bFile.Search(pattern, 1, 2);
    }
}
```

```
// Prints "posFound = 6"
Console.WriteLine("posFound = " + posFound);

// Close the OracleBFile
bFile.CloseFile();

bFile.Close();
bFile.Dispose();

con.Close();
con.Dispose();
}
}
```



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## Seek

Overrides `Stream`

This instance method sets the position on the current LOB stream.

### Declaration

```
// C#
public override Int64 Seek(Int64 offset, SeekOrigin origin);
```

### Parameters

- *offset*  
A byte offset relative to origin.
- *origin*  
A value of type `System.IO.SeekOrigin` indicating the reference point used to obtain the new position.

### Return Value

Returns an `Int64` that indicates the position.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

## Remarks

If *offset* is negative, the new position precedes the position specified by *origin* by the number of bytes specified by *offset*.

If *offset* is zero, the new position is the position specified by *origin*.

If *offset* is positive, the new position follows the position specified by *origin* by the number of bytes specified by *offset*.

`SeekOrigin.Begin` specifies the beginning of a stream.

`SeekOrigin.Current` specifies the current position within a stream.

`SeekOrigin.End` specifies the end of a stream.

## Example

```
// Database Setup, if you have not done so yet.
/* Log on as DBA (SYS or SYSTEM) that has CREATE ANY DIRECTORY privilege.

CREATE OR REPLACE DIRECTORY MYDIR AS 'C:\TEMP';

*/

// C#

using System;
using System.IO;
using Oracle.DataAccess.Client;
using Oracle.DataAccess.Types;

class SeekSample
{
    static void Main()
    {
        // Create MYDIR directory object as indicated previously and create a file
        // MyFile.txt with the text ABCDABC under C:\TEMP directory.
        // Note that the byte representation of the ABCDABC is 65666768656667

        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();

        OracleBFile bFile = new OracleBFile(con, "MYDIR", "MyFile.txt");

        // Open the OracleBFile
        bFile.OpenFile();

        // Set the Position to 2 with respect to SeekOrigin.Begin
        long newPosition = bFile.Seek(2, SeekOrigin.Begin);

        // Prints "newPosition      = 2"
        Console.WriteLine("newPosition      = " + newPosition);

        // Prints "bFile.Position  = 2"
        Console.WriteLine("bFile.Position  = " + bFile.Position);

        // Read 2 bytes into readBuffer, starting at buffer offset 1
        byte[] readBuffer = new byte[4];
```

```
int bytesRead = bFile.Read(readBuffer, 1, 2);

// Prints "bytesRead      = 2"
Console.WriteLine("bytesRead      = " + bytesRead);

// Prints "readBuffer      = 067680"
Console.Write("readBuffer      = ");
for(int index = 0; index < readBuffer.Length; index++)
{
    Console.Write(readBuffer[index]);
}
Console.WriteLine();

// Close the OracleBFile
bFile.CloseFile();

bFile.Close();
bFile.Dispose();

con.Close();
con.Dispose();
}
}
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## SetLength

This method is not supported.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## Write

This method is not supported.

 See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBFile Class](#)
- [OracleBFile Members](#)

## OracleBlob Class

An `OracleBlob` object is an object that has a reference to BLOB data. It provides methods for performing operations on BLOBs.

### Class Inheritance

```
System.Object
    System.MarshalByRefObject
        System.IO.Stream
            Oracle.DataAccess.Types.OracleBlob
```

### Declaration

```
// C#
public sealed class OracleBlob : Stream, ICloneable, INullable
```

### Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

### Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

### Example

```
// C#
using System;
using Oracle.DataAccess.Client;
using Oracle.DataAccess.Types;
```

```
class OracleBlobSample
{
    static void Main()
    {
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();

        OracleBlob blob = new OracleBlob(con);

        // Write 4 bytes from writeBuffer, starting at buffer offset 0
        byte[] writeBuffer = new byte[4] {1, 2, 3, 4};
        blob.Write(writeBuffer, 0, 4);

        // Append first 2 bytes from writeBuffer {1, 2} to the oracleBlob
        blob.Append(writeBuffer, 0, 2);

        // Prints "blob.Length = 6"
        Console.WriteLine("blob.Length = " + blob.Length);

        // Reset the Position for the Read
        blob.Position = 0;

        // Read 6 bytes into readBuffer, starting at buffer offset 0
        byte[] readBuffer = new byte[6];
        int bytesRead = blob.Read(readBuffer, 0, 6);

        // Prints "bytesRead = 6"
        Console.WriteLine("bytesRead = " + bytesRead);

        // Prints "readBuffer = 123412"
        Console.Write("readBuffer = ");
        for(int index = 0; index < readBuffer.Length; index++)
        {
            Console.Write(readBuffer[index]);
        }
        Console.WriteLine();

        // Search for the 2nd occurrence of a byte pattern '12'
        // starting from byte offset 0 in the OracleBlob
        byte[] pattern = new byte[2] {1, 2};
        long posFound = blob.Search(pattern, 0, 2);

        // Prints "posFound = 5"
        Console.WriteLine("posFound = " + posFound);

        // Erase 4 bytes of data starting at byte offset 1
        // Sets bytes to zero
        blob.Erase(1, 4);

        byte[] erasedBuffer = blob.Value;

        //Prints "erasedBuffer = 100002"
        Console.Write("erasedBuffer = ");
        for(int index = 0; index < erasedBuffer.Length; index++)
        {
            Console.Write(erasedBuffer[index]);
        }
        Console.WriteLine();
    }
}
```

```

blob.Close();
blob.Dispose();

con.Close();
con.Dispose();
}
}

```

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Members](#)
- [OracleBlob Constructors](#)
- [OracleBlob Static Fields](#)
- [OracleBlob Static Methods](#)
- [OracleBlob Instance Properties](#)
- [OracleBlob Instance Methods](#)

## OracleBlob Members

OracleBlob members are listed in the following tables.

### OracleBlob Constructors

OracleBlob constructors are listed in [Table 14-10](#).

**Table 14-10 OracleBlob Constructors**

Constructor	Description
<a href="#">OracleBlob Constructors</a>	Creates an instance of the OracleBlob class (Overloaded)

### OracleBlob Static Fields

OracleBlob static fields are listed in [Table 14-11](#).

**Table 14-11 OracleBlob Static Fields**

Field	Description
<a href="#">MaxSize</a>	Holds the maximum number of bytes a BLOB can hold, which is 4,294,967,295 (2 <sup>32</sup> - 1) bytes
<a href="#">Null</a>	Represents a null value that can be assigned to the value of an OracleBlob instance

## OracleBlob Static Methods

OracleBlob static methods are listed in [Table 14-12](#).

**Table 14-12 OracleBlob Static Methods**

Methods	Description
Equals	Inherited from <code>System.Object</code> (Overloaded)

## OracleBlob Instance Properties

OracleBlob instance properties are listed in [Table 14-13](#).

**Table 14-13 OracleBlob Instance Properties**

Properties	Description
<a href="#">CanRead</a>	Indicates whether or not the LOB stream can be read
<a href="#">CanSeek</a>	Indicates whether or not forward and backward seek operations be performed
<a href="#">CanWrite</a>	Indicates whether or not the LOB object supports writing
<a href="#">Connection</a>	Indicates the <code>OracleConnection</code> that is used to retrieve and write BLOB data
<a href="#">IsEmpty</a>	Indicates whether the BLOB is empty or not
<a href="#">IsInChunkWriteMode</a>	Indicates whether or not the BLOB has been opened to defer index updates
<a href="#">IsNull</a>	Indicates whether or not the current instance has a null value
<a href="#">IsTemporary</a>	Indicates whether or not the current instance is bound to a temporary BLOB
<a href="#">Length</a>	Indicates the size of the BLOB data
<a href="#">OptimumChunkSize</a>	Indicates the optimal data buffer length (or multiples thereof) that read and write operations should use to improve performance
<a href="#">Position</a>	Indicates the current read or write position in the LOB stream
<a href="#">Value</a>	Returns the data, starting from the first byte in BLOB, as a byte array

## OracleBlob Instance Methods

OracleBlob instance methods are listed in [Table 14-14](#).

**Table 14-14 OracleBlob Instance Methods**

Methods	Description
<a href="#">Append</a>	Appends the supplied data to the current <code>OracleBlob</code> instance (Overloaded)

Table 14-14 (Cont.) OracleBlob Instance Methods

Methods	Description
<a href="#">BeginChunkWrite</a>	Opens the BLOB
BeginRead	Inherited from <code>System.IO.Stream</code>
BeginWrite	Inherited from <code>System.IO.Stream</code>
<a href="#">Clone</a>	Creates a copy of an <code>OracleBlob</code> object
<a href="#">Close</a>	Closes the current stream and releases any resources associated with it
<a href="#">Compare</a>	Compares data referenced by the current instance and that of the supplied object
<a href="#">CopyTo</a>	Copies from the current <code>OracleBlob</code> instance to an <code>OracleBlob</code> object (Overloaded)
CreateObjRef	Inherited from <code>System.MarshalByRefObject</code>
<a href="#">Dispose</a>	Releases resources allocated by this object
<a href="#">EndChunkWrite</a>	Closes the BLOB referenced by the current <code>OracleBlob</code> instance
EndRead	Inherited from <code>System.IO.Stream</code>
EndWrite	Inherited from <code>System.IO.Stream</code>
Equals	Inherited from <code>System.Object</code> (Overloaded)
<a href="#">Erase</a>	Erases data (Overloaded)
<a href="#">Flush</a>	<i>Not supported</i>
GetHashCode	Inherited from <code>System.Object</code>
GetLifetimeService	Inherited from <code>System.MarshalByRefObject</code>
GetType	Inherited from <code>System.Object</code>
InitializedLifetimeService	Inherited from <code>System.MarshalByRefObject</code>
<a href="#">IsEqual</a>	Compares the LOB data referenced by the two <code>OracleBlobs</code>
<a href="#">Read</a>	Reads a specified amount of bytes from the ODP.NET LOB Type instance and populates the <code>buffer</code>
ReadByte	Inherited from <code>System.IO.Stream</code>
<a href="#">Search</a>	Searches for a binary pattern in the current instance of an <code>OracleBlob</code>
<a href="#">Seek</a>	Sets the position in the current LOB stream
<a href="#">SetLength</a>	Trims or truncates the BLOB value to the specified length
ToString	Inherited from <code>System.Object</code>
<a href="#">Write</a>	Writes the supplied buffer into the <code>OracleBlob</code>
WriteByte	Inherited from <code>System.IO.Stream</code>

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Members](#)

## OracleBlob Constructors

OracleBlob constructors are listed in [Table 14-10](#).

### Overload List:

- [OracleBlob\(OracleConnection\)](#)  
This constructor creates an instance of the OracleBlob class bound to a temporary BLOB with an OracleConnection object.
- [OracleBlob\(OracleConnection, bool\)](#)  
This constructor creates an instance of the OracleBlob class bound to a temporary BLOB with an OracleConnection object and a boolean value for caching.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## OracleBlob(OracleConnection)

This constructor creates an instance of the OracleBlob class bound to a temporary BLOB with an OracleConnection object.

### Declaration

```
// C#  
public OracleBlob(OracleConnection con);
```

### Parameters

- *con*  
The OracleConnection object.

### Exceptions

InvalidOperationException - The OracleConnection is not opened.

## Remarks

The connection must be opened explicitly by the application. `OracleBlob` does not open the connection implicitly.

The temporary `BLOB` utilizes the provided connection to store `BLOB` data. Caching is not turned on by this constructor.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## OracleBlob(OracleConnection, bool)

This constructor creates an instance of the `OracleBlob` class bound to a temporary `BLOB` with an `OracleConnection` object and a boolean value for caching.

### Declaration

```
// C#  
public OracleBlob(OracleConnection con, bool bCaching);
```

### Parameters

- *con*  
The `OracleConnection` object.
- *bCaching*  
A flag for enabling or disabling server-side caching.

### Exceptions

`InvalidOperationException` - The `OracleConnection` is not opened.

### Remarks

The connection must be opened explicitly by the application. `OracleBlob` does not open the connection implicitly.

The temporary `BLOB` uses the provided connection to store `BLOB` data. The *bCaching* input parameter determines whether or not server-side caching is used.

 See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## OracleBlob Static Fields

OracleBlob static fields are listed in [Table 14-15](#).

**Table 14-15 OracleBlob Static Fields**

Field	Description
<a href="#">MaxSize</a>	Holds the maximum number of bytes a BLOB can hold, which is 4,294,967,295 (2 <sup>32</sup> - 1) bytes
<a href="#">Null</a>	Represents a null value that can be assigned to the value of an OracleBlob instance

 See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## MaxSize

The `MaxSize` field holds the maximum number of bytes a BLOB can hold, which is 4,294,967,295 (2<sup>32</sup> - 1) bytes.

### Declaration

```
// C#  
public static readonly Int64 MaxSize = 4294967295;
```

### Remarks

This field can be useful in code that checks whether or not the operation exceeds the maximum length allowed.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## Null

This static field represents a null value that can be assigned to the value of an OracleBlob instance.

### Declaration

```
// C#  
public static readonly OracleBlob Null;
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## OracleBlob Static Methods

OracleBlob static methods are listed in [Table 14-16](#).

**Table 14-16 OracleBlob Static Methods**

Methods	Description
Equals	Inherited from System.Object (Overloaded)

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## OracleBlob Instance Properties

OracleBlob instance properties are listed in [Table 14-17](#).

**Table 14-17 OracleBlob Instance Properties**

Properties	Description
<a href="#">CanRead</a>	Indicates whether or not the LOB stream can be read
<a href="#">CanSeek</a>	Indicates whether or not forward and backward seek operations be performed
<a href="#">CanWrite</a>	Indicates whether or not the LOB object supports writing
<a href="#">Connection</a>	Indicates the <code>OracleConnection</code> that is used to retrieve and write BLOB data
<a href="#">IsEmpty</a>	Indicates whether the BLOB is empty or not
<a href="#">IsInChunkWriteMode</a>	Indicates whether or not the BLOB has been opened to defer index updates
<a href="#">IsNull</a>	Indicates whether or not the current instance has a null value
<a href="#">IsTemporary</a>	Indicates whether or not the current instance is bound to a temporary BLOB
<a href="#">Length</a>	Indicates the size of the BLOB data
<a href="#">OptimumChunkSize</a>	Indicates the optimal data buffer length (or multiples thereof) that read and write operations should use to improve performance
<a href="#">Position</a>	Indicates the current read or write position in the LOB stream
<a href="#">Value</a>	Returns the data, starting from the first byte in BLOB, as a byte array

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## CanRead

Overrides `Stream`

This instance property indicates whether or not the LOB stream can be read.

### Declaration

```
// C#  
public override bool CanRead{get;}
```

### Property Value

If the LOB stream can be read, returns `true`; otherwise, returns `false`.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## CanSeek

Overrides `Stream`

This instance property indicates whether or not forward and backward seek operations can be performed.

### Declaration

```
// C#  
public override bool CanSeek{get;}
```

### Property Value

If forward and backward seek operations can be performed, returns `true`; otherwise, returns `false`.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## CanWrite

Overrides `Stream`

This instance property indicates whether or not the LOB object supports writing.

### Declaration

```
// C#  
public override bool CanWrite{get;}
```

### Property Value

If the LOB stream can be written, returns `true`; otherwise, returns `false`.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## Connection

This instance property indicates the `OracleConnection` that is used to retrieve and write BLOB data.

### Declaration

```
// C#  
public OracleConnection Connection {get;}
```

### Property Value

An object of `OracleConnection`.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## IsEmpty

This instance property indicates whether the BLOB is empty or not.

### Declaration

```
// C#  
public bool IsEmpty {get;}
```

### Property Value

A `bool` that indicates whether or not the `BLOB` is empty.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## IsInChunkWriteMode

This instance property indicates whether or not the `BLOB` has been opened to defer index updates.

### Declaration

```
// C#  
public bool IsInChunkWriteMode{get;}
```

### Property Value

If the `BLOB` has been opened, returns `true`; otherwise, returns `false`.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## IsNull

This property indicates whether or not the current instance has a null value.

### Declaration

```
// C#  
public bool IsNull{get;}
```

### Property Value

Returns `true` if the current instance has a null value; otherwise, returns `false`.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## IsTemporary

This instance property indicates whether or not the current instance is bound to a temporary BLOB.

### Declaration

```
// C#  
public bool IsTemporary {get;}
```

### Property Value

`bool`

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## Length

Overrides `Stream`

This instance property indicates the size of the BLOB data in bytes.

### Declaration

```
// C#  
public override Int64 Length {get;}
```

### Property Value

A number indicating the size of the BLOB data in bytes.

## Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## OptimumChunkSize

This instance property indicates the optimal data buffer length (or multiples thereof) that read and write operations should use to improve performance.

### Declaration

```
// C#  
public int OptimumChunkSize{get;}
```

### Property Value

A number representing the minimum bytes to retrieve or send.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## Position

Overrides `Stream`

This instance property indicates the current read or write position in the LOB stream.

### Declaration

```
// C#  
public override Int64 Position{get; set;}
```

### Property Value

An `Int64` that indicates the read or write position.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

`ArgumentOutOfRangeException` - The `Position` is less than 0.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## Value

This instance property returns the data, starting from the first byte in the `BLOB`, as a byte array.

### Declaration

```
// C#  
public Byte[] Value{get;}
```

### Property Value

A byte array.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

`ArgumentOutOfRangeException` - The `Value` is less than 0.

### Remarks

The value of `Position` is not used or changed by using this property. 2 GB is the maximum byte array length that can be returned by this property.

 See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## OracleBlob Instance Methods

OracleBlob instance methods are listed in [Table 14-18](#).

**Table 14-18 OracleBlob Instance Methods**

Methods	Description
<a href="#">Append</a>	Appends the supplied data to the current OracleBlob instance (Overloaded)
<a href="#">BeginChunkWrite</a>	Opens the BLOB
BeginRead	Inherited from <code>System.IO.Stream</code>
BeginWrite	Inherited from <code>System.IO.Stream</code>
<a href="#">Clone</a>	Creates a copy of an OracleBlob object
<a href="#">Close</a>	Closes the current stream and releases any resources associated with it
<a href="#">Compare</a>	Compares data referenced by the current instance and that of the supplied object
<a href="#">CopyTo</a>	Copies from the current OracleBlob instance to an OracleBlob object (Overloaded)
CreateObjRef	Inherited from <code>System.MarshalByRefObject</code>
<a href="#">Dispose</a>	Releases resources allocated by this object
<a href="#">EndChunkWrite</a>	Closes the BLOB referenced by the current OracleBlob instance
EndRead	Inherited from <code>System.IO.Stream</code>
EndWrite	Inherited from <code>System.IO.Stream</code>
Equals	Inherited from <code>System.Object</code> (Overloaded)
<a href="#">Erase</a>	Erases data (Overloaded)
<a href="#">Flush</a>	<i>Not supported</i>
GetHashCode	Inherited from <code>System.Object</code>
GetLifetimeService	Inherited from <code>System.MarshalByRefObject</code>
GetType	Inherited from <code>System.Object</code>
InitializedLifetimeService	Inherited from <code>System.MarshalByRefObject</code>
<a href="#">IsEqual</a>	Compares the LOB data referenced by the two OracleBlobs

Table 14-18 (Cont.) OracleBlob Instance Methods

Methods	Description
<a href="#">Read</a>	Reads a specified amount of bytes from the ODP.NET LOB Type instance and populates the <code>buffer</code>
<code>ReadByte</code>	Inherited from <code>System.IO.Stream</code>
<a href="#">Search</a>	Searches for a binary pattern in the current instance of an <code>OracleBlob</code>
<a href="#">Seek</a>	Sets the position in the current LOB stream
<a href="#">SetLength</a>	Trims or truncates the BLOB value to the specified length
<code>ToString</code>	Inherited from <code>System.Object</code>
<a href="#">Write</a>	Writes the supplied buffer into the <code>OracleBlob</code>
<code>WriteByte</code>	Inherited from <code>System.IO.Stream</code>

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## Append

`Append` appends the supplied data to the end of the current `OracleBlob` instance.

**Overload List:**

- [Append\(OracleBlob\)](#)  
This instance method appends the BLOB data referenced by the provided `OracleBlob` object to the current `OracleBlob` instance.
- [Append\(byte\[\], int, int\)](#)  
This instance method appends data from the supplied byte array buffer to the end of the current `OracleBlob` instance.

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## Append(OracleBlob)

This instance method appends the BLOB data referenced by the provided `OracleBlob` object to the current `OracleBlob` instance.

### Declaration

```
// C#  
public void Append(OracleBlob obj);
```

### Parameters

- *obj*  
An object of `OracleBlob`.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The parameter has a different connection than the object, `OracleConnection` is not opened, or `OracleConnection` has been reopened.

### Remarks

No character set conversions are made.

The provided object and the current instance must be using the same connection; that is, the same `OracleConnection` object.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## Append(byte[], int, int)

This instance method appends data from the supplied byte array buffer to the end of the current `OracleBlob` instance.

### Declaration

```
// C#  
public void Append(byte[] buffer, int offset, int count);
```

### Parameters

- *buffer*  
An array of bytes.

- *offset*  
The zero-based byte offset in the buffer from which data is read.
- *count*  
The number of bytes to be appended.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

### Example

```
// C#

using System;
using Oracle.DataAccess.Client;
using Oracle.DataAccess.Types;

class AppendSample
{
    static void Main()
    {
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();

        OracleBlob blob = new OracleBlob(con);

        // Append 2 bytes {4, 5} to the OracleBlob
        byte[] buffer = new byte[3] {4, 5, 6};
        blob.Append(buffer, 0, 2);

        byte[] appendBuffer = blob.Value;

        // Prints "appendBuffer = 45"
        Console.WriteLine("appendBuffer = ");
        for(int index = 0; index < appendBuffer.Length; index++)
        {
            Console.WriteLine(appendBuffer[index]);
        }
        Console.WriteLine();

        blob.Close();
        blob.Dispose();

        con.Close();
        con.Dispose();
    }
}
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## BeginChunkWrite

This instance method opens the BLOB.

### Declaration

```
// C#  
public void BeginChunkWrite();
```

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

### Remarks

`BeginChunkWrite` does not need to be called before manipulating the BLOB data. This is provided for performance reasons.

After this method is called, write operations do not cause the domain or function-based index on the column to be updated. Index updates occur only once after `EndChunkWrite` is called.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## Clone

This instance method creates a copy of an `OracleBlob` object.

### Declaration

```
// C#  
public object Clone();
```

## Return Value

An OracleBlob object.

## Implements

ICloneable

## Exceptions

ObjectDisposedException - The object is already disposed.

InvalidOperationException - The OracleConnection is not open or has been closed during the lifetime of the object.

## Remarks

The cloned object has the same property values as that of the object being cloned.

## Example

```
// C#  
  
using System;  
using Oracle.DataAccess.Client;  
using Oracle.DataAccess.Types;  
  
class CloneSample  
{  
    static void Main()  
    {  
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";  
        OracleConnection con = new OracleConnection(constr);  
        con.Open();  
  
        OracleBlob blob1 = new OracleBlob(con);  
  
        // Prints "blob1.Position = 0"  
        Console.WriteLine("blob1.Position = " + blob1.Position);  
  
        // Set the Position before calling Clone()  
        blob1.Position = 1;  
  
        // Clone the OracleBlob  
        OracleBlob blob2 = (OracleBlob)blob1.Clone();  
  
        // Prints "blob2.Position = 1"  
        Console.WriteLine("blob2.Position = " + blob2.Position);  
  
        blob1.Close();  
        blob1.Dispose();  
  
        blob2.Close();  
        blob2.Dispose();  
  
        con.Close();  
        con.Dispose();  
    }  
}
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## Close

Overrides `Stream`

This instance method closes the current stream and releases any resources associated with it.

### Declaration

```
// C#  
public override void Close();
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## Compare

This instance method compares data referenced by the current instance and that of the supplied object.

### Declaration

```
// C#  
public int Compare(Int64 src_offset, OracleBlob obj, Int64 dst_offset,  
    Int64 amount);
```

### Parameters

- *src\_offset*  
The comparison starting point (in bytes) for the current instance.
- *obj*  
The provided `OracleBlob` object.
- *dst\_offset*  
The comparison starting point (in bytes) for the provided `OracleBlob`.

- *amount*  
The number of bytes to compare.

### Return Value

Returns a value that is:

- Less than zero: if the data referenced by the current instance is less than that of the supplied instance
- Zero: if both objects reference the same data
- Greater than zero: if the data referenced by the current instance is greater than that of the supplied instance

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The parameter has a different connection than the object, `OracleConnection` is not opened, or `OracleConnection` has been reopened.

`ArgumentOutOfRangeException` - The `src_offset`, the `dst_offset`, or the `amount` parameter is less than 0.

### Remarks

The provided object and the current instance must be using the same connection, that is, the same `OracleConnection` object.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## CopyTo

`CopyTo` copies data from the current instance to the provided `OracleBlob` object.

### Overload List:

- [CopyTo\(OracleBlob\)](#)  
This instance method copies data from the current instance to the provided `OracleBlob` object.
- [CopyTo\(OracleBlob, Int64\)](#)  
This instance method copies data from the current `OracleBlob` instance to the provided `OracleBlob` object with the specified destination offset.
- [CopyTo\(Int64, OracleBlob, Int64, Int64\)](#)

This instance method copies data from the current `OracleBlob` instance to the provided `OracleBlob` object with the specified source offset, destination offset, and character amounts.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## CopyTo(OracleBlob)

This instance method copies data from the current instance to the provided `OracleBlob` object.

### Declaration

```
// C#  
public Int64 CopyTo(OracleBlob obj);
```

### Parameters

- *obj*  
The `OracleBlob` object to which the data is copied.

### Return Value

The return value is the amount copied.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - This exception is thrown if any of the following conditions exist:

- The `OracleConnection` is not open or has been closed during the lifetime of the object.
- The LOB object parameter has a different connection than the object.

### Remarks

The provided object and the current instance must be using the same connection; that is, the same `OracleConnection` object.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## CopyTo(OracleBlob, Int64)

This instance method copies data from the current `OracleBlob` instance to the provided `OracleBlob` object with the specified destination offset.

### Declaration

```
// C#  
public Int64 CopyTo(OracleBlob obj, Int64 dst_offset);
```

### Parameters

- *obj*  
The `OracleBlob` object to which the data is copied.
- *dst\_offset*  
The offset (in bytes) at which the `OracleBlob` object is copied.

### Return Value

The return value is the amount copied.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`ArgumentOutOfRangeException` - The *dst\_offset* is less than 0.

`InvalidOperationException` - This exception is thrown if any of the following conditions exist:

- The `OracleConnection` is not open or has been closed during the lifetime of the object.
- The LOB object parameter has a different connection than the object.

### Remarks

If the *dst\_offset* is beyond the end of the `OracleBlob` data, spaces are written into the `OracleBlob` until the *dst\_offset* is met.

The offsets are 0-based. No character conversion is performed by this operation.

The provided object and the current instance must be using the same connection; that is, the same `OracleConnection` object.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## CopyTo(Int64, OracleBlob, Int64, Int64)

This instance method copies data from the current `OracleBlob` instance to the provided `OracleBlob` object with the specified source offset, destination offset, and character amounts.

### Declaration

```
// C#
public Int64 CopyTo(Int64 src_offset, OracleBlob obj, Int64 dst_offset,
    Int64 amount);
```

### Parameters

- *src\_offset*  
The offset (in bytes) in the current instance, from which the data is read.
- *obj*  
The `OracleBlob` object to which the data is copied.
- *dst\_offset*  
The offset (in bytes) at which the `OracleBlob` object is copied.
- *amount*  
The amount of data to be copied.

### Return Value

The return value is the amount copied.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The parameter has a different connection than the object, `OracleConnection` is not opened, or `OracleConnection` has been reopened.

`ArgumentOutOfRangeException` - The *src\_offset*, the *dst\_offset*, or the *amount* parameter is less than 0.

### Remarks

If the *dst\_offset* is beyond the end of the `OracleBlob` data, spaces are written into the `OracleBlob` until the *dst\_offset* is met.

The offsets are 0-based. No character conversion is performed by this operation.

The provided object and the current instance must be using the same connection; that is, the same `OracleConnection` object.

### Example

```
// C#

using System;
using Oracle.DataAccess.Client;
using Oracle.DataAccess.Types;

class CopyToSample
{
    static void Main()
    {
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();

        OracleBlob blob1 = new OracleBlob(con);
        OracleBlob blob2 = new OracleBlob(con);

        // Write 4 bytes, starting at buffer offset 0
        byte[] buffer = new byte[4] {1, 2, 3, 4};
        blob1.Write(buffer, 0, 4);

        // Copy 2 bytes from byte 0 of blob1 to byte 1 of blob2
        blob1.CopyTo(0, blob2, 1, 2);

        byte[] copyBuffer = blob2.Value;

        //Prints "Value = 012"
        Console.WriteLine("Value = ");
        for(int index = 0; index < copyBuffer.Length; index++)
        {
            Console.WriteLine(copyBuffer[index]);
        }
        Console.WriteLine();

        blob1.Close();
        blob1.Dispose();

        blob2.Close();
        blob2.Dispose();

        con.Close();
        con.Dispose();
    }
}
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## Dispose

This instance method releases resources allocated by this object.

### Declaration

```
// C#  
public void Dispose();
```

### Implements

IDisposable

### Remarks

Once `Dispose()` is called, the object of `OracleBlob` is in an uninitialized state.

Although some properties can still be accessed, their values may not be accountable. Since resources are freed, method calls may lead to exceptions. The object cannot be reused after being disposed.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## EndChunkWrite

This instance method closes the BLOB referenced by the current `OracleBlob` instance.

### Declaration

```
// C#  
public void EndChunkWrite();
```

### Exceptions

`ObjectDisposedException` - The object is already disposed.

InvalidOperationException - The `OracleConnection` is not open or has been closed during the lifetime of the object.

### Remarks

Index updates occur immediately if there is write operation(s) deferred by the `BeginChunkWrite` method.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## Erase

`Erase` erases a portion or all data.

### Overload List:

- [Erase\(\)](#)  
This instance method erases all data.
- [Erase\(Int64, Int64\)](#)  
This instance method erases a specified portion of data.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## Erase()

This instance method erases all data.

### Declaration

```
// C#  
public Int64 Erase();
```

### Return Value

The number of bytes erased.

**Remarks**

`Erase()` replaces all data with zero-byte fillers.

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## Erase(Int64, Int64)

This instance method erases a specified portion of data.

**Declaration**

```
// C#  
public Int64 Erase(Int64 offset, Int64 amount);
```

**Parameters**

- *offset*  
The offset from which to erase.
- *amount*  
The quantity (in bytes) to erase.

**Return Value**

The number of bytes erased.

**Exceptions**

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

`ArgumentOutOfRangeException` - The *offset* or *amount* parameter is less than 0.

**Remarks**

Replaces the specified *amount* of data with zero-byte fillers.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## Flush

This method is not supported.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## IsEqual

This instance method compares the LOB data referenced by the two `OracleBlobs`.

### Declaration

```
// C#  
public bool IsEqual(OracleBlob obj);
```

### Parameters

- *obj*  
An `OracleBlob` object.

### Return Value

If the current `OracleBlob` and the provided `OracleBlob` refer to the same LOB, returns `true`. Returns `false` otherwise.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

### Remarks

Note that this method can return `true` even if the two `OracleBlob` objects return `false` for `==` or `Equals()` because two different `OracleBlob` instances can refer to the same LOB.

The provided object and the current instance must be using the same connection, that is, the same `OracleConnection` object.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## Read

Overrides `Stream`

This instance method reads a specified amount of bytes from the ODP.NET LOB instance and populates the `buffer`.

### Declaration

```
// C#  
public override int Read(byte[] buffer, int offset, int count);
```

### Parameters

- `buffer`  
The byte array buffer to be populated.
- `offset`  
The starting offset (in bytes) at which the buffer is populated.
- `count`  
The amount of bytes to read.

### Return Value

The return value indicates the number of bytes read from the LOB.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

`ArgumentOutOfRangeException` - This exception is thrown if any of the following conditions exist:

- The `offset` or the `count` parameter is less than 0.
- The `offset` is greater than or equal to the `buffer.Length`.
- The `offset` and the `count` together are greater than the `buffer.Length`.

## Remarks

The LOB data is read starting from the position specified by the `Position` property.

## Example

```
// C#

using System;
using Oracle.DataAccess.Client;
using Oracle.DataAccess.Types;

class ReadSample
{
    static void Main()
    {
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();

        OracleBlob blob = new OracleBlob(con);

        // Write 3 bytes, starting at buffer offset 1
        byte[] writeBuffer = new byte[4] {1, 2, 3, 4};
        blob.Write(writeBuffer, 1, 3);

        // Reset the Position for Read
        blob.Position = 1;

        // Read 2 bytes into buffer starting at buffer offset 1
        byte[] readBuffer = new byte[4];
        int bytesRead = blob.Read(readBuffer, 1, 2);

        // Prints "bytesRead = 2"
        Console.WriteLine("bytesRead = " + bytesRead);

        // Prints "readBuffer = 0340"
        Console.Write("readBuffer = ");
        for(int index = 0; index < readBuffer.Length; index++)
        {
            Console.Write(readBuffer[index]);
        }
        Console.WriteLine();

        blob.Close();
        blob.Dispose();

        con.Close();
        con.Dispose();
    }
}
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## Search

This instance method searches for a binary pattern in the current instance of an `OracleBlob`.

### Declaration

```
// C#  
public Int64 Search(byte[] val, int64 offset, int64 nth);
```

### Parameters

- *val*  
The binary pattern being searched for.
- *offset*  
The 0-based offset (in bytes) starting from which the `OracleBlob` is searched.
- *nth*  
The specific occurrence (1-based) of the match for which the absolute offset (in bytes) is returned.

### Return Value

Returns the absolute *offset* of the start of the matched pattern (in bytes) for the *nth* occurrence of the match. Otherwise, 0 is returned.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

`ArgumentOutOfRangeException` - This exception is thrown if any of the following conditions exist:

- The *offset* is less than 0.
- The *nth* is less than or equal to 0.
- The *val.Length* is greater than 16383.
- The *nth* is greater than or equal to `OracleBlob.MaxValue`.
- The *offset* is greater than or equal to `OracleBlob.MaxValue`.

## Remarks

The limit of the search pattern is 16383 bytes.

## Example

```
// C#

using System;
using Oracle.DataAccess.Client;
using Oracle.DataAccess.Types;

class SearchSample
{
    static void Main()
    {
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();

        OracleBlob blob = new OracleBlob(con);

        // Write 7 bytes, starting at buffer offset 0
        byte[] buffer = new byte[7] {1, 2, 3, 4, 1, 2, 3};
        blob.Write(buffer, 0, 7);

        // Search for the 2nd occurrence of a byte pattern '23'
        // starting at offset 1 in the OracleBlob
        byte[] pattern = new byte[2] {2, 3};
        long posFound = blob.Search(pattern, 1, 2);

        // Prints "posFound = 6"
        Console.WriteLine("posFound = " + posFound);

        blob.Close();
        blob.Dispose();

        con.Close();
        con.Dispose();
    }
}
```

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## Seek

Overrides `Stream`

This instance method sets the position on the current LOB stream.

## Declaration

```
// C#  
public override Int64 Seek(Int64 offset, SeekOrigin origin);
```

## Parameters

- *offset*  
A byte offset relative to origin.
- *origin*  
A value of type `System.IO.SeekOrigin` indicating the reference point used to obtain the new position.

## Return Value

Returns `Int64` for the position.

## Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

## Remarks

If *offset* is negative, the new position precedes the position specified by *origin* by the number of bytes specified by *offset*.

If *offset* is zero, the new position is the position specified by *origin*.

If *offset* is positive, the new position follows the position specified by *origin* by the number of bytes specified by *offset*.

`SeekOrigin.Begin` specifies the beginning of a stream.

`SeekOrigin.Current` specifies the current position within a stream.

`SeekOrigin.End` specifies the end of a stream.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## SetLength

Overrides `Stream`

This instance method trims or truncates the `BLOB` value to the specified length (in bytes).

### Declaration

```
// C#  
public override void SetLength(Int64 newLen);
```

### Parameters

- `newLen`

The desired length of the current stream in bytes.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

`ArgumentOutOfRangeException` - The `newLen` parameter is less than 0.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## Write

Overrides `Stream`

This instance method writes the supplied buffer into the `OracleBlob`.

### Declaration

```
// C#  
public override void Write(byte[] buffer, int offset, int count);
```

### Parameters

- `buffer`

The byte array `buffer` that provides the data.

- `offset`

The 0-based offset (in bytes) from which the `buffer` is read.

- `count`

The amount of data (in bytes) that is to be written into the `OracleBlob`.

## Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

`ArgumentOutOfRangeException` - This exception is thrown if any of the following conditions exist:

- The *offset* or the *count* is less than 0.
- The *offset* is greater than or equal to the *buffer.Length*.
- The *offset* and the *count* together are greater than *buffer.Length*.

## Remarks

Destination *offset* in the `OracleBlob` can be specified by the `Position` property.

## Example

```
// C#

using System;
using Oracle.DataAccess.Client;
using Oracle.DataAccess.Types;

class WriteSample
{
    static void Main()
    {
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();

        OracleBlob blob = new OracleBlob(con);

        // Set the Position for the Write
        blob.Position = 0;

        // Begin ChunkWrite to improve performance
        // Index updates occur only once after EndChunkWrite
        blob.BeginChunkWrite();

        // Write to the OracleBlob in 5 chunks of 2 bytes each
        byte[] b = new byte[2] {1, 2};
        for(int index = 0; index < 5; index++)
        {
            blob.Write(b, 0, b.Length);
        }
        blob.EndChunkWrite();

        byte[] chunkBuffer = blob.Value;

        // Prints "chunkBuffer = 1212121212"
        Console.WriteLine("chunkBuffer = ");
        for(int index = 0; index < chunkBuffer.Length; index++)
        {
            Console.WriteLine(chunkBuffer[index]);
        }
    }
}
```

```

        Console.WriteLine();

        blob.Close();
        blob.Dispose();

        con.Close();
        con.Dispose();
    }
}

```

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBlob Class](#)
- [OracleBlob Members](#)

## OracleClob Class

An `OracleClob` is an object that has a reference to `CLOB` data. It provides methods for performing operations on `CLOB`s.

### Note:

The `OracleClob` object uses the client side character set when retrieving or writing `CLOB` data using a .NET Framework byte array.

### Class Inheritance

```

System.Object
    System.MarshalByRefObject
        System.IO.Stream
            Oracle.DataAccess.Types.OracleClob

```

### Declaration

```

// C#
public sealed class OracleClob : Stream, ICloneable, INullable

```

### Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

### Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

### Example

```
// C#

using System;
using Oracle.DataAccess.Client;
using Oracle.DataAccess.Types;

class OracleClobSample
{
    static void Main()
    {
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();

        OracleClob clob = new OracleClob(con);

        // Write 4 chars from writeBuffer, starting at buffer offset 0
        char[] writeBuffer = new char[4] {'a', 'b', 'c', 'd'};
        clob.Write(writeBuffer, 0, 4);

        // Append first 2 chars from writeBuffer {'a', 'b'} to the oracleClob
        clob.Append(writeBuffer, 0, 2);

        // Prints "clob.Length = 12"
        Console.WriteLine("clob.Length = " + clob.Length);

        // Reset the Position for the Read
        clob.Position = 0;

        // Read 6 chars into readBuffer, starting at buffer offset 0
        char[] readBuffer = new char[6];
        int charsRead = clob.Read(readBuffer, 0, 6);

        // Prints "charsRead = 6"
        Console.WriteLine("charsRead = " + charsRead);

        // Prints "readBuffer = abcdab"
        Console.Write("readBuffer = ");
        for(int index = 0; index < readBuffer.Length; index++)
        {
            Console.Write(readBuffer[index]);
        }
    }
}
```

```
Console.WriteLine();

// Search for the 2nd occurrence of a char pattern 'ab'
// starting from char offset 0 in the OracleClob
char[] pattern = new char[2] {'a', 'b'};
long posFound = clob.Search(pattern, 0, 2);

// Prints "posFound      = 5"
Console.WriteLine("posFound      = " + posFound);

// Erase 4 chars of data starting at char offset 1
// Sets chars to ''
clob.Erase(1, 4);

//Prints "clob.Value    = a      b"
Console.WriteLine("clob.Value    = " + clob.Value);

clob.Close();
clob.Dispose();

con.Close();
con.Dispose();
}
}
```



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Members](#)
- [OracleClob Constructors](#)
- [OracleClob Static Fields](#)
- [OracleClob Static Methods](#)
- [OracleClob Instance Properties](#)
- [OracleClob Instance Methods](#)

## OracleClob Members

OracleClob members are listed in the following tables.

### OracleClob Constructors

OracleClob constructors are listed in [Table 14-19](#).

**Table 14-19 OracleClob Constructors**

Constructor	Description
<a href="#">OracleClob Constructors</a>	Creates an instance of the OracleClob class bound to a temporary CLOB (Overloaded)

### OracleClob Static Fields

OracleClob static fields are listed in [Table 14-20](#).

**Table 14-20 OracleClob Static Fields**

Field	Description
<a href="#">MaxSize</a>	Holds the maximum number of bytes a CLOB can hold, which is 4,294,967,295 ( $2^{32} - 1$ ) bytes
<a href="#">Null</a>	Represents a null value that can be assigned to the value of an OracleClob instance

### OracleClob Static Methods

OracleClob static methods are listed in [Table 14-21](#).

**Table 14-21 OracleClob Static Methods**

Methods	Description
<a href="#">Equals</a>	Inherited from <code>System.Object</code> (Overloaded)

### OracleClob Instance Properties

OracleClob instance properties are listed in [Table 14-22](#).

**Table 14-22 OracleClob Instance Properties**

Properties	Description
<a href="#">CanRead</a>	Indicates whether or not the LOB stream can be read
<a href="#">CanSeek</a>	Indicates whether or not forward and backward seek operations can be performed
<a href="#">CanWrite</a>	Indicates whether or not the LOB stream can be written
<a href="#">Connection</a>	Indicates the <code>OracleConnection</code> that is used to retrieve and write CLOB data
<a href="#">IsEmpty</a>	Indicates whether the CLOB is empty or not
<a href="#">IsInChunkWriteMode</a>	Indicates whether or not the CLOB has been opened
<a href="#">IsNClob</a>	Indicates whether or not the OracleClob object represents an NCLOB.
<a href="#">IsNull</a>	Indicates whether or not the current instance has a null value
<a href="#">IsTemporary</a>	Indicates whether or not the current instance is bound to a temporary CLOB
<a href="#">Length</a>	Indicates the size of the CLOB data in bytes

**Table 14-22 (Cont.) OracleClob Instance Properties**

Properties	Description
<a href="#">OptimumChunkSize</a>	Indicates the minimum number of bytes to retrieve or send from the database during a read or write operation
<a href="#">Position</a>	Indicates the current read or write position in the LOB stream in bytes
<a href="#">Value</a>	Returns the data, starting from the first character in the CLOB or NCLOB, as a string

**OracleClob Instance Methods**

The `OracleClob` instance methods are listed in [Table 14-23](#).

**Table 14-23 OracleClob Instance Methods**

Methods	Description
<a href="#">Append</a>	Appends data to the current <code>OracleClob</code> instance (Overloaded)
<a href="#">BeginChunkWrite</a>	Opens the CLOB
<code>BeginRead</code>	Inherited from <code>System.IO.Stream</code>
<code>BeginWrite</code>	Inherited from <code>System.IO.Stream</code>
<a href="#">Clone</a>	Creates a copy of an <code>OracleClob</code> object
<a href="#">Close</a>	Closes the current stream and releases resources associated with it
<a href="#">Compare</a>	Compares data referenced by the current instance to that of the supplied object
<a href="#">CopyTo</a>	Copies the data to an <code>OracleClob</code> (Overloaded)
<code>CreateObjRef</code>	Inherited from <code>System.MarshalByRefObject</code>
<a href="#">Dispose</a>	Releases resources allocated by this object
<a href="#">EndChunkWrite</a>	Closes the CLOB referenced by the current <code>OracleClob</code> instance
<code>EndRead</code>	Inherited from <code>System.IO.Stream</code>
<code>EndWrite</code>	Inherited from <code>System.IO.Stream</code>
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)
<a href="#">Erase</a>	Erases the specified amount of data (Overloaded)
<a href="#">Flush</a>	<i>Not supported</i>
<a href="#">GetHashCode</a>	Returns a hash code for the current instance
<code>GetLifetimeService</code>	Inherited from <code>System.MarshalByRefObject</code>
<code>GetType</code>	Inherited from <code>System.Object</code>
<code>InitializeLifetimeService</code>	Inherited from <code>System.MarshalByRefObject</code>
<a href="#">IsEqual</a>	Compares the LOB data referenced by two <code>OracleClob</code> s

Table 14-23 (Cont.) OracleClob Instance Methods

Methods	Description
<a href="#">Read</a>	Reads from the current instance (Overloaded)
ReadByte	Inherited from <code>System.IO.Stream</code>
<a href="#">Search</a>	Searches for a character pattern in the current instance of <code>OracleClob</code> (Overloaded)
<a href="#">Seek</a>	Sets the position in the current LOB stream
<a href="#">SetLength</a>	Trims or truncates the CLOB value
ToString	Inherited from <code>System.Object</code>
<a href="#">Write</a>	Writes the provided buffer into the <code>OracleClob</code> (Overloaded)
WriteByte	Inherited from <code>System.IO.Stream</code>

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)

## OracleClob Constructors

`OracleClob` constructors create instances of the `OracleClob` class bound to a temporary CLOB.

**Overload List:**

- [OracleClob\(OracleConnection\)](#)  
This constructor creates an instance of the `OracleClob` class bound to a temporary CLOB with an `OracleConnection` object.
- [OracleClob\(OracleConnection, bool, bool\)](#)  
This constructor creates an instance of the `OracleClob` class that is bound to a temporary CLOB, with an `OracleConnection` object, a boolean value for caching, and a boolean value for `NCLOB`.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## OracleClob(OracleConnection)

This constructor creates an instance of the `OracleClob` class bound to a temporary `CLOB` with an `OracleConnection` object.

### Declaration

```
// C#  
public OracleClob(OracleConnection con);
```

### Parameters

- `con`

The `OracleConnection` object.

### Exceptions

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

### Remarks

The connection must be opened explicitly by the application. `OracleClob` does not open the connection implicitly. The temporary `CLOB` utilizes the provided connection to store `CLOB` data. Caching is not enabled by default.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## OracleClob(OracleConnection, bool, bool)

This constructor creates an instance of the `OracleClob` class that is bound to a temporary `CLOB`, with an `OracleConnection` object, a boolean value for caching, and a boolean value for `NCLOB`.

**Declaration**

```
// C#
public OracleClob(OracleConnection con, bool bCaching, bool bNCLOB);
```

**Parameters**

- *con*  
The `OracleConnection` object connection.
- *bCaching*  
A flag that indicates whether or not server-side caching is enabled.
- *bNCLOB*  
A flag that is set to `true` if the instance is a `NCLOB` or `false` if it is a `CLOB`.

**Exceptions**

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

**Remarks**

The connection must be opened explicitly by the application. `OracleClob` does not open the connection implicitly. The temporary `CLOB` or `NCLOB` uses the provided connection to store `CLOB` data.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## OracleClob Static Fields

`OracleClob` static fields are listed in [Table 14-24](#).

**Table 14-24 OracleClob Static Fields**

Field	Description
<a href="#">MaxSize</a>	Holds the maximum number of bytes a <code>CLOB</code> can hold, which is 4,294,967,295 (2 <sup>32</sup> - 1) bytes
<a href="#">Null</a>	Represents a null value that can be assigned to the value of an <code>OracleClob</code> instance

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## MaxSize

The `MaxSize` field holds the maximum number of bytes a CLOB can hold, which is 4,294,967,295 ( $2^{32} - 1$ ) bytes.

### Declaration

```
// C#  
public static readonly Int64 MaxSize = 4294967295;
```

### Remarks

This field is useful in code that checks whether or not your operation exceeds the maximum length (in bytes) allowed.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## Null

This static field represents a null value that can be assigned to the value of an `OracleClob` instance.

### Declaration

```
// C#  
public static readonly OracleClob Null;
```

 See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## OracleClob Static Methods

OracleClob static methods are listed in [Table 14-25](#).

**Table 14-25 OracleClob Static Methods**

Methods	Description
Equals	Inherited from <code>System.Object</code> (Overloaded)

 See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## OracleClob Instance Properties

OracleClob instance properties are listed in [Table 14-26](#).

**Table 14-26 OracleClob Instance Properties**

Properties	Description
<a href="#">CanRead</a>	Indicates whether or not the LOB stream can be read
<a href="#">CanSeek</a>	Indicates whether or not forward and backward seek operations can be performed
<a href="#">CanWrite</a>	Indicates whether or not the LOB stream can be written
<a href="#">Connection</a>	Indicates the <code>OracleConnection</code> that is used to retrieve and write CLOB data
<a href="#">IsEmpty</a>	Indicates whether the CLOB is empty or not
<a href="#">IsInChunkWriteMode</a>	Indicates whether or not the CLOB has been opened
<a href="#">IsNClob</a>	Indicates whether or not the <code>OracleClob</code> object represents an NCLOB.
<a href="#">IsNull</a>	Indicates whether or not the current instance has a null value

Table 14-26 (Cont.) OracleClob Instance Properties

Properties	Description
<a href="#">IsTemporary</a>	Indicates whether or not the current instance is bound to a temporary CLOB
<a href="#">Length</a>	Indicates the size of the CLOB data in bytes
<a href="#">OptimumChunkSize</a>	Indicates the minimum number of bytes to retrieve or send from the database during a read or write operation
<a href="#">Position</a>	Indicates the current read or write position in the LOB stream in bytes
<a href="#">Value</a>	Returns the data, starting from the first character in the CLOB or NCLOB, as a string

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## CanRead

Overrides `Stream`

This instance property indicates whether or not the LOB stream can be read.

**Declaration**

```
// C#  
public override bool CanRead{get;}
```

**Property Value**

If the LOB stream can be read, returns `true`; otherwise, returns `false`.

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## CanSeek

Overrides `Stream`

This instance property indicates whether or not forward and backward seek operations can be performed.

### Declaration

```
// C#  
public override bool CanSeek{get;}
```

### Property Value

If forward and backward seek operations can be performed, returns `true`; otherwise, returns `false`.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## CanWrite

Overrides `Stream`

This instance property indicates whether or not the LOB object supports writing.

### Declaration

```
// C#  
public override bool CanWrite{get;}
```

### Property Value

If the LOB stream can be written, returns `true`; otherwise, returns `false`.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## Connection

This instance property indicates the `OracleConnection` that is used to retrieve and write CLOB data.

### Declaration

```
// C#  
public OracleConnection Connection {get;}
```

### Property Value

An `OracleConnection`.

### Exceptions

`ObjectDisposedException` - The object is already disposed.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## IsEmpty

This instance property indicates whether the CLOB is empty or not.

### Declaration

```
// C#  
public bool IsEmpty {get;}
```

### Property Value

A `bool`.

### Exceptions

`ObjectDisposedException` - The object is already disposed.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## IsInChunkWriteMode

This instance property indicates whether or not the CLOB has been opened to defer index updates.

### Declaration

```
// C#  
public bool IsInChunkWriteMode{get;}
```

### Property Value

If the CLOB has been opened, returns `true`; otherwise, returns `false`.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## IsNClob

This instance property indicates whether or not the OracleClob object represents an NClob.

### Declaration

```
// C#  
public bool IsNClob {get;}
```

### Property Value

A `bool`.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## IsNull

This property indicates whether or not the current instance has a null value.

### Declaration

```
// C#  
public bool IsNull{get;}
```

### Property Value

Returns `true` if the current instance has a null value; otherwise, returns `false`.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## IsTemporary

This instance property indicates whether or not the current instance is bound to a temporary CLOB.

### Declaration

```
// C#  
public bool IsTemporary {get;}
```

### Property Value

A `bool`.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## Length

Overrides `Stream`

This instance property indicates the size of the CLOB data in bytes.

### Declaration

```
// C#  
public override Int64 Length {get;}
```

### Property Value

An `Int64` that indicates the size of the `CLOB` in bytes.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## OptimumChunkSize

This instance property indicates the minimum number of bytes to retrieve or send from the database during a read or write operation.

### Declaration

```
// C#  
public int OptimumChunkSize{get;}
```

### Property Value

A number representing the minimum bytes to retrieve or send.

### Exceptions

`ObjectDisposedException` - The object is already disposed.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## Position

Overrides `Stream`

This instance property indicates the current read or write position in the LOB stream in bytes.

### Declaration

```
// C#  
public override Int64 Position{get; set;}
```

### Property Value

An `Int64` that indicates the read or write position.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

`ArgumentOutOfRangeException` - The `Position` is less than 0.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## Value

This instance property returns the data, starting from the first character in the `CLOB` or `NCLOB`, as a string.

### Declaration

```
// C#  
public string Value{get;}
```

### Property Value

A string.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

`ArgumentOutOfRangeException` - The `Value` is less than 0.

### Remarks

The value of `Position` is neither used nor changed by using this property.

The maximum string length that can be returned by this property is 2 GB.

 See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## OracleClob Instance Methods

The `OracleClob` instance methods are listed in [Table 14-27](#).

**Table 14-27 OracleClob Instance Methods**

Methods	Description
<a href="#">Append</a>	Appends data to the current <code>OracleClob</code> instance (Overloaded)
<a href="#">BeginChunkWrite</a>	Opens the CLOB
<code>BeginRead</code>	Inherited from <code>System.IO.Stream</code>
<code>BeginWrite</code>	Inherited from <code>System.IO.Stream</code>
<a href="#">Clone</a>	Creates a copy of an <code>OracleClob</code> object
<a href="#">Close</a>	Closes the current stream and releases resources associated with it
<a href="#">Compare</a>	Compares data referenced by the current instance to that of the supplied object
<a href="#">CopyTo</a>	Copies the data to an <code>OracleClob</code> (Overloaded)
<code>CreateObjRef</code>	Inherited from <code>System.MarshalByRefObject</code>
<a href="#">Dispose</a>	Releases resources allocated by this object
<a href="#">EndChunkWrite</a>	Closes the CLOB referenced by the current <code>OracleClob</code> instance
<code>EndRead</code>	Inherited from <code>System.IO.Stream</code>
<code>EndWrite</code>	Inherited from <code>System.IO.Stream</code>
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)
<a href="#">Erase</a>	Erases the specified amount of data (Overloaded)
<a href="#">Flush</a>	<i>Not supported</i>
<a href="#">GetHashCode</a>	Returns a hash code for the current instance
<code>GetLifetimeService</code>	Inherited from <code>System.MarshalByRefObject</code>
<code>GetType</code>	Inherited from <code>System.Object</code>
<code>InitializeLifetimeService</code>	Inherited from <code>System.MarshalByRefObject</code>
<a href="#">IsEqual</a>	Compares the LOB data referenced by two <code>OracleClob</code> s
<a href="#">Read</a>	Reads from the current instance (Overloaded)
<code>ReadByte</code>	Inherited from <code>System.IO.Stream</code>

Table 14-27 (Cont.) OracleClob Instance Methods

Methods	Description
<a href="#">Search</a>	Searches for a character pattern in the current instance of <code>OracleClob</code> (Overloaded)
<a href="#">Seek</a>	Sets the position in the current LOB stream
<a href="#">SetLength</a>	Trims or truncates the CLOB value
<code>ToString</code>	Inherited from <code>System.Object</code>
<a href="#">Write</a>	Writes the provided buffer into the <code>OracleClob</code> (Overloaded)
<code>WriteByte</code>	Inherited from <code>System.IO.Stream</code>

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## Append

This instance method appends data to the current `OracleClob` instance.

### Overload List:

- [Append\(OracleClob\)](#)  
This instance method appends the CLOB data referenced by the provided `OracleClob` object to the current `OracleClob` instance.
- [Append\(byte \[\], int, int\)](#)  
This instance method appends data at the end of the CLOB, from the supplied byte array buffer, starting from offset (in bytes) of the supplied byte array buffer.
- [Append\(char \[\], int, int\)](#)  
This instance method appends data from the supplied character array buffer to the end of the current `OracleClob` instance, starting at the offset (in characters) of the supplied character buffer.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## Append(OracleClob)

This instance method appends the CLOB data referenced by the provided `OracleClob` object to the current `OracleClob` instance.

### Declaration

```
// C#  
public void Append(OracleClob obj);
```

### Parameters

- *obj*  
An `OracleClob` object.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The parameter has a different connection than the object, `OracleConnection` is not opened, or `OracleConnection` has been reopened.

### Remarks

No character set conversions are made.

The provided object and the current instance must be using the same connection; that is, the same `OracleConnection` object.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## Append(byte [], int, int)

This instance method appends data at the end of the CLOB, from the supplied byte array buffer, starting from offset (in bytes) of the supplied byte array buffer.

## Declaration

```
// C#  
public int Append(byte[] buffer, int offset, int count);
```

## Parameters

- *buffer*  
An array of bytes, representing a Unicode string.
- *offset*  
The zero-based byte offset in the buffer from which data is read.
- *count*  
The number of bytes to be appended.

## Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

`ArgumentOutOfRangeException` - Either the *offset* or the *count* parameter is not even.

## Remarks

Both *offset* and *count* must be even numbers for `CLOB` and `NCLOB` because every two bytes represent a Unicode character.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## Append(char [], int, int)

This instance method appends data from the supplied character array buffer to the end of the current `OracleClob` instance, starting at the offset (in characters) of the supplied character buffer.

## Declaration

```
// C#  
public void Append(char[] buffer, int offset, int count);
```

## Parameters

- *buffer*

An array of characters.

- *offset*

The zero-based offset (in characters) in the buffer from which data is read.

- *count*

The number of characters to be appended.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

### Example

```
// C#

using System;
using Oracle.DataAccess.Client;
using Oracle.DataAccess.Types;

class AppendSample
{
    static void Main()
    {
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();

        OracleClob clob = new OracleClob(con);

        // Append 2 chars {'d', 'e'} to the OracleClob
        char[] buffer = new char[3] {'d', 'e', 'f'};
        clob.Append(buffer, 0, 2);

        // Prints "clob.Value = de"
        Console.WriteLine("clob.Value = " + clob.Value);

        clob.Close();
        clob.Dispose();

        con.Close();
        con.Dispose();
    }
}
```

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## BeginChunkWrite

This instance method opens the CLOB.

### Declaration

```
// C#  
public void BeginChunkWrite();
```

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

### Remarks

`BeginChunkWrite` does not need to be called before manipulating the CLOB data. This is provided for performance reasons.

After this method is called, write operations do not cause the domain or function-based index on the column to be updated. Index updates occur only once after `EndChunkWrite` is called.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## Clone

This instance method creates a copy of an `OracleClob` object.

### Declaration

```
// C#  
public object Clone();
```

### Return Value

An `OracleClob` object.

### Implements

`ICloneable`

### Exceptions

`ObjectDisposedException` - The object is already disposed.

InvalidOperationException - The OracleConnection is not open or has been closed during the lifetime of the object.

### Remarks

The cloned object has the same property values as that of the object being cloned.

### Example

```
// C#

using System;
using Oracle.DataAccess.Client;
using Oracle.DataAccess.Types;

class CloneSample
{
    static void Main()
    {
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();

        OracleClob clob1 = new OracleClob(con);

        // Prints "clob1.Position = 0"
        Console.WriteLine("clob1.Position = " + clob1.Position);

        // Set the Position before calling Clone()
        clob1.Position = 1;

        // Clone the OracleClob
        OracleClob clob2 = (OracleClob)clob1.Clone();

        // Prints "clob2.Position = 1"
        Console.WriteLine("clob2.Position = " + clob2.Position);

        clob1.Close();
        clob1.Dispose();

        clob2.Close();
        clob2.Dispose();

        con.Close();
        con.Dispose();
    }
}
```

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## Close

Overrides `Stream`

This instance method closes the current stream and releases resources associated with it.

### Declaration

```
// C#  
public override void Close();
```

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## Compare

This instance method compares data referenced by the current instance to that of the supplied object.

### Declaration

```
// C#  
public int Compare(Int64 src_offset, OracleClob obj, Int64 dst_offset,  
    Int64 amount);
```

### Parameters

- *src\_offset*  
The comparison starting point (in characters) for the current instance.
- *obj*  
The provided `OracleClob` object.
- *dst\_offset*  
The comparison starting point (in characters) for the provided `OracleClob`.
- *amount*  
The number of characters to compare.

### Return Value

The method returns a value that is:

- Less than zero: if the data referenced by the current instance is less than that of the supplied instance.
- Zero: if both objects reference the same data.

- Greater than zero: if the data referenced by the current instance is greater than that of the supplied instance.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The parameter has a different connection than the object, `OracleConnection` is not opened, or `OracleConnection` has been reopened.

`ArgumentOutOfRangeException` - Either the `src_offset`, `dst_offset`, or `amount` parameter is less than 0.

### Remarks

The character set of the two `OracleClob` objects being compared should be the same for a meaningful comparison.

The provided object and the current instance must be using the same connection, that is, the same `OracleConnection` object.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## CopyTo

`CopyTo` copies data from the current instance to the provided `OracleClob` object.

### Overload List:

- [CopyTo\(OracleClob\)](#)  
This instance method copies data from the current instance to the provided `OracleClob` object.
- [CopyTo\(OracleClob, Int64\)](#)  
This instance method copies data from the current `OracleClob` instance to the provided `OracleClob` object with the specified destination offset.
- [CopyTo\(Int64, OracleClob, Int64, Int64\)](#)  
This instance method copies data from the current `OracleClob` instance to the provided `OracleClob` object with the specified source offset, destination offset, and character amounts.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## CopyTo(OracleClob)

This instance method copies data from the current instance to the provided `OracleClob` object.

### Declaration

```
// C#  
public Int64 CopyTo(OracleClob obj);
```

### Parameters

- *obj*  
The `OracleClob` object to which the data is copied.

### Return Value

The return value is the amount copied.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - This exception is thrown if any of the following conditions exist:

- The `OracleConnection` is not open or has been closed during the lifetime of the object.
- The LOB object parameter has a different connection than the object.

### Remarks

The provided object and the current instance must be using the same connection, that is, the same `OracleConnection` object.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## CopyTo(OracleClob, Int64)

This instance method copies data from the current `OracleClob` instance to the provided `OracleClob` object with the specified destination offset.

### Declaration

```
// C#  
public Int64 CopyTo(OracleClob obj, Int64 dst_offset);
```

### Parameters

- `obj`  
The `OracleClob` object to which the data is copied.
- `dst_offset`  
The offset (in characters) at which the `OracleClob` object is copied.

### Return Value

The return value is the amount copied.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`ArgumentOutOfRangeException` - The `dst_offset` is less than 0.

`InvalidOperationException` - This exception is thrown if any of the following conditions exist:

- The `OracleConnection` is not open or has been closed during the lifetime of the object.
- The LOB object parameter has a different connection than the object.

### Remarks

If the `dst_offset` is beyond the end of the `OracleClob` data, spaces are written into the `OracleClob` until the `dst_offset` is met.

The offsets are 0-based. No character conversion is performed by this operation.

The provided object and the current instance must be using the same connection; that is, the same `OracleConnection` object.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## CopyTo(Int64, OracleClob, Int64, Int64)

This instance method copies data from the current `OracleClob` instance to the provided `OracleClob` object with the specified source offset, destination offset, and character amounts.

### Declaration

```
// C#  
public Int64 CopyTo(Int64 src_offset, OracleClob obj, Int64 dst_offset,  
    Int64 amount);
```

### Parameters

- `src_offset`  
The offset (in characters) in the current instance, from which the data is read.
- `obj`  
The `OracleClob` object to which the data is copied.
- `dst_offset`  
The offset (in characters) at which the `OracleClob` object is copied.
- `amount`  
The amount of data to be copied.

### Return Value

The return value is the amount copied.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The parameter has a different connection than the object, `OracleConnection` is not opened, or `OracleConnection` has been reopened.

`ArgumentOutOfRangeException` - The `src_offset`, the `dst_offset`, or the `amount` parameter is less than 0.

### Remarks

If the `dst_offset` is beyond the end of the `OracleClob` data, spaces are written into the `OracleClob` until the `dst_offset` is met.

The offsets are 0-based. No character conversion is performed by this operation.

The provided object and the current instance must be using the same connection, that is, the same `OracleConnection` object.

### Example

```
// C#  
  
using System;  
using Oracle.DataAccess.Client;  
using Oracle.DataAccess.Types;
```

```
class CopyToSample
{
    static void Main()
    {
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();

        OracleClob clob1 = new OracleClob(con);
        OracleClob clob2 = new OracleClob(con);

        // Write 4 chars, starting at buffer offset 0
        char[] buffer = new char[4] {'a', 'b', 'c', 'd'};
        clob1.Write(buffer, 0, 4);

        // Copy 2 chars from char 0 of clob1 to char 1 of clob2
        clob1.CopyTo(0, clob2, 1, 2);

        //Prints "clob2.Value = ab"
        Console.WriteLine("clob2.Value = " + clob2.Value);

        clob1.Close();
        clob1.Dispose();

        clob2.Close();
        clob2.Dispose();

        con.Close();
        con.Dispose();
    }
}
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## Dispose

This instance method releases resources allocated by this object.

### Declaration

```
public void Dispose();
```

### Implements

IDisposable

### Remarks

The object cannot be reused after being disposed. Although some properties can still be accessed, their values cannot be accountable. Since resources are freed, method calls can lead to exceptions.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## EndChunkWrite

This instance method closes the CLOB referenced by the current `OracleClob` instance.

### Declaration

```
// C#  
public void EndChunkWrite();
```

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

### Remarks

Index updates occur immediately if write operation(s) are deferred by the `BeginChunkWrite` method.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## Erase

`Erase` erases part or all data.

**Overload List:**

- [Erase\(\)](#)  
This instance method erases all data.
- [Erase\(Int64, Int64\)](#)  
This instance method replaces the specified `amount` of data (in characters) starting from the specified `offset` with zero-byte fillers (in characters).

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## Erase()

This instance method erases all data.

**Declaration**

```
// C#  
public Int64 Erase();
```

**Return Value**

The number of characters erased.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## Erase(Int64, Int64)

This instance method replaces the specified `amount` of data (in characters) starting from the specified `offset` with zero-byte fillers (in characters).

**Declaration**

```
// C#  
public Int64 Erase(Int64 offset, Int64 amount);
```

### Parameters

- *offset*  
The offset.
- *amount*  
The amount of data.

### Return Value

The actual number of characters erased.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

`ArgumentOutOfRangeException` - The *offset* or *amount* parameter is less than 0.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## Flush

This method is not supported.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## GetHashCode

Overrides `Object`

This method returns a hash code for the current instance.

### Declaration

```
// C#  
public override int GetHashCode();
```

### Return Value

An `int` representing a hash code.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## IsEqual

This instance method compares the LOB data referenced by two `OracleClob`s.

### Declaration

```
// C#  
public bool IsEqual(OracleClob obj);
```

### Parameters

- *obj*  
An `OracleClob` object.

### Return Value

Returns `true` if the current `OracleClob` and the provided `OracleClob` refer to the same LOB. Otherwise, returns `false`.

### Remarks

Note that this method can return `true` even if the two `OracleClob` objects returns `false` for `==` or `Equals()` because two different `OracleClob` instances can refer to the same LOB.

The provided object and the current instance must be using the same connection, that is, the same `OracleConnection` object.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## Read

`Read` reads a specified amount from the current instance and populates the array buffer.

### Overload List:

- [Read\(byte \[\], int, int\)](#)  
This instance method reads a specified amount of bytes from the current instance and populates the byte array `buffer`.
- [Read\(char \[\], int, int\)](#)  
This instance method reads a specified amount of characters from the current instance and populates the character array `buffer`.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## Read(byte [], int, int)

Overrides `Stream`

This instance method reads a specified amount of bytes from the current instance and populates the byte array `buffer`.

### Declaration

```
// C#  
public override int Read(byte [] buffer, int offset, int count);
```

### Parameters

- `buffer`  
The byte array buffer that is populated.
- `offset`  
The offset (in bytes) at which the buffer is populated.

- *count*  
The amount of bytes to be read.

### Return Value

The number of bytes read from the CLOB.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

### Remarks

Both *offset* and *count* must be even numbers for CLOB and NCLOB because every two bytes represent a Unicode character.

The LOB data is read starting from the position specified by the `Position` property, which must also be an even number.

`OracleClob` is free to return fewer bytes than requested, even if the end of the stream has not been reached.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## Read(char [ ], int, int)

This instance method reads a specified amount of characters from the current instance and populates the character array buffer.

### Declaration

```
// C#  
public int Read(char[ ] buffer, int offset, int count);
```

### Parameters

- *buffer*  
The character array buffer that is populated.
- *offset*  
The offset (in characters) at which the buffer is populated.
- *count*  
The amount of characters to be read.

## Return Value

The return value indicates the number of characters read from the CLOB.

## Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

`ArgumentOutOfRangeException` - This exception is thrown if any of the following conditions exist:

- The *offset* or the *count* is less than 0.
- The *offset* is greater than or equal to the `buffer.Length`.
- The *offset* and the *count* together are greater than `buffer.Length`.

## Remarks

Handles all CLOB and NCLOB data as Unicode.

The LOB data is read starting from the position specified by the `Position` property.

## Example

```
// C#

using System;
using Oracle.DataAccess.Client;
using Oracle.DataAccess.Types;

class ReadSample
{
    static void Main()
    {
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();

        OracleClob clob = new OracleClob(con);

        // Write 3 chars, starting at buffer offset 1
        char[] writeBuffer = new char[4] {'a', 'b', 'c', 'd'};
        clob.Write(writeBuffer, 1, 3);

        // Reset the Position (in bytes) for Read
        clob.Position = 2;

        // Read 2 chars into buffer starting at buffer offset 1
        char[] readBuffer = new char[4];
        int charsRead = clob.Read(readBuffer, 1, 2);

        // Prints "charsRead = 2"
        Console.WriteLine("charsRead = " + charsRead);

        // Prints "readBuffer = cd "
        Console.Write("readBuffer = ");
        for(int index = 0; index < readBuffer.Length; index++)
```

```
{
    Console.WriteLine(readBuffer[index]);
}
Console.WriteLine();

clob.Close();
clob.Dispose();

con.Close();
con.Dispose();
}
}
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## Search

`Search` searches for a character pattern in the current instance of `OracleClob`.

### Overload List:

- [Search\(byte\[\], Int64, Int64\)](#)  
This instance method searches for a character pattern, represented by the byte array, in the current instance of `OracleClob`.
- [Search\(char\[\], Int64, Int64\)](#)  
This instance method searches for a character pattern in the current instance of `OracleClob`.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## Search(byte[], Int64, Int64)

This instance method searches for a character pattern, represented by the byte array, in the current instance of `OracleClob`.

## Declaration

```
// C#  
public int Search(byte[] val, Int64 offset, Int64 nth);
```

## Parameters

- *val*  
A Unicode byte array.
- *offset*  
The 0-based offset (in characters) starting from which the `OracleClob` is searched.
- *nth*  
The specific occurrence (1-based) of the match for which the absolute offset (in characters) is returned.

## Return Value

Returns the absolute *offset* of the start of the matched pattern (in bytes) for the *nth* occurrence of the match. Otherwise, 0 is returned.

## Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

`ArgumentOutOfRangeException` - This exception is thrown if any of the following conditions exist:

- The *offset* is less than 0.
- The *nth* is less than or equal to 0.
- The *nth* is greater than or equal to `OracleClob.MaxValue`.
- The *offset* is greater than or equal to `OracleClob.MaxValue`.

## Remarks

The `byte[]` is converted to Unicode before the search is made.

The limit of the search pattern is 16383 bytes.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## Search(char[ ], Int64, Int64)

This instance method searches for a character pattern in the current instance of OracleClob.

### Declaration

```
// C#  
public Int64 Search(char [ ] val, Int64 offset, Int64 nth);
```

### Parameters

- *val*  
The Unicode string being searched for.
- *offset*  
The 0-based offset (in characters) starting from which the OracleClob is searched.
- *nth*  
The specific occurrence (1-based) of the match for which the absolute offset (in characters) is returned.

### Return Value

Returns the absolute *offset* of the start of the matched pattern (in characters) for the *nth* occurrence of the match. Otherwise, 0 is returned.

### Exceptions

ObjectDisposedException - The object is already disposed.

InvalidOperationException - The OracleConnection is not open or has been closed during the lifetime of the object.

ArgumentOutOfRangeException - This exception is thrown if any of the following conditions exist:

- The *offset* is less than 0.
- The *nth* is less than or equal to 0.
- The *val.Length* doubled is greater than 16383.
- The *nth* is greater than or equal to OracleClob.MaxSize.
- The *offset* is greater than or equal to OracleClob.MaxSize.

### Remarks

The limit of the search pattern is 16383 bytes.

### Example

```
// C#  
  
using System;  
using Oracle.DataAccess.Client;  
using Oracle.DataAccess.Types;
```

```
class SearchSample
{
    static void Main()
    {
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";
        OracleConnection con = new OracleConnection(constr);
        con.Open();

        OracleClob clob = new OracleClob(con);

        // Write 7 chars, starting at buffer offset 0
        char[] buffer = new char[7] {'a', 'b', 'c', 'd', 'a', 'b', 'c'};
        clob.Write(buffer, 0, 7);

        // Search for the 2nd occurrence of a char pattern 'bc'
        // starting at offset 1 in the OracleBlob
        char[] pattern = new char[2] {'b', 'c'};
        long posFound = clob.Search(pattern, 1, 2);

        // Prints "posFound = 6"
        Console.WriteLine("posFound = " + posFound);

        clob.Close();
        clob.Dispose();

        con.Close();
        con.Dispose();
    }
}
```



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## Seek

Overrides Stream

This instance method sets the position on the current LOB stream.

### Declaration

```
// C#
public override Int64 Seek(Int64 offset, SeekOrigin origin);
```

### Parameters

- *offset*  
A byte offset relative to origin.
- *origin*

A value of type `System.IO.SeekOrigin` indicating the reference point used to obtain the new position.

### Return Value

Returns an `Int64` that indicates the position.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

### Remarks

If *offset* is negative, the new position precedes the position specified by *origin* by the number of characters specified by *offset*.

If *offset* is zero, the new position is the position specified by *origin*.

If *offset* is positive, the new position follows the position specified by *origin* by the number of characters specified by *offset*.

`SeekOrigin.Begin` specifies the beginning of a stream.

`SeekOrigin.Current` specifies the current position within a stream.

`SeekOrigin.End` specifies the end of a stream.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## SetLength

Overrides `Stream`

This instance method trims or truncates the `CLOB` value to the specified length (in characters).

### Declaration

```
// C#  
public override void SetLength(Int64 newLen);
```

### Parameters

- *newLen*

The desired length of the current stream in characters.

## Exceptions

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.

`ArgumentOutOfRangeException` - The `newLen` parameter is greater than 0.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## Write

This instance method writes data from the provided array buffer into the `OracleClob`.

### Overload List:

- [Write\(byte\[\], int, int\)](#)  
This instance method writes data from the provided byte array buffer into the `OracleClob`.
- [Write\(char\[\], int, int\)](#)  
This instance method writes data from the provided character array buffer into the `OracleClob`.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## Write(byte[], int, int)

Overrides `Stream`

This instance method writes data from the provided byte array buffer into the `OracleClob`.

### Declaration

```
// C#  
public override void Write(byte[] buffer, int offset, int count);
```

### Parameters

- *buffer*  
The byte array buffer that represents a Unicode string.
- *offset*  
The offset (in bytes) from which the *buffer* is read.
- *count*  
The amount of data (in bytes) from the buffer to be written into the *OracleClob*.

### Exceptions

*ObjectDisposedException* - The object is already disposed.

*InvalidOperationException* - The *OracleConnection* is not open or has been closed during the lifetime of the object.

*ArgumentOutOfRangeException* - This exception is thrown if any of the following conditions exist:

- The *offset* or the *count* is less than 0.
- The *offset* is greater than or equal to the *buffer.Length*.
- The *offset* and the *count* together are greater than the *buffer.Length*.
- The *offset*, the *count*, or the *Position* is not even.

### Remarks

Both *offset* and *count* must be even numbers for *CLOB* and *NCLOB* because every two bytes represent a Unicode character.

The LOB data is read starting from the position specified by the *Position* property. The *Position* property must be an even number.

If necessary, proper data conversion is carried out from the client character set to the database character set.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## Write(char[ ], int, int)

This instance method writes data from the provided character array buffer into the *OracleClob*.

## Declaration

```
// C#  
public void Write(char[ ] buffer, int offset, int count);
```

## Parameters

- *buffer*  
The character array buffer that is written to the OracleClob.
- *offset*  
The offset (in characters) from which the *buffer* is read.
- *count*  
The amount (in characters) from the buffer that is to be written into the OracleClob.

## Exceptions

ObjectDisposedException - The object is already disposed.

InvalidOperationException - The OracleConnection is not open or has been closed during the lifetime of the object.

ArgumentOutOfRangeException - This exception is thrown if any of the following conditions exist:

- The *offset* or the *count* is less than 0.
- The *offset* is greater than or equal to the *buffer.Length*.
- The *offset* and the *count* together are greater than *buffer.Length*.
- The *Position* is not even.

## Remarks

Handles all CLOB and NCLOB data as Unicode.

The LOB data is read starting from the position specified by the *Position* property.

If necessary, proper data conversion is carried out from the client character set to the database character set.

## Example

```
// C#  
  
using System;  
using Oracle.DataAccess.Client;  
using Oracle.DataAccess.Types;  
  
class WriteSample  
{  
    static void Main()  
    {  
        string constr = "User Id=scott;Password=tiger;Data Source=oracle";  
        OracleConnection con = new OracleConnection(constr);  
        con.Open();  
    }  
}
```

```
OracleClob clob = new OracleClob(con);

// Set the Position for the Write;
clob.Position = 0;

// Begin ChunkWrite to improve performance
// Index updates occur only once after EndChunkWrite
clob.BeginChunkWrite();

// Write to the OracleClob in 5 chunks of 2 chars each
char[] c = new char[2] {'a', 'b'};
for (int index = 0; index < 5; index++)
{
    clob.Write(c, 0, c.Length);
}
clob.EndChunkWrite();

// Prints "clob.Value = ababababab"
Console.WriteLine("clob.Value = " + clob.Value);

clob.Close();
clob.Dispose();

con.Close();
con.Dispose();
}
}
```

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleClob Class](#)
- [OracleClob Members](#)

## OracleRefCursor Class

An `OracleRefCursor` object represents an Oracle `REF CURSOR`.

### Class Inheritance

`System.Object`

`System.MarshalRefByObject`

`Oracle.DataAccess.Types.OracleRefCursor`

### Declaration

```
// C#
public sealed class OracleRefCursor : MarshalByRefObject, IDisposable, INullable
```

## Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

## Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

## Remarks

To minimize the number of open server cursors, `OracleRefReader` objects should be explicitly disposed.

## Example

```
// Database Setup
/*
connect scott/tiger@oracle
CREATE OR REPLACE FUNCTION MyFunc(refcur_out OUT SYS_REFCURSOR)
  RETURN SYS_REFCURSOR IS refcur_ret SYS_REFCURSOR;
BEGIN
  OPEN refcur_ret FOR SELECT * FROM EMP;
  OPEN refcur_out FOR SELECT * FROM DEPT;
  RETURN refcur_ret;
END MyFunc;
/
*/

// C#

using System;
using System.Data;
using Oracle.DataAccess.Client;
using Oracle.DataAccess.Types;

class OracleRefCursorSample
{
  static void Main()
  {
    // Example demonstrates how to use REF CURSORS returned from
    // PL/SQL Stored Procedures or Functions
    // Create the PL/SQL Function MyFunc as defined previously

    string constr = "User Id=scott;Password=tiger;Data Source=oracle";
    OracleConnection con = new OracleConnection(constr);
    con.Open();
  }
}
```

```
// Create an OracleCommand
OracleCommand cmd = new OracleCommand("MyFunc", con);
cmd.CommandType = CommandType.StoredProcedure;

// Bind the parameters
// p1 is the RETURN REF CURSOR bound to SELECT * FROM EMP;
OracleParameter p1 =
    cmd.Parameters.Add("refcur_ret", OracleDbType.RefCursor);
p1.Direction = ParameterDirection.ReturnValue;

// p2 is the OUT REF CURSOR bound to SELECT * FROM DEPT
OracleParameter p2 =
    cmd.Parameters.Add("refcur_out", OracleDbType.RefCursor);
p2.Direction = ParameterDirection.Output;

// Execute the command
cmd.ExecuteNonQuery();

// Construct an OracleDataReader from the REF CURSOR
OracleDataReader reader1 = ((OracleRefCursor)p1.Value).GetDataReader();

// Prints "reader1.GetName(0) = EMPNO"
Console.WriteLine("reader1.GetName(0) = " + reader1.GetName(0));

// Construct an OracleDataReader from the REF CURSOR
OracleDataReader reader2 = ((OracleRefCursor)p2.Value).GetDataReader();

// Prints "reader2.GetName(0) = DEPTNO"
Console.WriteLine("reader2.GetName(0) = " + reader2.GetName(0));

reader1.Close();
reader1.Dispose();

reader2.Close();
reader2.Dispose();

p1.Dispose();
p2.Dispose();

cmd.Dispose();

con.Close();
con.Dispose();
}
}
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRefCursor Members](#)
- [OracleRefCursor Static Methods](#)
- [OracleRefCursor Static Fields](#)
- [OracleRefCursor Properties](#)
- [OracleRefCursor Instance Methods](#)

## OracleRefCursor Members

`OracleRefCursor` members are listed in the following tables.

### OracleRefCursor Static Methods

`OracleRefCursor` static methods are listed in [Table 14-28](#).

**Table 14-28 OracleRefCursor Static Methods**

Methods	Description
<a href="#">Equals</a>	Inherited from <code>System.Object</code> (Overloaded)

### OracleRefCursor Static Fields

`OracleRefCursor` static field is listed in [Table 14-29](#).

**Table 14-29 OracleRefCursor Static Field**

Methods	Description
<a href="#">Null</a>	Represents a null value that can be assigned to an <code>OracleRefCursor</code> instance

### OracleRefCursor Properties

`OracleRefCursor` properties are listed in [Table 14-30](#).

**Table 14-30 OracleRefCursor Properties**

Properties	Description
<a href="#">Connection</a>	A reference to the <code>OracleConnection</code> used to fetch the REF CURSOR data
<a href="#">FetchSize</a>	Specifies the size that the <code>OracleDataReader</code> internal cache needs to store result set data
<a href="#">IsNull</a>	Indicates whether or not the <code>OracleRefCursor</code> is null

**Table 14-30 (Cont.) OracleRefCursor Properties**

Properties	Description
<a href="#">RowSize</a>	Specifies the amount of memory the <code>OracleRefCursor</code> internal cache needs to store one row of data

**OracleRefCursor Instance Methods**

`OracleRefCursor` instance methods are listed in [Table 14-31](#).

**Table 14-31 OracleRefCursor Instance Methods**

Methods	Description
<a href="#">Dispose</a>	Disposes the resources allocated by the <code>OracleRefCursor</code> object
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)
<a href="#">GetDataReader</a>	Returns an <code>OracleDataReader</code> object for the REF CURSOR
<code>GetHashCode</code>	Inherited from <code>System.Object</code>
<code>GetType</code>	Inherited from <code>System.Object</code>
<code>ToString</code>	Inherited from <code>System.Object</code>

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRefCursor Class](#)

**OracleRefCursor Static Methods**

`OracleRefCursor` static methods are listed in [Table 14-32](#).

**Table 14-32 OracleRefCursor Static Methods**

Methods	Description
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRefCursor Class](#)
- [OracleRefCursor Members](#)

## OracleRefCursor Static Fields

`OracleRefCursor` static field is listed in [Table 14-32](#).

**Table 14-33 OracleRefCursor Static Field**

Methods	Description
<a href="#">Null</a>	Represents a null value that can be assigned to an <code>OracleRefCursor</code> instance

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRefCursor Class](#)
- [OracleRefCursor Members](#)

## Null

This static field represents a null value that can be assigned to an `OracleRefCursor` instance.

### Declaration

```
// C#  
public static readonly OracleRefCursor Null;
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRefCursor Class](#)
- [OracleRefCursor Members](#)

## OracleRefCursor Properties

OracleRefCursor properties are listed in [Table 14-34](#).

**Table 14-34 OracleRefCursor Properties**

Properties	Description
<a href="#">Connection</a>	A reference to the OracleConnection used to fetch the REF CURSOR data
<a href="#">FetchSize</a>	Specifies the size that the OracleDataReader internal cache needs to store result set data
<a href="#">IsNull</a>	Indicates whether or not the OracleRefCursor is null
<a href="#">RowSize</a>	Specifies the amount of memory the OracleRefcursor internal cache needs to store one row of data

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRefCursor Class](#)
- [OracleRefCursor Members](#)

## Connection

This property refers to the OracleConnection used to fetch the REF CURSOR data.

### Declaration

```
// C#  
public OracleConnection Connection {get;}
```

### Property Value

An OracleConnection.

### Exceptions

ObjectDisposedException - The object is already disposed.

### Remarks

This property is bound to a REF CURSOR once it is set. After the OracleRefCursor object is created by the constructor, this property is initially null. An OracleRefCursor object can be bound to a REF CURSOR after a command execution.

If the connection is closed or returned to the connection pool, the OracleRefCursor is placed in an uninitialized state and no operation can be carried out from it. However, the uninitialized OracleRefCursor can be reassigned to another REF CURSOR.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRefCursor Class](#)
- [OracleRefCursor Members](#)

## FetchSize

This property specifies the size that the `OracleDataReader` internal cache needs to store result set data.

### Declaration

```
// C#  
public long FetchSize {get; set;}
```

### Property Value

A long that specifies the size (in bytes) of the `OracleRefCursor` internal cache.

### Exceptions

`ArgumentException` - The `FetchSize` value specified is invalid.

### Remarks

Default = 131072.

The `FetchSize` property value is inherited by the `OracleCommand` that created the `OracleRefCursor` object. The `FetchSize` property on the `OracleDataReader` object determines the amount of data the `OracleRefCursor` fetches into its internal cache for each database round-trip.

This property is useful if the `OracleRefCursor` is explicitly used to fill the `DataSet` or `DataTable` through the `OracleDataAdapter`, because it can provide control on how the data of the `REF CURSOR` is fetched.

If an `OracleDataReader` object is created from the `OracleRefCursor`, the resulting `OracleDataReader` object inherits the `FetchSize` value of the `OracleDataReader` object. However, the inherited value can be overridden, if it is set before the first invocation of the `OracleDataReader` `Read` method for the given result set, by setting the `OracleDataReader` `FetchSize` property.

The `RowSize` and `FetchSize` properties handle UDT and `XMLType` data differently than other scalar data types. Because only a reference to the UDT and `XMLType` data is stored in the ODP.NET's internal cache, the `RowSize` property accounts for only the memory needed for the reference (which is very small) and not the actual size of the UDT and `XMLType` data. Thus, applications can inadvertently fetch a large number of UDT or `XMLType` instances from the database in a single database round-trip. This is because the actual size of UDT and `XMLType` data does not count against the `FetchSize`, and it would require numerous UDT and `XMLType` references to fill up the default cache size of 131072 bytes. Therefore, when fetching

UDT or `XMLType` data, the `FetchSize` property must be appropriately configured to control the number of UDT and `XMLType` instances that are to be fetched, rather than the amount of the actual UDT and `XMLType` data to be fetched.

NOTE: For LOB and `LONG` data types, only the sizes specified in the `InitialLOBFetchSize` and `InitialLONGFetchSize` properties are accounted for by the `RowSize` property in addition to the metadata and reference information that is maintained by the cache for each LOB in the select list.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRefCursor Class](#)
- [OracleRefCursor Members](#)

## IsNull

This property indicates whether or not the `OracleRefCursor` is null.

### Declaration

```
// C#  
public bool IsNull {get;}
```

### Property Value

Returns `true` if the `OracleRefCursor` represents a null value. Returns `false` otherwise.

### Exception

`ObjectDisposedException` - The object is already disposed.

`InvalidOperationException` - The `OracleConnection` is not open or has been closed during the lifetime of the object.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRefCursor Class](#)
- [OracleRefCursor Members](#)

## RowSize

This property specifies the amount of memory the `OracleRefcursor` internal cache needs to store one row of data.

**Declaration**

```
// C#
public long RowSize {get;}
```

**Property Value**

A long that indicates the amount of memory (in bytes) that an `OracleRefCursor` needs to store one row of data for the executed query.

**Remarks**

The `RowSize` property is set to a nonzero value when the `OracleRefCursor` object is created. This property can be used at design time or dynamically during run time, to set the `FetchSize`, based on number of rows. For example, to enable the `OracleRefCursor` to fetch *N* rows for each database round-trip, the `OracleRefCursor FetchSize` property can be set dynamically to `RowSize * N`. Note that for the `FetchSize` to take effect appropriately, it must be set before the it is used to fill the `DataSet/DataTable` using `OracleDataAdapter`.

If an `OracleDataReader` is obtained from the `OracleRefCursor` through the `GetDataReader` method, the resulting `OracleDataReader` will have its `FetchSize` property set to the `FetchSize` value of the `OracleRefCursor`.

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRefCursor Class](#)
- [OracleRefCursor Members](#)

## OracleRefCursor Instance Methods

`OracleRefCursor` instance methods are listed in [Table 14-35](#).

**Table 14-35 OracleRefCursor Instance Methods**

Methods	Description
<a href="#">Dispose</a>	Disposes the resources allocated by the <code>OracleRefCursor</code> object
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)
<a href="#">GetDataReader</a>	Returns an <code>OracleDataReader</code> object for the REF CURSOR
<code>GetHashCode</code>	Inherited from <code>System.Object</code>
<code>GetType</code>	Inherited from <code>System.Object</code>
<code>ToString</code>	Inherited from <code>System.Object</code>

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRefCursor Class](#)
- [OracleRefCursor Members](#)

## Dispose

This instance method disposes of the resources allocated by the `OracleRefCursor` object.

### Declaration

```
// C#  
public void Dispose();
```

### Implements

`IDisposable`

### Remarks

The object cannot be reused after being disposed.

Once `Dispose()` is called, the object of `OracleRefCursor` is in an uninitialized state. Although some properties can still be accessed, their values may not be accountable. Since resources are freed, method calls can lead to exceptions.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRefCursor Class](#)
- [OracleRefCursor Members](#)

## GetDataReader

This instance method returns an `OracleDataReader` object for the `REF CURSOR`.

### Declaration

```
// C#  
public OracleDataReader GetDataReader();
```

### Return Value

`OracleDataReader`

## Remarks

Using the `OracleDataReader`, rows can be fetched from the `REF CURSOR`.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRefCursor Class](#)
- [OracleRefCursor Members](#)

# 15

## Oracle Data Provider for .NET Types Structures

This chapter describes the ODP.NET Types structures.

This chapter contains these topics:

- [OracleBinary Structure](#)
- [OracleBoolean Structure](#)
- [OracleDate Structure](#)
- [OracleDecimal Structure](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalYM Structure](#)
- [OracleString Structure](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampTZ Structure](#)
- [INullable Interface](#)

### OracleBinary Structure

The `OracleBinary` structure represents a variable-length stream of binary data to be stored in or retrieved from a database.

#### Class Inheritance

```
System.Object
    System.ValueType
        Oracle.DataAccess.Types.OracleBinary
```

#### Declaration

```
// C#
public struct OracleBinary : IComparable, INullable, IXmlSerializable
```

#### Requirements

---

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll

---

---

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

---

### Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

### Example

```
// C#  
  
using System;  
using Oracle.DataAccess.Types;  
  
class OracleBinarySample  
{  
    static void Main(string[] args)  
    {  
        // Initialize the OracleBinary structures  
        OracleBinary binary1= new OracleBinary(new byte[] {1,2,3,4,5});  
        OracleBinary binary2 = new OracleBinary(new byte[] {1,2,3});  
        OracleBinary binary3 = new OracleBinary(new byte[] {4,5});  
        OracleBinary binary4 = binary2 + binary3;  
  
        // Compare binary1 and binary4; they're equal  
        if (binary1 == binary4)  
            Console.WriteLine("The two OracleBinary structs are equal");  
        else  
            Console.WriteLine("The two OracleBinary structs are different");  
    }  
}
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBinary Members](#)
- [OracleBinary Constructor](#)
- [OracleBinary Static Fields](#)
- [OracleBinary Static Methods](#)
- [OracleBinary Static Operators](#)
- [OracleBinary Static Type Conversion Operators](#)
- [OracleBinary Properties](#)
- [OracleBinary Instance Methods](#)

## OracleBinary Members

OracleBinary members are listed in the following tables:

### OracleBinary Constructors

OracleBinary constructors are listed in [Table 15-1](#)

**Table 15-1 OracleBinary Constructors**

Constructor	Description
<a href="#">OracleBinary Constructor</a>	Instantiates a new instance of OracleBinary structure

### OracleBinary Static Fields

The OracleBinary static fields are listed in [Table 15-2](#).

**Table 15-2 OracleBinary Static Fields**

Field	Description
<a href="#">Null</a>	Represents a null value that can be assigned to an instance of the OracleBinary structure

### OracleBinary Static Methods

The OracleBinary static methods are listed in [Table 15-3](#).

**Table 15-3 OracleBinary Static Methods**

Methods	Description
<a href="#">Concat</a>	Returns the concatenation of two <code>OracleBinary</code> structures
<a href="#">Equals</a>	Determines if two <code>OracleBinary</code> values are equal (Overloaded)
<a href="#">GetXsdType</a>	Returns the XML Schema definition language (XSD) of the specified <code>XmlSchemaSet</code>
<a href="#">GreaterThan</a>	Determines if the first of two <code>OracleBinary</code> values is greater than the second
<a href="#">GreaterThanOrEqual</a>	Determines if the first of two <code>OracleBinary</code> values is greater than or equal to the second
<a href="#">LessThan</a>	Determines if the first of two <code>OracleBinary</code> values is less than the second
<a href="#">LessThanOrEqual</a>	Determines if the first of two <code>OracleBinary</code> values is less than or equal to the second
<a href="#">NotEquals</a>	Determines if two <code>OracleBinary</code> values are not equal

**OracleBinary Static Operators**

The `OracleBinary` static operators are listed in [Table 15-4](#).

**Table 15-4 OracleBinary Static Operators**

Operator	Description
<a href="#">operator +</a>	Concatenates two <code>OracleBinary</code> values
<a href="#">operator ==</a>	Determines if two <code>OracleBinary</code> values are equal
<a href="#">operator &gt;</a>	Determines if the first of two <code>OracleBinary</code> values is greater than the second
<a href="#">operator &gt;=</a>	Determines if the first of two <code>OracleBinary</code> values is greater than or equal to the second
<a href="#">operator !=</a>	Determines if two <code>OracleBinary</code> values are not equal
<a href="#">operator &lt;</a>	Determines if the first of two <code>OracleBinary</code> value is less than the second
<a href="#">operator &lt;=</a>	Determines if the first of two <code>OracleBinary</code> value is less than or equal to the second

**OracleBinary Static Type Conversion Operators**

The `OracleBinary` static type conversion operators are listed in [Table 15-5](#).

**Table 15-5 OracleBinary Static Type Conversion Operators**

Operator	Description
<a href="#">explicit operator byte[ ]</a>	Converts an instance value to a byte array
<a href="#">implicit operator OracleBinary</a>	Converts an instance value to an <code>OracleBinary</code> structure

**OracleBinary Properties**

The `OracleBinary` properties are listed in [Table 15-6](#).

**Table 15-6 OracleBinary Properties**

Properties	Description
<a href="#">IsNull</a>	Indicates whether or not the current instance has a null value
<a href="#">Item</a>	Obtains the particular <code>byte</code> in an <code>OracleBinary</code> structure using an index
<a href="#">Length</a>	Returns the length of the binary data
<a href="#">Value</a>	Returns the binary data that is stored in an <code>OracleBinary</code> structure

**OracleBinary Instance Methods**

The `OracleBinary` instance methods are listed in [Table 15-7](#).

**Table 15-7 OracleBinary Instance Methods**

Methods	Description
<a href="#">CompareTo</a>	Compares the current instance to an object and returns an integer that represents their relative values
<a href="#">Equals</a>	Determines if two objects contain the same binary data (Overloaded)
<a href="#">GetHashCode</a>	Returns a hash code for the current instance
<a href="#">GetType</a>	Inherited from <code>System.Object</code>
<a href="#">ToString</a>	Converts the current <code>OracleBinary</code> structure to a string

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBinary Structure](#)

## OracleBinary Constructor

The `OracleBinary` constructor instantiates a new instance of the `OracleBinary` structure and sets its value to the provided array of bytes.

**Declaration**

```
// C#  
public OracleBinary(byte[ ] bytes);
```

**Parameters**

- *bytes*  
A byte array.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBinary Structure](#)
- [OracleBinary Members](#)

## OracleBinary Static Fields

The `OracleBinary` static fields are listed in [Table 15-8](#).

**Table 15-8 OracleBinary Static Fields**

Field	Description
<a href="#">Null</a>	Represents a null value that can be assigned to an instance of the <code>OracleBinary</code> structure

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBinary Structure](#)
- [OracleBinary Members](#)

## Null

This static field represents a null value that can be assigned to an instance of the `OracleBinary` structure.

**Declaration**

```
// C#  
public static readonly OracleBinary Null;
```

 See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBinary Structure](#)
- [OracleBinary Members](#)

## OracleBinary Static Methods

The `OracleBinary` static methods are listed in [Table 15-9](#).

**Table 15-9 OracleBinary Static Methods**

Methods	Description
<a href="#">Concat</a>	Returns the concatenation of two <code>OracleBinary</code> structures
<a href="#">Equals</a>	Determines if two <code>OracleBinary</code> values are equal (Overloaded)
<a href="#">GetXsdType</a>	Returns the XML Schema definition language (XSD) of the specified <code>XmlSchemaSet</code>
<a href="#">GreaterThan</a>	Determines if the first of two <code>OracleBinary</code> values is greater than the second
<a href="#">GreaterThanOrEqual</a>	Determines if the first of two <code>OracleBinary</code> values is greater than or equal to the second
<a href="#">LessThan</a>	Determines if the first of two <code>OracleBinary</code> values is less than the second
<a href="#">LessThanOrEqual</a>	Determines if the first of two <code>OracleBinary</code> values is less than or equal to the second
<a href="#">NotEquals</a>	Determines if two <code>OracleBinary</code> values are not equal

 See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBinary Structure](#)
- [OracleBinary Members](#)

### Concat

This method returns the concatenation of two `OracleBinary` structures.

**Declaration**

```
// C#
public static OracleBinary Concat(OracleBinary value1, OracleBinary value2);
```

### Parameters

- *value1*  
The first OracleBinary.
- *value2*  
The second OracleBinary.

### Return Value

An OracleBinary.

### Remarks

If either argument has a null value, the returned OracleBinary structure has a null value.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBinary Structure](#)
- [OracleBinary Members](#)

## Equals

This method determines if two OracleBinary values are equal.

### Declaration

```
// C#  
public static bool Equals(OracleBinary value1, OracleBinary value2);
```

### Parameters

- *value1*  
The first OracleBinary.
- *value2*  
The second OracleBinary.

### Return Value

Returns true if two OracleBinary values are equal; otherwise returns false.

### Remarks

The following rules apply to the behavior of this method.

- Any OracleBinary that has a value is greater than an OracleBinary that has a null value.

- Two `OracleBinary`s that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBinary Structure](#)
- [OracleBinary Members](#)

## GetXsdType

This method returns the XML Schema definition language (XSD) of the specified `XmlSchemaSet`.

### Declaration

```
// C#  
public static XmlQualifiedName GetXsdType(XmlSchemaSet schemaSet);
```

### Parameters

- *schemaSet*  
An `XmlSchemaSet`.

### Return Value

Returns a string that indicates the XSD of the specified `XmlSchemaSet`.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBinary Structure](#)
- [OracleBinary Members](#)

## GreaterThan

This method determines whether or not the first of two `OracleBinary` values is greater than the second.

### Declaration

```
// C#  
public static bool GreaterThan(OracleBinary value1, OracleBinary value2);
```

### Parameters

- *value1*

The first `OracleBinary`.

- `value2`

The second `OracleBinary`.

### Return Value

Returns `true` if the first of two `OracleBinary` values is greater than the second; otherwise returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleBinary` that has a value is greater than an `OracleBinary` that has a null value.
- Two `OracleBinary`s that contain a null value are equal.

### Example

```
// C#  
  
using System;  
using Oracle.DataAccess.Types;  
  
class GreaterThanSample  
{  
    static void Main(string[] args)  
    {  
        OracleBinary binary1 = OracleBinary.Null;  
        OracleBinary binary2 = new OracleBinary(new byte[] {1});  
  
        // Compare two OracleBinary structs; binary1 < binary2  
        if (OracleBinary.GreaterThan(binary1, binary2))  
            Console.WriteLine("binary1 > binary2");  
        else  
            Console.WriteLine("binary1 < binary2");  
    }  
}
```

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBinary Structure](#)
- [OracleBinary Members](#)

## GreaterThanOrEqual

This method determines whether or not the first of two `OracleBinary` values is greater than or equal to the second.

### Declaration

```
// C#  
public static bool GreaterThanOrEqual(OracleBinary value1, OracleBinary value2);
```

### Parameters

- *value1*  
The first OracleBinary.
- *value2*  
The second OracleBinary.

### Return Value

Returns `true` if the first of two OracleBinary values is greater than or equal to the second; otherwise returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any OracleBinary that has a value is greater than an OracleBinary that has a null value.
- Two OracleBinarys that contain a null value are equal.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBinary Structure](#)
- [OracleBinary Members](#)

## LessThan

This method determines whether or not the first of two OracleBinary values is less than the second.

### Declaration

```
// C#  
public static bool LessThan(OracleBinary value1, OracleBinary value2);
```

### Parameters

- *value1*  
The first OracleBinary.
- *value2*  
The second OracleBinary.

### Return Value

Returns `true` if the first of two `OracleBinary` values is less than the second; otherwise returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleBinary` that has a value is greater than an `OracleBinary` that has a null value.
- Two `OracleBinary`s that contain a null value are equal.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBinary Structure](#)
- [OracleBinary Members](#)

## LessThanOrEqual

This method determines whether or not the first of two `OracleBinary` values is less than or equal to the second.

### Declaration

```
// C#  
public static bool LessThanOrEqual(OracleBinary value1, OracleBinary value2);
```

### Parameters

- *value1*  
The first `OracleBinary`.
- *value2*  
The second `OracleBinary`.

### Return Value

Returns `true` if the first of two `OracleBinary` values is less than or equal to the second; otherwise returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleBinary` that has a value is greater than an `OracleBinary` that has a null value.
- Two `OracleBinary`s that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBinary Structure](#)
- [OracleBinary Members](#)

## NotEquals

This method determines whether or not two `OracleBinary` values are not equal.

### Declaration

```
// C#  
public static bool NotEquals(OracleBinary value1, OracleBinary value2);
```

### Parameters

- `value1`  
The first `OracleBinary`.
- `value2`  
The second `OracleBinary`.

### Return Value

Returns `true` if two `OracleBinary` values are not equal; otherwise returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleBinary` that has a value is greater than an `OracleBinary` that has a null value.
- Two `OracleBinary`s that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBinary Structure](#)
- [OracleBinary Members](#)

## OracleBinary Static Operators

The `OracleBinary` static operators are listed in [Table 15-10](#).

**Table 15-10 OracleBinary Static Operators**

Operator	Description
<a href="#">operator +</a>	Concatenates two OracleBinary values
<a href="#">operator ==</a>	Determines if two OracleBinary values are equal
<a href="#">operator &gt;</a>	Determines if the first of two OracleBinary values is greater than the second
<a href="#">operator &gt;=</a>	Determines if the first of two OracleBinary values is greater than or equal to the second
<a href="#">operator !=</a>	Determines if two OracleBinary values are not equal
<a href="#">operator &lt;</a>	Determines if the first of two OracleBinary value is less than the second
<a href="#">operator &lt;=</a>	Determines if the first of two OracleBinary value is less than or equal to the second

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBinary Structure](#)
- [OracleBinary Members](#)

## operator +

This method concatenates two OracleBinary values.

### Declaration

```
// C#  
public static OracleBinary operator + (OracleBinary value1, OracleBinary value2);
```

### Parameters

- *value1*  
The first OracleBinary.
- *value2*  
The second OracleBinary.

### Return Value

OracleBinary

### Remarks

If either argument has a null value, the returned OracleBinary structure has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBinary Structure](#)
- [OracleBinary Members](#)

## operator ==

This method determines if two `OracleBinary` values are equal.

### Declaration

```
// C#  
public static bool operator == (OracleBinary value1, OracleBinary value2);
```

### Parameters

- `value1`  
The first `OracleBinary`.
- `value2`  
The second `OracleBinary`.

### Return Value

Returns `true` if they are the same; otherwise returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleBinary` that has a value is greater than an `OracleBinary` that has a null value.
- Two `OracleBinary`s that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBinary Structure](#)
- [OracleBinary Members](#)

## operator >

This method determines if the first of two `OracleBinary` values is greater than the second.

## Declaration

```
// C#  
public static bool operator > (OracleBinary value1, OracleBinary value2);
```

## Parameters

- *value1*  
The first OracleBinary.
- *value2*  
The second OracleBinary.

## Return Value

Returns `true` if the first of two OracleBinary values is greater than the second; otherwise, returns `false`.

## Remarks

The following rules apply to the behavior of this method.

- Any OracleBinary that has a value is greater than an OracleBinary that has a null value.
- Two OracleBinarys that contain a null value are equal.

## Example

```
// C#  
  
using System;  
using Oracle.DataAccess.Types;  
  
class OperatorSample  
{  
    static void Main(string[] args)  
    {  
        OracleBinary binary1 = OracleBinary.Null;  
        OracleBinary binary2 = new OracleBinary(new byte[] {1});  
  
        // Compare two OracleBinary structs; binary1 < binary2  
        if (binary1 > binary2)  
            Console.WriteLine("binary1 > binary2");  
        else  
            Console.WriteLine("binary1 < binary2");  
    }  
}
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBinary Structure](#)
- [OracleBinary Members](#)

## operator >=

This method determines if the first of two `OracleBinary` values is greater than or equal to the second.

### Declaration

```
// C#  
public static bool operator >= (OracleBinary value1, OracleBinary value2);
```

### Parameters

- `value1`  
The first `OracleBinary`.
- `value2`  
The second `OracleBinary`.

### Return Value

Returns `true` if the first of two `OracleBinary` values is greater than or equal to the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleBinary` that has a value is greater than an `OracleBinary` that has a null value.
- Two `OracleBinary`s that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBinary Structure](#)
- [OracleBinary Members](#)

## operator !=

This method determines if two `OracleBinary` values are not equal.

### Declaration

```
// C#  
public static bool operator != (OracleBinary value1, OracleBinary value2);
```

### Parameters

- *value1*  
The first OracleBinary.
- *value2*  
The second OracleBinary.

### Return Value

Returns `true` if the two OracleBinary values are not equal; otherwise, returns `false`.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBinary Structure](#)
- [OracleBinary Members](#)

## operator <

This method determines if the first of two OracleBinary values is less than the second.

### Declaration

```
// C#  
public static bool operator < ( OracleBinary value1, OracleBinary value2);
```

### Parameters

- *value1*  
The first OracleBinary.
- *value2*  
The second OracleBinary.

### Return Value

Returns `true` if the first of two OracleBinary values is less than the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleBinary` that has a value is greater than an `OracleBinary` that has a null value.
- Two `OracleBinary`s that contain a null value are equal.

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBinary Structure](#)
- [OracleBinary Members](#)

## operator <=

This method determines if the first of two `OracleBinary` values is less than or equal to the second.

**Declaration**

```
// C#  
public static bool operator <= (OracleBinary value1, OracleBinary value2);
```

**Parameters**

- *value1*  
The first `OracleBinary`.
- *value2*  
The second `OracleBinary`.

**Return Value**

Returns `true` if the first of two `OracleBinary` values is less than or equal to the second; otherwise, returns `false`.

**Remarks**

The following rules apply to the behavior of this method.

- Any `OracleBinary` that has a value is greater than an `OracleBinary` that has a null value.
- Two `OracleBinary`s that contain a null value are equal.

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBinary Structure](#)
- [OracleBinary Members](#)

## OracleBinary Static Type Conversion Operators

The `OracleBinary` static type conversion operators are listed in [Table 15-11](#).

**Table 15-11 OracleBinary Static Type Conversion Operators**

Operator	Description
<a href="#">explicit operator byte[]</a>	Converts an instance value to a byte array
<a href="#">implicit operator OracleBinary</a>	Converts an instance value to an <code>OracleBinary</code> structure

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBinary Structure](#)
- [OracleBinary Members](#)

### explicit operator byte[]

This method converts an `OracleBinary` value to a byte array.

#### Declaration

```
// C#  
public static explicit operator byte[] (OracleBinary val);
```

#### Parameters

- `val`  
An `OracleBinary`.

#### Return Value

A byte array.

#### Exceptions

`OracleNullValueException` - The `OracleBinary` structure has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBinary Structure](#)
- [OracleBinary Members](#)

## implicit operator OracleBinary

This method converts a byte array to an `OracleBinary` structure.

### Declaration

```
// C#
public static implicit operator OracleBinary(byte[] bytes);
```

### Parameters

- *bytes*  
A byte array.

### Return Value

`OracleBinary`

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBinary Structure](#)
- [OracleBinary Members](#)

## OracleBinary Properties

The `OracleBinary` properties are listed in [Table 15-12](#).

**Table 15-12 OracleBinary Properties**

Properties	Description
<a href="#">IsNull</a>	Indicates whether or not the current instance has a null value
<a href="#">Item</a>	Obtains the particular byte in an <code>OracleBinary</code> structure using an index
<a href="#">Length</a>	Returns the length of the binary data
<a href="#">Value</a>	Returns the binary data that is stored in an <code>OracleBinary</code> structure

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBinary Structure](#)
- [OracleBinary Members](#)

## IsNull

This property indicates whether or not the current instance has a null value.

### Declaration

```
// C#  
public bool IsNull {get;}
```

### Property Value

Returns `true` if the current instance has a null value; otherwise returns `false`.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBinary Structure](#)
- [OracleBinary Members](#)

## Item

This property obtains the particular `byte` in an `OracleBinary` structure using an index.

### Declaration

```
// C#  
public byte this[int index] {get;}
```

### Property Value

A `byte` in the specified index.

### Exceptions

`OracleNullValueException` - The current instance has a null value.

### Example

```
// C#  
  
using System;
```

```
using Oracle.DataAccess.Types;

class ItemSample
{
    static void Main(string[] args)
    {
        OracleBinary binary = new OracleBinary(new byte[] {1,2,3,4});

        // Prints the value 4
        Console.WriteLine(binary.Length - 1);
    }
}
```

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBinary Structure](#)
- [OracleBinary Members](#)

## Length

This property returns the length of the binary data.

### Declaration

```
// C#
public int length {get;}
```

### Property Value

Length of the binary data.

### Exceptions

`OracleNullValueException` - The current instance has a null value.

### Example

```
// C#

using System;
using Oracle.DataAccess.Types;

class LengthSample
{
    static void Main(string[] args)
    {
        OracleBinary binary = new OracleBinary(new byte[] {1,2,3,4});

        // Prints the value 4
        Console.WriteLine(binary.Length);
    }
}
```

 See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBinary Structure](#)
- [OracleBinary Members](#)

## Value

This property returns the binary data that is stored in the `OracleBinary` structure.

### Declaration

```
// C#
public byte[] Value {get;}
```

### Property Value

Binary data.

### Exceptions

`OracleNullValueException` - The current instance has a null value.

 See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBinary Structure](#)
- [OracleBinary Members](#)

## OracleBinary Instance Methods

The `OracleBinary` instance methods are listed in [Table 15-13](#).

**Table 15-13 OracleBinary Instance Methods**

Methods	Description
<a href="#">CompareTo</a>	Compares the current instance to an object and returns an integer that represents their relative values
<a href="#">Equals</a>	Determines if two objects contain the same binary data (Overloaded)
<a href="#">GetHashCode</a>	Returns a hash code for the current instance
<a href="#">GetType</a>	Inherited from <code>System.Object</code>
<a href="#">ToString</a>	Converts the current <code>OracleBinary</code> structure to a string

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBinary Structure](#)
- [OracleBinary Members](#)

## CompareTo

This method compares the current instance to an object and returns an integer that represents their relative values

### Declaration

```
// C#  
public int CompareTo(object obj);
```

### Parameters

- *obj*  
The object being compared.

### Return Value

The method returns a number that is:

- Less than zero: if the current `OracleBinary` instance value is less than *obj*.
- Zero: if the current `OracleBinary` instance and *obj* values have the same binary data.
- Greater than zero: if the current `OracleBinary` instance value is greater than *obj*.

### Implements

`Comparable`

### Exceptions

`ArgumentException` - The parameter is not of type `OracleBinary`.

### Remarks

The following rules apply to the behavior of this method.

- The comparison must be between `OracleBinary`s. For example, comparing an `OracleBinary` instance with an `OracleTimeStamp` instance is not allowed. When an `OracleBinary` is compared with a different type, an `ArgumentException` is thrown.
- Any `OracleBinary` that has a value is greater than an `OracleBinary` that has a null value.
- Two `OracleBinary`s that contain a null value are equal.

## Example

```
// C#

using System;
using Oracle.DataAccess.Types;

class CompareToSample
{
    static void Main(string[] args)
    {
        OracleBinary binary1 = new OracleBinary(new byte[] {1,2,3});
        OracleBinary binary2 = new OracleBinary(new byte[] {1,2,3,4});

        // Compare
        if (binary1.CompareTo(binary2) == 0)
            Console.WriteLine("binary1 is the same as binary2");
        else
            Console.WriteLine("binary1 is different from binary2");
    }
}
```

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBinary Structure](#)
- [OracleBinary Members](#)

## Equals

This method determines whether or not an object is an instance of `OracleBinary`, and has the same binary data as the current instance.

### Declaration

```
// C#
public override bool Equals(object obj);
```

### Parameters

- *obj*  
The object being compared.

### Return Value

Returns `true` if *obj* is an instance of `OracleBinary`, and has the same binary data as the current instance; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleBinary` that has a value is greater than an `OracleBinary` that has a null value.
- Two `OracleBinary`s that contain a null value are equal.

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBinary Structure](#)
- [OracleBinary Members](#)

## GetHashCode

Overrides `Object`

This method returns a hash code for the `OracleBinary` instance.

**Declaration**

```
// C#  
public override int GetHashCode();
```

**Return Value**

An `int` that represents the hash.

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBinary Structure](#)
- [OracleBinary Members](#)

## ToString

Overrides `Object`

This method converts an `OracleBinary` instance to a string instance.

**Declaration**

```
// C#  
public override string ToString();
```

**Return Value**

string

**Remarks**

If the current `OracleBinary` instance has a null value, the returned string "null".

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBinary Structure](#)
- [OracleBinary Members](#)

## OracleBoolean Structure

The `OracleBoolean` structure represents a logical value that is either `TRUE` or `FALSE`.

ODP.NET, Unmanaged Driver can access Oracle Database PL/SQL Booleans in Oracle Database Release 12.1 and later. ODP.NET, Managed Driver can access Oracle Database PL/SQL Booleans in Oracle Database Release 12.2 and later.

**Class Inheritance**

```
System.Object
```

```
    System.ValueType
```

```
        Oracle.DataAccess.Types.OracleBoolean
```

**Declaration**

```
// C#
public struct OracleBoolean : IComparable, INullable, IXmlSerializable
```

**Requirements**

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

**Thread Safety**

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

## Remarks

A `OracleBoolean` structure represents three possible values: `TRUE`, `FALSE`, and `NULL`. A non-zero value is interpreted as `TRUE`.

## Example

```
// C#
using System;
using System.Data;
using Oracle.DataAccess.Types; // for use with ODP.NET, Unmanaged Driver
// using Oracle.ManagedDataAccess.Types; // for use with ODP.NET, Managed Driver

class OracleBooleanSample
{
    static void Main(string[] args)
    {
        OracleBoolean oracleBoolean1 = new OracleBoolean(true);
        OracleBoolean oracleBoolean2 = new OracleBoolean(0);

        Console.WriteLine("oracleBoolean1 : " + oracleBoolean1);
        Console.WriteLine("oracleBoolean2 : " + oracleBoolean2);
    }
}
```

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Members](#)
- [OracleBoolean Constructors](#)
- [OracleBoolean Static Fields](#)
- [OracleBoolean Static Methods](#)
- [OracleBoolean Static Operators](#)
- [OracleBoolean Static Type Conversions](#)
- [OracleBoolean Properties](#)
- [OracleBoolean Instance Methods](#)

## OracleBoolean Members

`OracleBoolean` members are listed in the following tables:

### OracleBoolean Constructors

`OracleBoolean` constructors are listed in [Table 15-14](#)

**Table 15-14 OracleBoolean Constructors**

Constructor	Description
<a href="#">OracleBoolean Constructors</a>	Instantiates a new instance of <code>OracleBoolean</code> structure (Overloaded)

**OracleBoolean Static Fields**

The `OracleBoolean` static fields are listed in [Table 15-15](#).

**Table 15-15 OracleBoolean Static Fields**

Field	Description
<a href="#">False</a>	Represents a false value that can be assigned to an <code>OracleBoolean</code> instance
<a href="#">Null</a>	Represents a null value that can be assigned to an <code>OracleBoolean</code> instance
<a href="#">One</a>	Indicates a constant representing the positive one value
<a href="#">True</a>	Represents a true value that can be assigned to an <code>OracleBoolean</code> instance
<a href="#">Zero</a>	Indicates a constant representing the zero value

**OracleBoolean Static Methods**

`OracleBoolean` static methods are listed in [Table 15-16](#)

**Table 15-16 OracleBoolean Static Methods**

Methods	Description
<a href="#">And</a>	Returns the result of bitwise AND operation of two <code>OracleBoolean</code> instances
<a href="#">Equals</a>	Determines whether or not the two <code>OracleBoolean</code> values are equal
<a href="#">GreaterThan</a>	Determines whether or not the first of two <code>OracleBoolean</code> values is greater than the second
<a href="#">GreaterThanOrEquals</a>	Determines whether or not the first of two <code>OracleBoolean</code> values is greater than or equal to the second
<a href="#">LessThan</a>	Determines whether or not the first of two <code>OracleBoolean</code> values is less than the second
<a href="#">LessThanOrEquals</a>	Determines whether or not the first of two <code>OracleBoolean</code> values is less than or equal to the second
<a href="#">NotEquals</a>	Determines whether or not two <code>OracleBoolean</code> values are not equal
<a href="#">OnesComplement</a>	Returns the result of a one's complement operation on the specified <code>OracleBoolean</code> value
<a href="#">Or</a>	Returns the result of bitwise OR operation of two <code>OracleBoolean</code> instances

**Table 15-16 (Cont.) OracleBoolean Static Methods**

Methods	Description
<a href="#">Parse</a>	Returns an OracleBoolean structure and sets its value using a string
<a href="#">Xor</a>	Returns the result of a bitwise exclusive OR operation of two OracleBoolean instances

**OracleBoolean Static Operators**

The OracleBoolean static operators are listed in [Table 15-17](#).

**Table 15-17 OracleBoolean Static Operators**

Field	Description
<a href="#">operator &gt;</a>	Determines whether or not the first of two OracleBoolean values is greater than the second
<a href="#">operator &gt;=</a>	Determines whether or not the first of two OracleBoolean values is greater than or equal to the second
<a href="#">operator &lt;</a>	Determines whether or not the first of two OracleBoolean values is less than the second
<a href="#">operator &lt;=</a>	Determines whether or not the first of two OracleBoolean values is less than or equal to the second
<a href="#">operator ==</a>	Indicates whether or not the two OracleBoolean instances are equal
<a href="#">operator !=</a>	Determines whether or not two OracleBoolean values are not equal
<a href="#">operator !</a>	Determines the result of a NOT operation on a OracleBoolean
<a href="#">operator ~</a>	Returns the result of a one's complement operation on the specified OracleBoolean value
<a href="#">operator false</a>	Determines whether or not the specified OracleBoolean value is false
<a href="#">operator true</a>	Determines whether or not the specified OracleBoolean value is true
<a href="#">operator &amp;</a>	Returns the result of bitwise AND operation of two OracleBoolean instances
<a href="#">operator  </a>	Returns the result of bitwise OR operation of two OracleBoolean instances
<a href="#">operator ^</a>	Returns the result of bitwise exclusive OR operation of two OracleBoolean instances

**The OracleBoolean Static Type conversions**

The OracleBoolean static type conversions are listed in [Table 15-18](#)

**Table 15-18 OracleBoolean Static Type Conversions**

Field	Description
<a href="#">implicit operator OracleBoolean</a>	Returns the <code>OracleBoolean</code> representation of a boolean value
<a href="#">explicit operator bool</a>	Returns the boolean representation of the <code>OracleBoolean</code> value
<a href="#">explicit operator OracleBoolean</a>	Converts a structure to an <code>OracleBoolean</code> structure (Overloaded)

**OracleBoolean Properties**

The `OracleBoolean` properties are listed in [Table 15-25](#).

**Table 15-19 OracleBoolean Properties**

Properties	Description
<a href="#">ByteValue</a>	Returns a <code>byte</code> that represents the <code>OracleBoolean</code> structure
<a href="#">IsFalse</a>	Indicates whether or not the value of the current instance is false
<a href="#">IsNull</a>	Indicates whether or not the current instance has a null value
<a href="#">IsTrue</a>	Indicates whether or not the value of the current instance is true
<a href="#">Value</a>	Returns a boolean value that represents the current instance

**OracleBoolean Instance Methods**

The `OracleBoolean` instance methods are listed in [Table 15-20](#).

**Table 15-20 OracleBoolean Instance Methods**

Method	Description
<a href="#">CompareTo</a>	Compares the current instance to the supplied object and returns an integer that represents their relative values
<a href="#">Equals</a>	Determines whether or not an object is an instance of <code>OracleBoolean</code> , and whether or not the value of the object is equal to the current instance
<a href="#">GetHashCode</a>	Returns a hash code for the current instance
<a href="#">ToString</a>	Returns the <code>string</code> representation of the current instance

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)

## OracleBoolean Constructors

The `OracleBoolean` constructors instantiates a new instance of the `OracleBoolean` structure.

### Overload List:

- [OracleBoolean\(bool\)](#)

This constructor creates a new instance of the `OracleBoolean` structure and sets its value to the supplied `Boolean` value.

- [OracleBoolean\(int\)](#)

This constructor creates a new instance of the `OracleBoolean` structure and sets its value to the supplied `Int32` value.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## OracleBoolean(bool)

This constructor creates a new instance of the `OracleBoolean` structure and sets its value to the supplied `Boolean` value.

### Declaration

```
// C#  
public OracleBoolean(bool value) ;
```

### Parameters

- *value*

The provided `Boolean` value.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## OracleBoolean(int)

This constructor creates a new instance of the `OracleBoolean` structure and sets its value to the supplied `Int32` value.

### Declaration

```
// C#  
public OracleBoolean(int value)
```

### Parameters

- `value`  
The provided `Int32` value.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## OracleBoolean Static Fields

The `OracleBoolean` static fields are listed in [Table 15-21](#).

**Table 15-21 OracleBoolean Static Fields**

Field	Description
<a href="#">False</a>	Represents a false value that can be assigned to an <code>OracleBoolean</code> instance
<a href="#">Null</a>	Represents a null value that can be assigned to an <code>OracleBoolean</code> instance
<a href="#">One</a>	Indicates a constant representing the positive one value
<a href="#">True</a>	Represents a true value that can be assigned to an <code>OracleBoolean</code> instance
<a href="#">Zero</a>	Indicates a constant representing the zero value

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## False

This static field represents a false value that can be assigned to an `OracleBoolean` instance.

### Declaration

```
// C#  
public static readonly OracleBoolean False;
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## Null

This static field represents a null value that can be assigned to an `OracleBoolean` instance.

### Declaration

```
// C#  
public static readonly OracleBoolean Null;
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## One

This static field indicates a constant representing the positive one value.

### Declaration

```
// C#  
public static readonly OracleBoolean One;
```

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## True

This static field represents a true value that can be assigned to an `OracleBoolean` instance.

### Declaration

```
// C#  
public static readonly OracleBoolean True;
```

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## Zero

This static field indicates a constant representing the zero value.

### Declaration

```
// C#  
public static readonly OracleBoolean Zero;
```

 See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## OracleBoolean Static Methods

OracleBoolean static methods are listed in [Table 15-22](#)

**Table 15-22 OracleBoolean Static Methods**

Methods	Description
<a href="#">And</a>	Returns the result of bitwise AND operation of two OracleBoolean instances
<a href="#">Equals</a>	Determines whether or not the two OracleBoolean values are equal
<a href="#">GreaterThan</a>	Determines whether or not the first of two OracleBoolean values is greater than the second
<a href="#">GreaterThanOrEquals</a>	Determines whether or not the first of two OracleBoolean values is greater than or equal to the second
<a href="#">LessThan</a>	Determines whether or not the first of two OracleBoolean values is less than the second
<a href="#">LessThanOrEquals</a>	Determines whether or not the first of two OracleBoolean values is less than or equal to the second
<a href="#">NotEquals</a>	Determines whether or not two OracleBoolean values are not equal
<a href="#">OnesComplement</a>	Returns the result of a one's complement operation on the specified OracleBoolean value
<a href="#">Or</a>	Returns the result of bitwise OR operation of two OracleBoolean instances
<a href="#">Parse</a>	Returns an OracleBoolean structure and sets its value using a string
<a href="#">Xor</a>	Returns the result of a bitwise exclusive OR operation of two OracleBoolean instances

 See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## And

This method returns the result of bitwise AND operation of two OracleBoolean instances.

### Declaration

```
// C#  
public static OracleBoolean And(OracleBoolean value1, OracleBoolean value2);
```

### Parameters

- *value1*  
An OracleBoolean instance
- *value2*  
An OracleBoolean instance

### Return Value

An OracleBoolean that contains the value of the result of bitwise AND operation of two OracleBoolean instances.

### Remarks

If either of the specified OracleBoolean instances is null, an OracleBoolean with a null value will be returned.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## Equals

This method returns an OracleBoolean that indicates whether or not the two OracleBoolean instances are equal.

### Declaration

```
// C#  
public static OracleBoolean Equal(OracleBoolean value1, OracleBoolean value2);
```

### Parameters

- *value1*  
An OracleBoolean instance
- *value2*

An OracleBoolean instance

### Return Value

An OracleBoolean that is true if the specified two OracleBoolean instances are equal; otherwise, returns an OracleBoolean that is false.

### Remarks

If either of the specified OracleBoolean instances is null, an OracleBoolean with a null value will be returned.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## GreaterThan

This method determines if the first of two OracleBoolean values is greater than the second.

### Declaration

```
// C#  
public static OracleBoolean GreaterThan(OracleBoolean value1, OracleBoolean value2);
```

### Parameters

- *value1*  
The first OracleBoolean
- *value2*  
The second OracleBoolean

### Return Value

An OracleBoolean that is true if the first of two OracleBoolean values is greater than the second; otherwise, returns false.

### Remarks

If either of the specified OracleBoolean instances is null, an OracleBoolean with a null value will be returned.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## GreaterThanOrEquals

This method determines if the first of two `OracleBoolean` values is greater than or equal to the second.

### Declaration

```
// C#  
public static OracleBoolean GreaterThanOrEquals(OracleBoolean value1,  
OracleBoolean value2);
```

### Parameters

- *value1*  
The first `OracleBoolean`
- *value2*  
The second `OracleBoolean`

### Return Value

An `OracleBoolean` that is `true` if the first of two `OracleBoolean` values is greater than or equal to the second; otherwise, returns `false`.

### Remarks

If either of the specified `OracleBoolean` instances is `null`, an `OracleBoolean` with a `null` value will be returned.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## LessThan

This method determines if the first of two `OracleBoolean` values is less than the second.

### Declaration

```
// C#  
public static OracleBoolean LessThan(OracleBoolean value1, OracleBoolean value2);
```

### Parameters

- *value1*  
The first OracleBoolean
- *value2*  
The second OracleBoolean

### Return Value

An OracleBoolean that is true if the first of two OracleBoolean values is less than the second; otherwise, returns false.

### Remarks

If either of the specified OracleBoolean instances is null, an OracleBoolean with a null value will be returned.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## LessThanOrEquals

This method determines if the first of two OracleBoolean values is less or equal than the second.

### Declaration

```
// C#  
public static OracleBoolean LessThanOrEquals(OracleBoolean value1, OracleBoolean value2);
```

### Parameters

- *value1*  
The first OracleBoolean
- *value2*  
The second OracleBoolean

### Return Value

An `OracleBoolean` that is `true` if the first of two `OracleBoolean` values is less than or equal to the second; otherwise, returns `false`.

### Remarks

If either of the specified `OracleBoolean` instances is `null`, an `OracleBoolean` with a `null` value will be returned.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## NotEquals

This method determines if two `OracleBoolean` values are not equal.

### Declaration

```
// C#  
public static OracleBoolean NotEquals(OracleBoolean value1, OracleBoolean  
value2);
```

### Parameters

- `value1`  
The first `OracleBoolean`
- `value2`  
The second `OracleBoolean`

### Return Value

An `OracleBoolean` that is `true` if two `OracleBoolean` values are not equal; otherwise, returns `false`.

### Remarks

If either of the specified `OracleBoolean` instances is `null`, an `OracleBoolean` with a `null` value will be returned.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## OnesComplement

This method returns the result of a one's complement operation on the specified `OracleBoolean` value.

### Declaration

```
// C#  
public static OracleBoolean OnesComplement(OracleBoolean value1);
```

### Parameters

- `value1`  
An `OracleBoolean` instance

### Return Value

An `OracleBoolean` that contains the value of the result of a one's complement operation on the specified `OracleBoolean` value.

### Remarks

If the specified `OracleBoolean` instance is null, an `OracleBoolean` with a null value will be returned.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## Or

This method returns the result of bitwise OR operation of two `OracleBoolean` instances.

### Declaration

```
// C#  
public static OracleBoolean Or(OracleBoolean value1, OracleBoolean value2);
```

### Parameters

- *value1*  
An OracleBoolean instance
- *value2*  
An OracleBoolean instance

### Return Value

An OracleBoolean that contains the value of the result of bitwise OR operation of two OracleBoolean instances.

### Remarks

If either of the specified OracleBoolean instances is null, an OracleBoolean with a null value will be returned.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## Parse

This method converts a string to an OracleBoolean.

### Declaration

```
// C#  
public static OracleBoolean Parse(string str);
```

### Parameters

- *str*  
The string being converted.

### Return Value

A new OracleBoolean structure.

### Exceptions

ArgumentNullException – The *str* parameter is null.

IndexOutOfRangeException – The *str* parameter is an empty string.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## Xor

This method returns the result of a bitwise exclusive OR operation of two `OracleBoolean` instances.

### Declaration

```
// C#  
public static OracleBoolean Xor(OracleBoolean value1, OracleBoolean value2);
```

### Parameters

- `value1`  
An `OracleBoolean` instance
- `value2`  
An `OracleBoolean` instance

### Return Value

An `OracleBoolean` that contains the value of the result of bitwise exclusive OR operation of two `OracleBoolean` instances.

### Remarks

If either of the specified `OracleBoolean` instances is null, an `OracleBoolean` with a null value will be returned.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## OracleBoolean Static Operators

The `OracleBoolean` static operators are listed in [Table 15-23](#).

Table 15-23 OracleBoolean Static Operators

Field	Description
<a href="#">operator &gt;</a>	Determines whether or not the first of two OracleBoolean values is greater than the second
<a href="#">operator &gt;=</a>	Determines whether or not the first of two OracleBoolean values is greater than or equal to the second
<a href="#">operator &lt;</a>	Determines whether or not the first of two OracleBoolean values is less than the second
<a href="#">operator &lt;=</a>	Determines whether or not the first of two OracleBoolean values is less than or equal to the second
<a href="#">operator ==</a>	Indicates whether or not the two OracleBoolean instances are equal
<a href="#">operator !=</a>	Determines whether or not two OracleBoolean values are not equal
<a href="#">operator !</a>	Determines the result of a NOT operation on a OracleBoolean
<a href="#">operator ~</a>	Returns the result of a one's complement operation on the specified OracleBoolean value
<a href="#">operator false</a>	Determines whether or not the specified OracleBoolean value is false
<a href="#">operator true</a>	Determines whether or not the specified OracleBoolean value is true
<a href="#">operator &amp;</a>	Returns the result of bitwise AND operation of two OracleBoolean instances
<a href="#">operator  </a>	Returns the result of bitwise OR operation of two OracleBoolean instances
<a href="#">operator ^</a>	Returns the result of bitwise exclusive OR operation of two OracleBoolean instances

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

**operator >**

This method determines whether or not the first of two OracleBoolean values is greater than the second.

**Declaration**

```
// C#
public static operator > (OracleBoolean value1, OracleBoolean value2);
```

### Parameters

- *value1*  
An OracleBoolean instance
- *value2*  
An OracleBoolean instance

### Return Value

An OracleBoolean that is true if the first of two OracleBoolean values is greater than the second; otherwise, returns false.

### Remarks

If either of the specified OracleBoolean instances is null, an OracleBoolean with a null value will be returned.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## operator >=

This method determines whether or not the first of two OracleBoolean values is greater than or equal to the second.

### Declaration

```
// C#  
public static operator >= (OracleBoolean value1, OracleBoolean value2);
```

### Parameters

- *value1*  
An OracleBoolean instance
- *value2*  
An OracleBoolean instance

### Return Value

An OracleBoolean that is true if the first of two OracleBoolean values is greater than or equal to the second; otherwise, returns false.

### Remarks

If either of the specified `OracleBoolean` instances is null, an `OracleBoolean` with a null value will be returned.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## operator <

This method determines whether or not the first of two `OracleBoolean` values is less than the second.

### Declaration

```
// C#  
public static operator < (OracleBoolean value1, OracleBoolean value2);
```

### Parameters

- `value1`  
An `OracleBoolean` instance
- `value2`  
An `OracleBoolean` instance

### Return Value

An `OracleBoolean` that is true if the first of two `OracleBoolean` values is less than the second; otherwise, returns false.

### Remarks

If either of the specified `OracleBoolean` instances is null, an `OracleBoolean` with a null value will be returned.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## operator <=

This method determines whether or not the first of two `OracleBoolean` values is less than or equal to the second.

### Declaration

```
// C#  
public static operator <= (OracleBoolean value1, OracleBoolean value2);
```

### Parameters

- `value1`  
An `OracleBoolean` instance
- `value2`  
An `OracleBoolean` instance

### Return Value

An `OracleBoolean` that is `true` if the first of two `OracleBoolean` values is less than or equal to the second; otherwise, returns `false`.

### Remarks

If either of the specified `OracleBoolean` instances is `null`, an `OracleBoolean` with a `null` value will be returned.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## operator ==

This method returns an `OracleBoolean` that indicates whether or not the two `OracleBoolean` instances are equal.

### Declaration

```
// C#  
public static operator == (OracleBoolean value1, OracleBoolean value2);
```

### Parameters

- `value1`  
An `OracleBoolean` instance
- `value2`

An OracleBoolean instance

### Return Value

An OracleBoolean that is true if the specified two OracleBoolean instances are equal; otherwise, returns false.

### Remarks

If either of the specified OracleBoolean instances is null, an OracleBoolean with a null value will be returned.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## operator !=

This method determines whether or not two OracleBoolean values are not equal.

### Declaration

```
// C#  
public static operator != (OracleBoolean value1, OracleBoolean value2);
```

### Parameters

- *value1*  
An OracleBoolean instance
- *value2*  
An OracleBoolean instance

### Return Value

An OracleBoolean that is true if two OracleBoolean values are not equal; otherwise, returns false.

### Remarks

If either of the specified OracleBoolean instances is null, an OracleBoolean with a null value will be returned.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## operator !

This method determines the result of a NOT operation on a `OracleBoolean`.

### Declaration

```
// C#  
public static operator ! (OracleBoolean value1);
```

### Parameters

- `value1`  
An `OracleBoolean` instance

### Return Value

An `OracleBoolean` that is true if the specified `OracleBoolean` value is true; otherwise, returns false.

### Remarks

If the specified `OracleBoolean` instance is null, an `OracleBoolean` with a null value will be returned.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## operator ~

This method returns the result of a one's complement operation on the specified `OracleBoolean` value.

### Declaration

```
// C#  
public static operator ~ (OracleBoolean value1);
```

### Parameters

- *value1*  
An OracleBoolean instance

### Return Value

An OracleBoolean that contains the value of the result of a one's complement operation on the specified OracleBoolean value.

### Remarks

If the specified OracleBoolean instance is null, an OracleBoolean with a null value will be returned.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## operator false

This method determines whether or not the specified OracleBoolean value is false.

### Declaration

```
// C#  
public static operator false (OracleBoolean value1);
```

### Parameters

- *value1*  
An OracleBoolean instance

### Return Value

An OracleBoolean that is true if specified OracleBoolean value is false; otherwise, returns false.

### Remarks

This property will return false if the current instance is null.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## operator true

This method determines whether or not the specified `OracleBoolean` value is true.

### Declaration

```
// C#  
public static operator true (OracleBoolean value1);
```

### Parameters

- `value1`  
An `OracleBoolean` instance

### Return Value

An `OracleBoolean` that is true if specified `OracleBoolean` value is true; otherwise, returns false.

### Remarks

This property will return `false` if the current instance is `null`.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## operator &

This method returns the result of bitwise AND operation of two `OracleBoolean` instances.

### Declaration

```
// C#  
public static operator & (OracleBoolean value1, OracleBoolean value2);
```

### Parameters

- *value1*  
An OracleBoolean instance
- *value2*  
An OracleBoolean instance

### Return Value

An OracleBoolean that contains the value of the result of bitwise AND operation of two OracleBoolean instances.

### Remarks

If either of the specified OracleBoolean instances is null, an OracleBoolean with a null value will be returned.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## operator |

This method returns the result of bitwise OR operation of two OracleBoolean instances.

### Declaration

```
// C#  
public static operator | (OracleBoolean value1, OracleBoolean value2);
```

### Parameters

- *value1*  
An OracleBoolean instance
- *value2*  
An OracleBoolean instance

### Return Value

An OracleBoolean that contains the value of the result of bitwise OR operation of two OracleBoolean instances.

### Remarks

If either of the specified `OracleBoolean` instances is null, an `OracleBoolean` with a null value will be returned.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## operator ^

This method returns the result of bitwise exclusive OR operation of two `OracleBoolean` instances.

### Declaration

```
// C#  
public static operator ^ (OracleBoolean value1, OracleBoolean value2);
```

### Parameters

- `value1`  
An `OracleBoolean` instance
- `value2`  
An `OracleBoolean` instance

### Return Value

An `OracleBoolean` that contains the value of the result of bitwise exclusive OR operation of two `OracleBoolean` instances.

### Remarks

If either of the specified `OracleBoolean` instances is null, an `OracleBoolean` with a null value will be returned.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## OracleBoolean Static Type Conversions

The `OracleBoolean` static type conversions are listed in [Table 15-24](#)

**Table 15-24 OracleBoolean Static Type Conversions**

Field	Description
<a href="#">implicit operator OracleBoolean</a>	Returns the <code>OracleBoolean</code> representation of a boolean value
<a href="#">explicit operator bool</a>	Returns the boolean representation of the <code>OracleBoolean</code> value
<a href="#">explicit operator OracleBoolean</a>	Converts a structure to an <code>OracleBoolean</code> structure (Overloaded)

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## implicit operator OracleBoolean

This method returns the `OracleBoolean` representation of a boolean value.

### Declaration

```
// C#  
public static implicit operator OracleBoolean(bool value1);
```

### Parameters

- `value1`  
An `OracleBoolean` instance

### Return Value

An `OracleBoolean`.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## explicit operator bool

This method returns the boolean representation of the `OracleBoolean` value.

### Declaration

```
// C#  
public static explicit operator bool(OracleBoolean value1);
```

### Parameters

- `value1`  
An `OracleBoolean` structure

### Return Value

A boolean

### Exception

`OracleNullValueException` – `OracleBoolean` has a null value.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## explicit operator OracleBoolean

`explicit operator OracleBoolean` converts the provided structure to an `OracleBoolean` structure.

### Overload List

- [explicit operator OracleBoolean\(byte\)](#)  
This method converts the supplied byte to an `OracleBoolean` structure.
- [explicit operator OracleBoolean\(Decimal\)](#)  
This method converts the supplied `Decimal` to an `OracleBoolean` structure.
- [explicit operator OracleBoolean\(Double\)](#)  
This method converts the supplied `Double` to an `OracleBoolean` structure.
- [explicit operator OracleBoolean\(Int16\)](#)  
This method converts the supplied `Int16` to an `OracleBoolean` structure.
- [explicit operator OracleBoolean\(int\)](#)  
This method converts the supplied `int` to an `OracleBoolean` structure.

- [explicit operator OracleBoolean\(Int64\)](#)  
This method converts the supplied Int64 to an OracleBoolean structure.
- [explicit operator OracleBoolean\(Single\)](#)  
This method converts the supplied Single to an OracleBoolean structure.
- [explicit operator OracleBoolean\(String\)](#)  
This method converts the supplied String to an OracleBoolean structure.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## explicit operator OracleBoolean(byte)

This method converts the supplied byte to an OracleBoolean structure.

### Declaration

```
// C#  
public static explicit operator OracleBoolean(byte value1);
```

### Parameters

- *value1*  
A byte

### Return Value

An OracleBoolean structure.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## explicit operator OracleBoolean(Decimal)

This method converts the supplied Decimal to an OracleBoolean structure.

**Declaration**

```
// C#  
public static explicit operator OracleBoolean(Decimal value1);
```

**Parameters**

- *value1*  
A Decimal

**Return Value**

An OracleBoolean structure.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## explicit operator OracleBoolean(Double)

This method converts the supplied Double to an OracleBoolean structure.

**Declaration**

```
// C#  
public static explicit operator OracleBoolean(Double value1);
```

**Parameters**

- *value1*  
A Double

**Return Value**

An OracleBoolean structure.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## explicit operator OracleBoolean(Int16)

This method converts the supplied Int16 to an OracleBoolean structure.

### Declaration

```
// C#  
public static explicit operator OracleBoolean(Int16 value1);
```

### Parameters

- *value1*  
An Int16

### Return Value

An OracleBoolean structure.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## explicit operator OracleBoolean(int)

This method converts the supplied int to an OracleBoolean structure.

### Declaration

```
// C#  
public static explicit operator OracleBoolean(int value1);
```

### Parameters

- *value1*  
An int

### Return Value

An OracleBoolean structure.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## explicit operator OracleBoolean(Int64)

This method converts the supplied Int64 to an OracleBoolean structure.

### Declaration

```
// C#  
public static explicit operator OracleBoolean(Int64 value1);
```

### Parameters

- *value1*  
An Int64

### Return Value

An OracleBoolean structure.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## explicit operator OracleBoolean(Single)

This method converts the supplied Single to an OracleBoolean structure.

### Declaration

```
// C#  
public static explicit operator OracleBoolean(Single value1);
```

### Parameters

- *value1*  
A Single

### Return Value

An `OracleBoolean` structure.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## explicit operator OracleBoolean(String)

This method converts the supplied `String` to an `OracleBoolean` structure.

### Declaration

```
// C#  
public static explicit operator OracleBoolean(String value1);
```

### Parameters

- `value1`  
A `String`

### Return Value

An `OracleBoolean` structure.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## OracleBoolean Properties

The `OracleBoolean` properties are listed in [Table 15-25](#).

**Table 15-25 OracleBoolean Properties**

Properties	Description
<a href="#">ByteValue</a>	Returns a <code>byte</code> that represents the <code>OracleBoolean</code> structure

Table 15-25 (Cont.) OracleBoolean Properties

Properties	Description
<a href="#">IsFalse</a>	Indicates whether or not the value of the current instance is false
<a href="#">IsNull</a>	Indicates whether or not the current instance has a null value
<a href="#">IsTrue</a>	Indicates whether or not the value of the current instance is true
<a href="#">Value</a>	Returns a boolean value that represents the current instance

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## ByteValue

This property returns a byte that represents the `OracleBoolean` structure.

### Declaration

```
// C#  
public byte ByteValue {get;}
```

### Property Value

A byte that represents the value of `OracleBoolean` structure.

### Exceptions

`OracleNullValueException` – The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## IsFalse

This property indicates whether or not the value of the current instance is false.

### Declaration

```
// C#  
public bool IsFalse {get;}
```

### Property Value

A bool value that returns `true` if the current instance is false; otherwise, returns `false`.

### Remarks

This property will return `false` if the current instance is null.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## IsNull

This property indicates whether or not the current instance has a null value.

### Declaration

```
// C#  
public bool IsNull {get;}
```

### Property Value

A bool value that returns `true` if the current instance has a null value; otherwise, returns `false`.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## IsTrue

This property indicates whether or not the value of the current instance is true.

**Declaration**

```
// C#  
public bool IsTrue {get;}
```

**Property Value**

A bool value that returns `true` if the current instance is true; otherwise, returns `false`.

**Remarks**

This property will return `false` if the current instance is null.

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## Value

This property returns a boolean value that represents the current instance.

**Declaration**

```
// C#  
public bool Value {get;}
```

**Property Value**

A bool value that returns `true` if the current instance is true; otherwise, returns `false`.

**Exceptions**

`OracleNullValueException` – The current instance has a null value.

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## OracleBoolean Instance Methods

The `OracleBoolean` instance methods are listed in [Table 15-26](#).

Table 15-26 OracleBoolean Instance Methods

Method	Description
<a href="#">CompareTo</a>	Compares the current instance to the supplied object and returns an integer that represents their relative values
<a href="#">Equals</a>	Determines whether or not an object is an instance of <code>OracleBoolean</code> , and whether or not the value of the object is equal to the current instance
<a href="#">GetHashCode</a>	Returns a hash code for the current instance
<a href="#">ToString</a>	Returns the <code>string</code> representation of the current instance

 See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## CompareTo

This method compares the current instance to the supplied object and returns an `integer` that represents their relative values.

### Declaration

```
// C#  
public int CompareTo(object obj);
```

### Parameter

- `obj`  
The supplied instance.

### Return Value

The method returns a number:

- Less than zero: if the value of the current instance is less than `obj`.
- Zero: if the value of the current instance is equal to `obj`.
- Greater than zero: if the value of the current instance is greater than `obj`.

### Implements

`IComparable`

### Exceptions

`ArgumentException` - The parameter is not of type `OracleBoolean`.

## Remarks

The following rules apply to the behavior of this method.

- The comparison must be between `OracleBoolean`. For example, comparing an `OracleBoolean` instance with an `OracleBinary` instance is not allowed. When an `OracleBoolean` is compared with a different type, an `ArgumentException` is thrown.
- Any `OracleBoolean` that has a value compares greater than an `OracleBoolean` that has a null value.
- Two `OracleBoolean` that contain a null value are equal.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## Equals

Overrides `Object`

This method determines whether or not an object is an instance of `OracleBoolean`, and whether or not the value of the object is equal to the current instance.

### Declaration

```
// C#  
public override bool Equals(object obj);
```

### Parameter

- `obj`  
An `OracleBoolean` instance.

### Return Value

Returns `true` if `obj` is an instance of `OracleBoolean`, and the value of `obj` is equal to the current instance; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleBoolean` that has a value compares greater than an `OracleBoolean` that has a null value.
- Two `OracleBooleans` that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## GetHashCode

Overrides `Object`

This method returns a hash code for the current instance.

### Declaration

```
// C#  
public override int GetHashCode();
```

### Return Value

Returns a hash code.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## ToString

Overrides `Object`

This method returns the string representation of the current instance.

### Declaration

```
// C#  
public override string ToString();
```

### Return Value

Returns the `OracleBoolean` value in a string representation.

### Remarks

If the current instance has a null value, the returned string is `null`.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleBoolean Structure](#)
- [OracleBoolean Members](#)

## OracleDate Structure

The `OracleDate` structure represents the Oracle `DATE` data type to be stored in or retrieved from a database. Each `OracleDate` stores the following information: year, month, day, hour, minute, and second.

### Class Inheritance

```
System.Object
    System.ValueType
        Oracle.DataAccess.Types.OracleDate
```

### Declaration

```
// C#
public struct OracleDate : IComparable, INullable, IXmlSerializable
```

### Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

### Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

### Example

```
// C#
using System;
using Oracle.DataAccess.Types;
using Oracle.DataAccess.Client;
```

```

class OracleDateSample
{
    static void Main(string[] args)
    {
        // Initialize the dates to the lower and upper boundaries
        OracleDate date1 = OracleDate.MinValue;
        OracleDate date2 = OracleDate.MaxValue;
        OracleDate date3 = new OracleDate(DateTime.MinValue);
        OracleDate date4 = new OracleDate(DateTime.MaxValue);

        // Set the thread's DateFormat for output
        OracleGlobalization info = OracleGlobalization.GetClientInfo();
        info.DateFormat = "DD-MON-YYYY BC";
        OracleGlobalization.SetThreadInfo(info);

        // Print the lower and upper boundaries
        Console.WriteLine("OracleDate ranges from\n{0}\nto\n{1}\n",
            date1, date2);
        Console.WriteLine(".NET DateTime ranges from\n{0}\nto\n{1}\n",
            date3, date4);
    }
}

```

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Members](#)
- [OracleDate Constructors](#)
- [OracleDate Static Fields](#)
- [OracleDate Static Methods](#)
- [OracleDate Static Operators](#)
- [OracleDate Static Type Conversions](#)
- [OracleDate Properties](#)
- [OracleDate Methods](#)

## OracleDate Members

OracleDate members are listed in the following tables:

### OracleDate Constructors

OracleDate constructors are listed in [Table 15-27](#)

**Table 15-27 OracleDate Constructors**

Constructor	Description
<a href="#">OracleDate Constructors</a>	Instantiates a new instance of OracleDate structure (Overloaded)

### OracleDate Static Fields

The `OracleDate` static fields are listed in [Table 15-28](#).

**Table 15-28 OracleDate Static Fields**

Field	Description
<a href="#">MaxValue</a>	Represents the maximum valid date for an <code>OracleDate</code> structure, which is December 31, 9999 23:59:59
<a href="#">MinValue</a>	Represents the minimum valid date for an <code>OracleDate</code> structure, which is January 1, -4712 0:0:0
<a href="#">Null</a>	Represents a null value that can be assigned to the value of an <code>OracleDate</code> structure instance

### OracleDate Static Methods

The `OracleDate` static methods are listed in [Table 15-29](#).

**Table 15-29 OracleDate Static Methods**

Methods	Description
<a href="#">Equals</a>	Determines if two <code>OracleDate</code> values are equal (Overloaded)
<a href="#">GreaterThan</a>	Determines if the first of two <code>OracleDate</code> values is greater than the second
<a href="#">GreaterThanOrEqual</a>	Determines if the first of two <code>OracleDate</code> values is greater than or equal to the second
<a href="#">LessThan</a>	Determines if the first of two <code>OracleDate</code> values is less than the second
<a href="#">LessThanOrEqual</a>	Determines if the first of two <code>OracleDate</code> values is less than or equal to the second
<a href="#">NotEquals</a>	Determines if two <code>OracleDate</code> values are not equal
<a href="#">GetSysDate</a>	Returns an <code>OracleDate</code> structure that represents the current date and time
<a href="#">Parse</a>	Returns an <code>OracleDate</code> structure and sets its value using a string

### OracleDate Static Operators

The `OracleDate` static operators are listed in [Table 15-30](#).

**Table 15-30 OracleDate Static Operators**

Operator	Description
<a href="#">operator ==</a>	Determines if two <code>OracleDate</code> values are the same
<a href="#">operator &gt;</a>	Determines if the first of two <code>OracleDate</code> values is greater than the second
<a href="#">operator &gt;=</a>	Determines if the first of two <code>OracleDate</code> values is greater than or equal to the second

**Table 15-30 (Cont.) OracleDate Static Operators**

Operator	Description
<a href="#">operator !=</a>	Determines if the two OracleDate values are not equal
<a href="#">operator &lt;</a>	Determines if the first of two OracleDate values is less than the second
<a href="#">operator &lt;=</a>	Determines if the first of two OracleDate values is less than or equal to the second

**OracleDate Static Type Conversions**

The OracleDate static type conversions are listed in [Table 15-31](#).

**Table 15-31 OracleDate Static Type Conversions**

Operator	Description
<a href="#">explicit operator DateTime</a>	Converts a structure to a DateTime structure
<a href="#">explicit operator OracleDate</a>	Converts a structure to an OracleDate structure (Overloaded)

**OracleDate Properties**

The OracleDate properties are listed in [Table 15-32](#).

**Table 15-32 OracleDate Properties**

Properties	Description
<a href="#">BinData</a>	Gets an array of bytes that represents an Oracle DATE in Oracle internal format
<a href="#">Day</a>	Gets the day component of an OracleDate method
<a href="#">IsNull</a>	Indicates whether or not the current instance has a null value
<a href="#">Hour</a>	Gets the hour component of an OracleDate
<a href="#">Minute</a>	Gets the minute component of an OracleDate
<a href="#">Month</a>	Gets the month component of an OracleDate
<a href="#">Second</a>	Gets the second component of an OracleDate
<a href="#">Value</a>	Gets the date and time that is stored in the OracleDate structure
<a href="#">Year</a>	Gets the year component of an OracleDate

**OracleDate Methods**

The OracleDate methods are listed in [Table 15-33](#).

Table 15-33 OracleDate Methods

Methods	Description
<a href="#">CompareTo</a>	Compares the current <code>OracleDate</code> instance to an object, and returns an integer that represents their relative values
<a href="#">Equals</a>	Determines whether or not an object has the same date and time as the current <code>OracleDate</code> instance (Overloaded)
<a href="#">GetHashCode</a>	Returns a hash code for the <code>OracleDate</code> instance
<a href="#">GetDaysBetween</a>	Calculates the number of days between the current <code>OracleDate</code> instance and an <code>OracleDate</code> structure
<a href="#">GetType</a>	Inherited from <code>System.Object</code>
<a href="#">ToOracleTimeStamp</a>	Converts the current <code>OracleDate</code> structure to an <code>OracleTimeStamp</code> structure
<a href="#">ToString</a>	Converts the current <code>OracleDate</code> structure to a string

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)

## OracleDate Constructors

The `OracleDate` constructors instantiates a new instance of the `OracleDate` structure.

**Overload List:**

- [OracleDate\(DateTime\)](#)  
This constructor creates a new instance of the `OracleDate` structure and sets its value for date and time using the supplied `DateTime` value.
- [OracleDate\(string\)](#)  
This constructor creates a new instance of the `OracleDate` structure and sets its value using the supplied string.
- [OracleDate\(int, int, int\)](#)  
This constructor creates a new instance of the `OracleDate` structure and set its value for date using the supplied year, month, and day.
- [OracleDate\(int, int, int, int, int, int\)](#)  
This constructor creates a new instance of the `OracleDate` structure and set its value for time using the supplied year, month, day, hour, minute, and second.
- [OracleDate\(byte \[\]\)](#)  
This constructor creates a new instance of the `OracleDate` structure and sets its value to the provided byte array, which is in the internal Oracle `DATE` format.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## OracleDate(DateTime)

This constructor creates a new instance of the `OracleDate` structure and sets its value for date and time using the supplied `DateTime` value.

### Declaration

```
// C#  
public OracleDate (DateTime dt);
```

### Parameters

- *dt*  
The provided `DateTime` value.

### Remarks

The `OracleDate` structure only supports up to a second precision. The time value in the provided `DateTime` structure that has a precision smaller than second is ignored.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## OracleDate(string)

This constructor creates a new instance of the `OracleDate` structure and sets its value using the supplied string.

### Declaration

```
// C#  
public OracleDate (string dateStr);
```

### Parameters

- *dateStr*

A string that represents an Oracle DATE.

### Exceptions

**ArgumentException** - The *dateStr* is an invalid string representation of an Oracle DATE or the *dateStr* is not in the date format specified by the thread's `OracleGlobalization.DateFormat` property, which represents the Oracle NLS\_DATE\_FORMAT parameter.

**ArgumentNullException** - The *dateStr* is null.

### Remarks

The names and abbreviations used for months and days are in the language specified by the `DateLanguage` and `Calendar` properties of the thread's `OracleGlobalization` object. If any of the thread's globalization properties are set to null or an empty string, the client computer's settings are used.

### Example

```
// C#

using System;
using Oracle.DataAccess.Types;
using Oracle.DataAccess.Client;

class OracleDateSample
{
    static void Main(string[] args)
    {
        // Set the thread's DateFormat for the OracleDate constructor
        OracleGlobalization info = OracleGlobalization.GetClientInfo();
        info.DateFormat = "YYYY-MON-DD";
        OracleGlobalization.SetThreadInfo(info);

        // construct OracleDate from a string using the DateFormat specified.
        OracleDate date = new OracleDate("1999-DEC-01");

        // Set a different DateFormat for the thread
        info.DateFormat = "MM/DD/YYYY";
        OracleGlobalization.SetThreadInfo(info);

        // Print "12/01/1999"
        Console.WriteLine(date.ToString());
    }
}
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)
- ["OracleGlobalization Class"](#)
- *Oracle Database SQL Language Reference* for further information on date format elements

## OracleDate(int, int, int)

This constructor creates a new instance of the `OracleDate` structure and set its value for date using the supplied year, month, and day.

### Declaration

```
// C#  
public OracleDate (int year, int month, int day);
```

### Parameters

- `year`  
The supplied year. Range of `year` is (-4712 to 9999).
- `month`  
The supplied month. Range of `month` is (1 to 12).
- `day`  
The supplied day. Range of `day` is (1 to 31).

### Exceptions

`ArgumentOutOfRangeException` - The argument value for one or more of the parameters is out of the specified range.

`ArgumentException` - The argument values of the parameters cannot be used to construct a valid `OracleDate` (that is, the day is out of range for the month).

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## OracleDate(int, int, int, int, int, int)

This constructor creates a new instance of the `OracleDate` structure and set its value for time using the supplied year, month, day, hour, minute, and second.

### Declaration

```
// C#  
public OracleDate (int year, int month, int day, int hour, int minute, int second);
```

### Parameters

- `year`  
The supplied year. Range of `year` is (-4712 to 9999).
- `month`  
The supplied month. Range of `month` is (1 to 12).
- `day`  
The supplied day. Range of `day` is (1 to 31).
- `hour`  
The supplied hour. Range of `hour` is (0 to 23).
- `minute`  
The supplied minute. Range of `minute` is (0 to 59).
- `second`  
The supplied second. Range of `second` is (0 to 59).

### Exceptions

`ArgumentOutOfRangeException` - The argument value for one or more of the parameters is out of the specified range.

`ArgumentException` - The argument values of the parameters cannot be used to construct a valid `OracleDate` (that is, the day is out of range for the month).

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## OracleDate(byte [ ])

This constructor creates a new instance of the `OracleDate` structure and sets its value to the provided byte array, which is in the internal Oracle `DATE` format.

**Declaration**

```
// C#
public OracleDate(byte [] bytes);
```

**Parameters**

- *bytes*

A byte array that represents Oracle DATE in the internal Oracle DATE format.

**Exceptions**

ArgumentException - *bytes* is null or *bytes* is not in internal Oracle DATE format or *bytes* is not a valid Oracle DATE.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## OracleDate Static Fields

The OracleDate static fields are listed in [Table 15-34](#).

**Table 15-34 OracleDate Static Fields**

Field	Description
<a href="#">MaxValue</a>	Represents the maximum valid date for an OracleDate structure, which is December 31, 9999 23:59:59
<a href="#">MinValue</a>	Represents the minimum valid date for an OracleDate structure, which is January 1, -4712 0:0:0
<a href="#">Null</a>	Represents a null value that can be assigned to the value of an OracleDate structure instance

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## MaxValue

This static field represents the maximum valid date for an `OracleDate` structure, which is December 31, 9999 23:59:59.

### Declaration

```
// C#  
public static readonly OracleDate MaxValue;
```

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## MinValue

This static field represents the minimum valid date for an `OracleDate` structure, which is January 1, -4712.

### Declaration

```
// C#  
public static readonly OracleDate MinValue;
```

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## Null

This static field represents a null value that can be assigned to the value of an `OracleDate` instance.

### Declaration

```
// C#  
public static readonly OracleDate Null;
```

 See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## OracleDate Static Methods

The `OracleDate` static methods are listed in [Table 15-35](#).

**Table 15-35 OracleDate Static Methods**

Methods	Description
<a href="#">Equals</a>	Determines if two <code>OracleDate</code> values are equal (Overloaded)
<a href="#">GreaterThan</a>	Determines if the first of two <code>OracleDate</code> values is greater than the second
<a href="#">GreaterThanOrEqual</a>	Determines if the first of two <code>OracleDate</code> values is greater than or equal to the second
<a href="#">LessThan</a>	Determines if the first of two <code>OracleDate</code> values is less than the second
<a href="#">LessThanOrEqual</a>	Determines if the first of two <code>OracleDate</code> values is less than or equal to the second
<a href="#">NotEquals</a>	Determines if two <code>OracleDate</code> values are not equal
<a href="#">GetSysDate</a>	Returns an <code>OracleDate</code> structure that represents the current date and time
<a href="#">Parse</a>	Returns an <code>OracleDate</code> structure and sets its value using a string

 See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## Equals

Overloads `Object`

This method determines if two `OracleDate` values are equal.

### Declaration

```
// C#  
public static bool Equals(OracleDate value1, OracleDate value2);
```

### Parameters

- *value1*  
The first OracleDate.
- *value2*  
The second OracleDate.

### Return Value

Returns `true` if two OracleDate values are equal; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any OracleDate that has a value compares greater than an OracleDate that has a null value.
- Two OracleDates that contain a null value are equal.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## GreaterThan

This method determines if the first of two OracleDate values is greater than the second.

### Declaration

```
// C#  
public static bool GreaterThan(OracleDate value1, OracleDate value2);
```

### Parameters

- *value1*  
The first OracleDate.
- *value2*  
The second OracleDate.

### Return Value

Returns `true` if the first of two `OracleDate` values is greater than the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleDate` that has a value compares greater than an `OracleDate` that has a null value.
- Two `OracleDates` that contain a null value are equal.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## GreaterThanOrEqual

This method determines if the first of two `OracleDate` values is greater than or equal to the second.

### Declaration

```
// C#  
public static bool GreaterThanOrEqual(OracleDate value1, OracleDate value2);
```

### Parameters

- `value1`  
The first `OracleDate`.
- `value2`  
The second `OracleDate`.

### Return Value

Returns `true` if the first of two `OracleDate` values is greater than or equal to the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleDate` that has a value compares greater than an `OracleDate` that has a null value.
- Two `OracleDates` that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## LessThan

This method determines if the first of two `OracleDate` values is less than the second.

### Declaration

```
// C#  
public static bool LessThan(OracleDate value1, OracleDate value2);
```

### Parameters

- `value1`  
The first `OracleDate`.
- `value2`  
The second `OracleDate`.

### Return Value

Returns `true` if the first of two `OracleDate` values is less than the second. Otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleDate` that has a value compares greater than an `OracleDate` that has a null value.
- Two `OracleDates` that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## LessThanOrEqual

This method determines if the first of two `OracleDate` values is less than or equal to the second.

### Declaration

```
// C#  
public static bool LessThanOrEqual(OracleDate value1, OracleDate value2);
```

### Parameters

- `value1`  
The first `OracleDate`.
- `value2`  
The second `OracleDate`.

### Return Value

Returns `true` if the first of two `OracleDate` values is less than or equal to the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleDate` that has a value compares greater than an `OracleDate` that has a null value.
- Two `OracleDates` that contain a null value are equal.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## NotEquals

This method determines if two `OracleDate` values are not equal.

### Declaration

```
// C#  
public static bool NotEquals(OracleDate value1, OracleDate value2);
```

### Parameters

- `value1`

The first `OracleDate`.

- `value2`

The second `OracleDate`.

### Return Value

Returns `true` if two `OracleDate` values are not equal; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleDate` that has a value compares greater than an `OracleDate` that has a null value.
- Two `OracleDates` that contain a null value are equal.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## GetSysDate

This method gets an `OracleDate` structure that represents the current date and time.

### Declaration

```
// C#  
public static OracleDate GetSysDate ();
```

### Return Value

An `OracleDate` structure that represents the current date and time.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## Parse

This method gets an `OracleDate` structure and sets its value for date and time using the supplied string.

### Declaration

```
// C#  
public static OracleDate Parse (string dateStr);
```

### Parameters

- `dateStr`  
A string that represents an Oracle `DATE`.

### Return Value

An `OracleDate` structure.

### Exceptions

`ArgumentException` - The `dateStr` is an invalid string representation of an Oracle `DATE` or the `dateStr` is not in the date format specified by the thread's `OracleGlobalization.DateFormat` property, which represents the Oracle `NLS_DATE_FORMAT` parameter.

`ArgumentNullException` - The `dateStr` is null.

### Remarks

The names and abbreviations used for months and days are in the language specified by the `DateLanguage` and `Calendar` properties of the thread's `OracleGlobalization` object. If any of the thread's globalization properties are set to null or an empty string, the client computer's settings are used.

### Example

```
// C#  
  
using System;  
using Oracle.DataAccess.Types;  
using Oracle.DataAccess.Client;  
  
class ParseSample  
{  
    static void Main(string[] args)  
    {  
        // Set the thread's DateFormat for the OracleDate constructor  
        OracleGlobalization info = OracleGlobalization.GetClientInfo();  
        info.DateFormat = "YYYY-MON-DD";  
        OracleGlobalization.SetThreadInfo(info);  
  
        // Construct OracleDate from a string using the DateFormat specified  
        OracleDate date = OracleDate.Parse("1999-DEC-01");  
  
        // Set a different DateFormat on the thread for ToString()  
        info.DateFormat = "MM-DD-YY";  
    }  
}
```

```

OracleGlobalization.SetThreadInfo(info);

// Print "12-01-1999"
Console.WriteLine(date.ToString());
}
}

```

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)
- ["OracleGlobalization Class"](#)
- ["Globalization Support "](#)
- *Oracle Database SQL Language Reference* for further information on datetime format elements

## OracleDate Static Operators

The `OracleDate` static operators are listed in [Table 15-36](#).

**Table 15-36 OracleDate Static Operators**

Operator	Description
<code>operator ==</code>	Determines if two <code>OracleDate</code> values are the same
<code>operator &gt;</code>	Determines if the first of two <code>OracleDate</code> values is greater than the second
<code>operator &gt;=</code>	Determines if the first of two <code>OracleDate</code> values is greater than or equal to the second
<code>operator !=</code>	Determines if the two <code>OracleDate</code> values are not equal
<code>operator &lt;</code>	Determines if the first of two <code>OracleDate</code> values is less than the second
<code>operator &lt;=</code>	Determines if the first of two <code>OracleDate</code> values is less than or equal to the second

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## operator ==

This method determines if two `OracleDate` values are the same.

### Declaration

```
// C#  
public static bool operator == (OracleDate value1, OracleDate value2);
```

### Parameters

- `value1`  
The first `OracleDate`.
- `value2`  
The second `OracleDate`.

### Return Value

Returns `true` if they are the same; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleDate` that has a value compares greater than an `OracleDate` that has a null value.
- Two `OracleDates` that contain a null value are equal.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## operator >

This method determines if the first of two `OracleDate` values is greater than the second.

### Declaration

```
// C#  
public static bool operator > (OracleDate value1, OracleDate value2);
```

### Parameters

- `value1`  
The first `OracleDate`.

- *value2*  
The second OracleDate.

### Return Value

Returns `true` if the first of two OracleDate values is greater than the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any OracleDate that has a value compares greater than an OracleDate that has a null value.
- Two OracleDates that contain a null value are equal.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## operator >=

This method determines if the first of two OracleDate values is greater than or equal to the second.

### Declaration

```
// C#  
public static bool operator >= (OracleDate value1, OracleDate value2);
```

### Parameters

- *value1*  
The first OracleDate.
- *value2*  
The second OracleDate.

### Return Value

Returns `true` if the first of two OracleDate values is greater than or equal to the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any OracleDate that has a value compares greater than an OracleDate that has a null value.

- Two `OracleDates` that contain a null value are equal.

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## operator !=

This method determines if the two `OracleDate` values are not equal.

### Declaration

```
// C#  
public static bool operator != (OracleDate value1, OracleDate value2);
```

### Parameters

- `value1`  
The first `OracleDate`.
- `value2`  
The second `OracleDate`.

### Return Value

Returns `true` if the two `OracleDate` values are not equal; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleDate` that has a value compares greater than an `OracleDate` that has a null value.
- Two `OracleDates` that contain a null value are equal.

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## operator <

This method determines if the first of two `OracleDate` values is less than the second.

### Declaration

```
// C#  
public static bool operator < (OracleDate value1, OracleDate value2);
```

### Parameters

- `value1`  
The first `OracleDate`.
- `value2`  
The second `OracleDate`.

### Return Value

Returns `true` if the first of two `OracleDate` values is less than the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleDate` that has a value compares greater than an `OracleDate` that has a null value.
- Two `OracleDates` that contain a null value are equal.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## operator <=

This method determines if the first of two `OracleDate` values is less than or equal to the second.

### Declaration

```
// C#  
public static bool operator <= (OracleDate value1, OracleDate value2);
```

### Parameters

- `value1`

The first `OracleDate`.

- `value2`

The second `OracleDate`.

### Return Value

Returns `true` if the first of two `OracleDate` values is less than or equal to the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleDate` that has a value compares greater than an `OracleDate` that has a null value.
- Two `OracleDates` that contain a null value are equal.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## OracleDate Static Type Conversions

The `OracleDate` static type conversions are listed in [Table 15-37](#).

**Table 15-37 OracleDate Static Type Conversions**

Operator	Description
<a href="#">explicit operator DateTime</a>	Converts a structure to a <code>DateTime</code> structure
<a href="#">explicit operator OracleDate</a>	Converts a structure to an <code>OracleDate</code> structure (Overloaded)

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## explicit operator DateTime

This method converts an `OracleDate` structure to a `DateTime` structure.

### Declaration

```
// C#  
public static explicit operator DateTime(OracleDate val);
```

### Parameters

- `val`  
An `OracleDate` structure.

### Return Value

A `DateTime` structure.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## explicit operator OracleDate

`explicit operator OracleDate` converts the provided structure to an `OracleDate` structure.

### Overload List:

- [explicit operator OracleDate\(DateTime\)](#)  
This method converts a `DateTime` structure to an `OracleDate` structure.
- [explicit operator OracleDate\(OracleTimeStamp\)](#)  
This method converts an `OracleTimeStamp` structure to an `OracleDate` structure.
- [explicit operator OracleDate\(string\)](#)  
This method converts the supplied string to an `OracleDate` structure.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## explicit operator OracleDate(DateTime)

This method converts a `DateTime` structure to an `OracleDate` structure.

### Declaration

```
// C#  
public static explicit operator OracleDate(DateTime dt);
```

### Parameters

- `dt`  
A `DateTime` structure.

### Return Value

An `OracleDate` structure.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## explicit operator OracleDate(OracleTimeStamp)

This method converts an `OracleTimeStamp` structure to an `OracleDate` structure.

### Declaration

```
// C#  
public explicit operator OracleDate(OracleTimeStamp ts);
```

### Parameters

- `ts`  
`OracleTimeStamp`

### Return Value

The returned `OracleDate` structure contains the date and time in the `OracleTimeStamp` structure.

### Remarks

The precision of the `OracleTimeStamp` value can be lost during the conversion.

If the `OracleTimeStamp` structure has a null value, the returned `OracleDate` structure also has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## explicit operator OracleDate(string)

This method converts the supplied string to an `OracleDate` structure.

### Declaration

```
// C#  
public explicit operator OracleDate (string dateStr);
```

### Parameters

- `dateStr`  
A string representation of an Oracle `DATE`.

### Return Value

The returned `OracleDate` structure contains the date and time in the string `dateStr`.

### Exceptions

`ArgumentNullException` - The `dateStr` is null.

`ArgumentException` - This exception is thrown if any of the following conditions exist:

- The `dateStr` is an invalid string representation of an Oracle `DATE`.
- The `dateStr` is not in the date format specified by the thread's `OracleGlobalization.DateFormat` property, which represents the Oracle `NLS_DATE_FORMAT` parameter.

### Remarks

The names and abbreviations used for months and days are in the language specified by the `DateLanguage` and `Calendar` properties of the thread's `OracleGlobalization` object. If any of the thread's globalization properties are set to null or an empty string, the client computer's settings are used.

### Example

```
// C#  
  
using System;  
using Oracle.DataAccess.Client;  
using Oracle.DataAccess.Types;  
  
class OracleDateSample  
{
```

```

static void Main(string[] args)
{
    // Set the thread's DateFormat to a specific format
    OracleGlobalization info = OracleGlobalization.GetClientInfo();
    info.DateFormat = "YYYY-MON-DD";
    OracleGlobalization.SetThreadInfo(info);

    // Construct OracleDate from a string using the DateFormat specified
    OracleDate date = (OracleDate)"1999-DEC-01";

    // Set a different DateFormat on the thread for ToString()
    info.DateFormat = "MON DD YY";
    OracleGlobalization.SetThreadInfo(info);

    // Prints "DEC 01 99"
    Console.WriteLine(date.ToString());
}
}

```

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)
- ["OracleGlobalization Class"](#)
- ["Globalization Support "](#)

## OracleDate Properties

The `OracleDate` properties are listed in [Table 15-38](#).

**Table 15-38 OracleDate Properties**

Properties	Description
<a href="#">BinData</a>	Gets an array of bytes that represents an Oracle <code>DATE</code> in Oracle internal format
<a href="#">Day</a>	Gets the day component of an <code>OracleDate</code> method
<a href="#">IsNull</a>	Indicates whether or not the current instance has a null value
<a href="#">Hour</a>	Gets the hour component of an <code>OracleDate</code>
<a href="#">Minute</a>	Gets the minute component of an <code>OracleDate</code>
<a href="#">Month</a>	Gets the month component of an <code>OracleDate</code>
<a href="#">Second</a>	Gets the second component of an <code>OracleDate</code>
<a href="#">Value</a>	Gets the date and time that is stored in the <code>OracleDate</code> structure
<a href="#">Year</a>	Gets the year component of an <code>OracleDate</code>

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## BinData

This property gets a array of bytes that represents an Oracle `DATE` in Oracle internal format.

### Declaration

```
// C#  
public byte[] BinData{get;}
```

### Property Value

An array of bytes.

### Exceptions

`OracleNullValueException` - `OracleDate` has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## Day

This property gets the day component of an `OracleDate`.

### Declaration

```
// C#  
public int Day{get;}
```

### Property Value

A number that represents the day. Range of `Day` is (1 to 31).

### Exceptions

`OracleNullValueException` - `OracleDate` has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## IsNull

This property indicates whether or not the current instance has a null value.

### Declaration

```
// C#  
public bool IsNull{get;}
```

### Property Value

Returns `true` if the current instance has a null value; otherwise, returns `false`.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## Hour

This property gets the `hour` component of an `OracleDate`.

### Declaration

```
// C#  
public int Hour {get;}
```

### Property Value

A number that represents `Hour`. Range of `Hour` is (0 to 23).

### Exceptions

`OracleNullValueException` - `OracleDate` has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## Minute

This property gets the minute component of an `OracleDate`.

### Declaration

```
// C#  
public int Minute {get;}
```

### Property Value

A number that represents `Minute`. Range of `Minute` is (0 to 59).

### Exceptions

`OracleNullValueException` - `OracleDate` has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## Month

This property gets the month component of an `OracleDate`.

### Declaration

```
// C#  
public int Month {get;}
```

### Property Value

A number that represents `Month`. Range of `Month` is (1 to 12).

### Exceptions

`OracleNullValueException` - `OracleDate` has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## Second

This property gets the `second` component of an `OracleDate`.

### Declaration

```
// C#  
public int Second {get;}
```

### Property Value

A number that represents `Second`. Range of `Second` is (0 to 59).

### Exceptions

`OracleNullValueException` - `OracleDate` has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## Value

This property specifies the date and time that is stored in the `OracleDate` structure.

### Declaration

```
// C#  
public DateTime Value {get;}
```

### Property Value

A `DateTime`.

### Exceptions

`OracleNullValueException` - `OracleDate` has a null value.

 See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## Year

This property gets the `year` component of an `OracleDate`.

### Declaration

```
// C#
public int Year {get;}
```

### Property Value

A number that represents `Year`. Range of `Year` is (-4712 to 9999).

### Exceptions

`OracleNullValueException` - `OracleDate` has a null value.

 See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## OracleDate Methods

The `OracleDate` methods are listed in [Table 15-39](#).

**Table 15-39 OracleDate Methods**

Methods	Description
<a href="#">CompareTo</a>	Compares the current <code>OracleDate</code> instance to an object, and returns an integer that represents their relative values
<a href="#">Equals</a>	Determines whether or not an object has the same date and time as the current <code>OracleDate</code> instance (Overloaded)
<a href="#">GetHashCode</a>	Returns a hash code for the <code>OracleDate</code> instance
<a href="#">GetDaysBetween</a>	Calculates the number of days between the current <code>OracleDate</code> instance and an <code>OracleDate</code> structure

Table 15-39 (Cont.) OracleDate Methods

Methods	Description
<code>GetType</code>	Inherited from <code>System.Object</code>
<code>ToOracleTimeStamp</code>	Converts the current <code>OracleDate</code> structure to an <code>OracleTimeStamp</code> structure
<code>ToString</code>	Converts the current <code>OracleDate</code> structure to a string

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## CompareTo

This method compares the current `OracleDate` instance to an object, and returns an integer that represents their relative values.

### Declaration

```
// C#  
public int CompareTo(object obj);
```

### Parameters

- *obj*  
An object.

### Return Value

The method returns:

- Less than zero: if the current `OracleDate` instance value is less than that of *obj*.
- Zero: if the current `OracleDate` instance and *obj* values are equal.
- Greater than zero: if the current `OracleDate` instance value is greater than *obj*.

### Implements

`IComparable`

### Exceptions

`ArgumentException` - The *obj* parameter is not an instance of `OracleDate`.

## Remarks

The following rules apply to the behavior of this method.

- The comparison must be between `OracleDates`. For example, comparing an `OracleDate` instance with an `OracleBinary` instance is not allowed. When an `OracleDate` is compared with a different type, an `ArgumentException` is thrown.
- Any `OracleDate` that has a value compares greater than an `OracleDate` that has a null value.
- Two `OracleDates` that contain a null value are equal.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## Equals

This method determines whether or not an object has the same date and time as the current `OracleDate` instance.

### Declaration

```
// C#  
public override bool Equals( object obj);
```

### Parameters

- *obj*  
An object.

### Return Value

Returns `true` if *obj* has the same type as the current instance and represents the same date and time; otherwise returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleDate` that has a value compares greater than an `OracleDate` that has a null value.
- Two `OracleDates` that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## GetHashCode

Overrides `Object`

This method returns a hash code for the `OracleDate` instance.

### Declaration

```
// C#  
public override int GetHashCode();
```

### Return Value

A number that represents the hash code.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## GetDaysBetween

This method calculates the number of days between the current `OracleDate` instance and the supplied `OracleDate` structure.

### Declaration

```
// C#  
public int GetDaysBetween (OracleDate val);
```

### Parameters

- *val*  
An `OracleDate` structure.

### Return Value

The number of days between the current `OracleDate` instance and the `OracleDate` structure.

## Exceptions

`OracleNullValueException` - The current instance or the supplied `OracleDate` structure has a null value.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## ToOracleTimeStamp

This method converts the current `OracleDate` structure to an `OracleTimeStamp` structure.

### Declaration

```
// C#  
public OracleTimeStamp ToOracleTimeStamp();
```

### Return Value

An `OracleTimeStamp` structure.

### Remarks

The returned `OracleTimeStamp` structure has date and time in the current instance.

If the `OracleDate` instance has a null value, the returned `OracleTimeStamp` structure has a null value.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)

## ToString

Overrides `ValueType`

This method converts the current `OracleDate` structure to a string.

## Declaration

```
// C#  
public override string ToString();
```

## Return Value

A string.

## Remarks

The returned value is a string representation of the `OracleDate` in the format specified by the thread's `OracleGlobalization.DateFormat` property. The names and abbreviations used for months and days are in the language specified by the thread's `OracleGlobalization.DateLanguage` and `OracleGlobalization.Calendar` properties. If any of the thread's globalization properties are set to null or an empty string, the client computer's settings are used.

## Example

```
// C#  
  
using System;  
using Oracle.DataAccess.Client;  
using Oracle.DataAccess.Types;  
  
class ToStringSample  
{  
    static void Main(string[] args)  
    {  
        // Set the thread's DateFormat to a specific format  
        OracleGlobalization info = OracleGlobalization.GetClientInfo();  
        info.DateFormat = "YYYY-MON-DD";  
        OracleGlobalization.SetThreadInfo(info);  
  
        // Construct OracleDate from a string using the DateFormat specified  
        OracleDate date = (OracleDate)"1999-DEC-01";  
  
        // Set a different DateFormat on the thread for ToString()  
        info.DateFormat = "YYYY/MM/DD";  
        OracleGlobalization.SetThreadInfo(info);  
  
        // Prints "1999/12/01"  
        Console.WriteLine(date.ToString());  
    }  
}
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDate Structure](#)
- [OracleDate Members](#)
- ["OracleGlobalization Class"](#)
- ["Globalization Support "](#)

## OracleDecimal Structure

The `OracleDecimal` structure represents an Oracle `NUMBER` in the database or any Oracle numeric value.

### Class Inheritance

`System.Object`

`System.ValueType`

`Oracle.DataAccess.Types.OracleDecimal`

### Declaration

```
// C#
public struct OracleDecimal : IComparable, INullable, IXmlSerializable
```

### Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	<code>Oracle.DataAccess.dll</code>	<code>Oracle.ManagedDataAccess.dll</code>	<code>Oracle.ManagedDataAccess.dll</code>
<b>Namespace</b>	<code>Oracle.DataAccess.Client</code>	<code>Oracle.ManagedDataAccess.Client</code>	<code>Oracle.ManagedDataAccess.Client</code>
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

### Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

### Remarks

`OracleDecimal` can store up to 38 precision, while the `.NET Decimal` data type can only hold up to 28 precision. When accessing the `OracleDecimal.Value` property from an `OracleDecimal` that has a value greater than 28 precision, an exception is thrown. To retrieve

the actual value of `OracleDecimal`, use the `OracleDecimal.ToString()` method. Another approach is to obtain the `OracleDecimal` value as a byte array in an internal Oracle NUMBER format through the `BinData` property.

### Example

```
// C#

using System;
using Oracle.DataAccess.Types;

class OracleDecimalSample
{
    static void Main(string[] args)
    {
        // Illustrates the range of OracleDecimal vs. .NET decimal
        OracleDecimal decimal1 = OracleDecimal.MinValue;
        OracleDecimal decimal2 = OracleDecimal.MaxValue;
        OracleDecimal decimal3 = new OracleDecimal(decimal.MinValue);
        OracleDecimal decimal4 = new OracleDecimal(decimal.MaxValue);

        // Print the ranges
        Console.WriteLine("OracleDecimal can range from\n{0}\nto\n{1}\n",
            decimal1, decimal2);
        Console.WriteLine(".NET decimal can range from\n{0}\nto\n{1}\n",
            decimal3, decimal4);
    }
}
```

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Constructors](#)
- [OracleDecimal Static Fields](#)
- [OracleDecimal Static \(Comparison\) Methods](#)
- [OracleDecimal Static \(Manipulation\) Methods](#)
- [OracleDecimal Static \(Logarithmic\) Methods](#)
- [OracleDecimal Static \(Trigonometric\) Methods](#)
- [OracleDecimal Static \(Comparison\) Operators](#)
- [OracleDecimal Static Operators \(Conversion from .NET Type to OracleDecimal\)](#)
- [OracleDecimal Static Operators \(Conversion from OracleDecimal to .NET\)](#)
- [OracleDecimal Properties](#)
- [OracleDecimal Instance Methods](#)

## OracleDecimal Members

OracleDecimal members are listed in the following tables:

### OracleDecimal Constructors

OracleDecimal constructors are listed in [Table 15-40](#)

**Table 15-40 OracleDecimal Constructors**

Constructor	Description
<a href="#">OracleDecimal Constructors</a>	Instantiates a new instance of OracleDecimal structure (Overloaded)

### OracleDecimal Static Fields

The OracleDecimal static fields are listed in [Table 15-41](#).

**Table 15-41 OracleDecimal Static Fields**

Field	Description
<a href="#">MaxPrecision</a>	A constant representing the maximum precision, which is 38
<a href="#">MaxScale</a>	A constant representing the maximum scale, which is 127
<a href="#">MaxValue</a>	A constant representing the maximum value for this structure, which is $9.9\dots9 \times 10^{125}$
<a href="#">MinScale</a>	A constant representing the minimum scale, which is -84
<a href="#">MinValue</a>	A constant representing the minimum value for this structure, which is $-1.0 \times 10^{130}$
<a href="#">NegativeOne</a>	A constant representing the negative one value
<a href="#">Null</a>	Represents a null value that can be assigned to an OracleDecimal instance
<a href="#">One</a>	A constant representing the positive one value
<a href="#">Pi</a>	A constant representing the numeric Pi value
<a href="#">Zero</a>	A constant representing the zero value

### OracleDecimal Static (Comparison) Methods

The OracleDecimal static (comparison) methods are listed in [Table 15-42](#).

**Table 15-42 OracleDecimal Static (Comparison) Methods**

Methods	Description
<a href="#">Equals</a>	Determines if two OracleDecimal values are equal (Overloaded)
<a href="#">GreaterThan</a>	Determines if the first of two OracleDecimal values is greater than the second
<a href="#">GreaterThanOrEqual</a>	Determines if the first of two OracleDecimal values is greater than or equal to the second

**Table 15-42 (Cont.) OracleDecimal Static (Comparison) Methods**

Methods	Description
<a href="#">LessThan</a>	Determines if the first of two <code>OracleDecimal</code> values is less than the second
<a href="#">LessThanOrEqualTo</a>	Determines if the first of two <code>OracleDecimal</code> values is less than or equal to the second.
<a href="#">NotEquals</a>	Determines if two <code>OracleDecimal</code> values are not equal

**OracleDecimal Static (Manipulation) Methods**

The `OracleDecimal` static (manipulation) methods are listed in [Table 15-43](#).

**Table 15-43 OracleDecimal Static (Manipulation) Methods**

Methods	Description
<a href="#">Abs</a>	Returns the absolute value of an <code>OracleDecimal</code>
<a href="#">Add</a>	Adds two <code>OracleDecimal</code> structures
<a href="#">AdjustScale</a>	Returns a new <code>OracleDecimal</code> with the specified number of digits and indicates whether or not to round or truncate the number if the scale is less than original
<a href="#">Ceiling</a>	Returns a new <code>OracleDecimal</code> structure with its value set to the ceiling of an <code>OracleDecimal</code> structure
<a href="#">ConvertToPrecScale</a>	Returns a new <code>OracleDecimal</code> structure with a new precision and scale
<a href="#">Divide</a>	Divides one <code>OracleDecimal</code> value by another
<a href="#">Floor</a>	Returns a new <code>OracleDecimal</code> structure with its value set to the floor of an <code>OracleDecimal</code> structure
<a href="#">Max</a>	Returns the maximum value of the two supplied <code>OracleDecimal</code> structures
<a href="#">Min</a>	Returns the minimum value of the two supplied <code>OracleDecimal</code> structures
<a href="#">Mod</a>	Returns a new <code>OracleDecimal</code> structure with its value set to the modulus of two <code>OracleDecimal</code> structures
<a href="#">Multiply</a>	Returns a new <code>OracleDecimal</code> structure with its value set to the result of multiplying two <code>OracleDecimal</code> structures
<a href="#">Negate</a>	Returns a new <code>OracleDecimal</code> structure with its value set to the negation of the supplied <code>OracleDecimal</code> structure
<a href="#">Parse</a>	Converts a string to an <code>OracleDecimal</code>
<a href="#">Round</a>	Returns a new <code>OracleDecimal</code> structure with its value set to that of the supplied <code>OracleDecimal</code> structure and rounded off to the specified place
<a href="#">SetPrecision</a>	Returns a new <code>OracleDecimal</code> structure with a new specified precision.

**Table 15-43 (Cont.) OracleDecimal Static (Manipulation) Methods**

Methods	Description
<a href="#">Shift</a>	Returns a new OracleDecimal structure with its value set to that of the supplied OracleDecimal structure, and its decimal place shifted to the specified number of places to the right
<a href="#">Sign</a>	Determines the sign of an OracleDecimal structure
<a href="#">Sqrt</a>	Returns a new OracleDecimal structure with its value set to the square root of the supplied OracleDecimal structure
<a href="#">Subtract</a>	Returns a new OracleDecimal structure with its value set to result of subtracting one OracleDecimal structure from another
<a href="#">Truncate</a>	Truncates the OracleDecimal at a specified position

**OracleDecimal Static (Logarithmic) Methods**

The OracleDecimal static (logarithmic) methods are listed in [Table 15-44](#).

**Table 15-44 OracleDecimal Static (Logarithmic) Methods**

Methods	Description
<a href="#">Exp</a>	Returns a new OracleDecimal structure with its value set to e raised to the supplied power
<a href="#">Log</a>	Returns the supplied OracleDecimal structure with its value set to the logarithm of the supplied OracleDecimal structure (Overloaded)
<a href="#">Pow</a>	Returns a new OracleDecimal structure with its value set to the supplied OracleDecimal structure raised to the supplied power (Overloaded)

**OracleDecimal Static (Trigonometric) Methods**

The OracleDecimal static (trigonometric) methods are listed in [Table 15-45](#).

**Table 15-45 OracleDecimal Static (Trigonometric) Methods**

Methods	Description
<a href="#">Acos</a>	Returns an angle in radians whose cosine is the supplied OracleDecimal structure
<a href="#">Asin</a>	Returns an angle in radians whose sine is the supplied OracleDecimal structure
<a href="#">Atan</a>	Returns an angle in radians whose tangent is the supplied OracleDecimal structure
<a href="#">Atan2</a>	Returns an angle in radians whose tangent is the quotient of the two supplied OracleDecimal structures
<a href="#">Cos</a>	Returns the cosine of the supplied angle in radians
<a href="#">Sin</a>	Returns the sine of the supplied angle in radians
<a href="#">Tan</a>	Returns the tangent of the supplied angle in radians

**Table 15-45 (Cont.) OracleDecimal Static (Trigonometric) Methods**

Methods	Description
<a href="#">Cosh</a>	Returns the hyperbolic cosine of the supplied angle in radians
<a href="#">Sinh</a>	Returns the hyperbolic sine of the supplied angle in radians
<a href="#">Tanh</a>	Returns the hyperbolic tangent of the supplied angle in radians

**OracleDecimal Static (Comparison) Operators**

The `OracleDecimal` static (comparison) operators are listed in [Table 15-46](#).

**Table 15-46 OracleDecimal Static (Comparison) Operators**

Operator	Description
<a href="#">operator +</a>	Adds two <code>OracleDecimal</code> values
<a href="#">operator /</a>	Divides one <code>OracleDecimal</code> value by another
<a href="#">operator ==</a>	Determines if the two <code>OracleDecimal</code> values are equal
<a href="#">operator &gt;</a>	Determines if the first of two <code>OracleDecimal</code> values is greater than the second
<a href="#">operator &gt;=</a>	Determines if the first of two <code>OracleDecimal</code> values is greater than or equal to the second
<a href="#">operator !=</a>	Determines if the two <code>OracleDecimal</code> values are not equal
<a href="#">operator &lt;</a>	Determines if the first of two <code>OracleDecimal</code> values is less than the second
<a href="#">operator &lt;=</a>	Determines if the first of two <code>OracleDecimal</code> values is less than or equal to the second
<a href="#">operator *</a>	Multiplies two <code>OracleDecimal</code> structures
<a href="#">operator -</a>	Subtracts one <code>OracleDecimal</code> structure from another
<a href="#">operator -</a>	Negates an <code>OracleDecimal</code> structure
<a href="#">operator%</a>	Returns a new <code>OracleDecimal</code> structure with its value set to the modulus of two <code>OracleDecimal</code> structures.

**OracleDecimal Static Operators (Conversion from .NET Type to OracleDecimal)**

The `OracleDecimal` static operators (Conversion from .NET Type to `OracleDecimal`) are listed in [Table 15-47](#).

**Table 15-47 OracleDecimal Static Operators (Conversion from .NET Type to OracleDecimal)**

Operator	Description
<a href="#">implicit operator OracleDecimal</a>	Converts an instance value to an <code>OracleDecimal</code> structure (Overloaded)
<a href="#">explicit operator OracleDecimal</a>	Converts an instance value to an <code>OracleDecimal</code> structure (Overloaded)

## OracleDecimal Static Operators (Conversion from OracleDecimal to .NET)

The `OracleDecimal` static operators (Conversion from `OracleDecimal` to .NET) are listed in [Table 15-48](#).

**Table 15-48 OracleDecimal Static Operators (Conversion from OracleDecimal to .NET)**

Operator	Description
<a href="#">explicit operator byte</a>	Returns the <code>byte</code> representation of the <code>OracleDecimal</code> value
<a href="#">explicit operator decimal</a>	Returns the decimal representation of the <code>OracleDecimal</code> value
<a href="#">explicit operator double</a>	Returns the <code>double</code> representation of the <code>OracleDecimal</code> value
<a href="#">explicit operator short</a>	Returns the <code>short</code> representation of the <code>OracleDecimal</code> value
<a href="#">explicit operator int</a>	Returns the <code>int</code> representation of the <code>OracleDecimal</code> value
<a href="#">explicit operator long</a>	Returns the <code>long</code> representation of the <code>OracleDecimal</code> value
<a href="#">explicit operator float</a>	Returns the <code>float</code> representation of the <code>OracleDecimal</code> value

## OracleDecimal Properties

The `OracleDecimal` properties are listed in [Table 15-49](#).

**Table 15-49 OracleDecimal Properties**

Properties	Description
<a href="#">BinData</a>	Returns a byte array that represents the Oracle <code>NUMBER</code> in Oracle internal format
<a href="#">Format</a>	Specifies the format for <code>ToString()</code>
<a href="#">IsInt</a>	Indicates whether or not the current instance is an integer
<a href="#">IsNull</a>	Indicates whether or not the current instance has a null value
<a href="#">IsPositive</a>	Indicates whether or not the current instance is greater than 0
<a href="#">IsZero</a>	Indicates whether or not the current instance has a zero value
<a href="#">Value</a>	Returns a decimal value

## OracleDecimal Instance Methods

The `OracleDecimal` instance methods are listed in [Table 15-50](#).

**Table 15-50 OracleDecimal Instance Methods**

Method	Description
<a href="#">CompareTo</a>	Compares the current instance to the supplied object and returns an integer that represents their relative values
<a href="#">Equals</a>	Determines whether or not an object is an instance of <code>OracleDecimal</code> , and whether or not the value of the object is equal to the current instance (Overloaded)

Table 15-50 (Cont.) OracleDecimal Instance Methods

Method	Description
<a href="#">GetHashCode</a>	Returns a hash code for the current instance
<a href="#">GetType</a>	Inherited from <code>System.Object</code>
<a href="#">ToByte</a>	Returns the <code>byte</code> representation of the current instance
<a href="#">ToDouble</a>	Returns the <code>double</code> representation of the current instance
<a href="#">ToInt16</a>	Returns the <code>Int16</code> representation of the current instance
<a href="#">ToInt32</a>	Returns the <code>Int32</code> representation of the current instance
<a href="#">ToInt64</a>	Returns the <code>Int64</code> representation of the current instance
<a href="#">ToSingle</a>	Returns the <code>Single</code> representation of the current instance
<a href="#">ToString</a>	Overloads <code>Object.ToString()</code> Returns the <code>string</code> representation of the current instance

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Structure](#)

## OracleDecimal Constructors

The `OracleDecimal` constructors instantiate a new instance of the `OracleDecimal` structure.

**Overload List:**

- [OracleDecimal\(byte \[ \]\)](#)  
This constructor creates a new instance of the `OracleDecimal` structure and sets its value to the supplied byte array, which is in an Oracle `NUMBER` format.
- [OracleDecimal\(decimal\)](#)  
This constructor creates a new instance of the `OracleDecimal` structure and sets its value to the supplied `Decimal` value.
- [OracleDecimal\(double\)](#)  
This constructor creates a new instance of the `OracleDecimal` structure and sets its value to the supplied `double` value.
- [OracleDecimal\(int\)](#)  
This constructor creates a new instance of the `OracleDecimal` structure and sets its value to the supplied `Int32` value.
- [OracleDecimal\(float\)](#)

This constructor creates a new instance of the `OracleDecimal` structure and sets its value to the supplied `Single` value.

- [OracleDecimal\(long\)](#)

This constructor creates a new instance of the `OracleDecimal` structure and sets its value to the supplied `Int64` value.

- [OracleDecimal\(string\)](#)

This constructor creates a new instance of the `OracleDecimal` structure and sets its value to the supplied `string` value.

- [OracleDecimal\(string, string\)](#)

This constructor creates a new instance of the `OracleDecimal` structure with the supplied `string` value and number format.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## OracleDecimal(byte [ ])

This constructor creates a new instance of the `OracleDecimal` structure and sets its value to the supplied byte array, which is in an Oracle `NUMBER` format.

### Declaration

```
// C#  
public OracleDecimal(byte [] bytes);
```

### Parameters

- *bytes*

A byte array that represents an Oracle `NUMBER` in an internal Oracle format.

### Exceptions

`ArgumentException` - The *bytes* parameter is not in a internal Oracle `NUMBER` format or *bytes* has an invalid value.

`ArgumentNullException` - The *bytes* parameter is null.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## OracleDecimal(decimal)

This constructor creates a new instance of the `OracleDecimal` structure and sets its value to the supplied `Decimal` value.

### Declaration

```
// C#  
public OracleDecimal(decimal decX);
```

### Parameters

- `decX`  
The provided `Decimal` value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## OracleDecimal(double)

This constructor creates a new instance of the `OracleDecimal` structure and sets its value to the supplied `double` value.

### Declaration

```
// C#  
public OracleDecimal(double doubleX)
```

### Parameters

- `doubleX`  
The provided `double` value.

## Exceptions

`OverflowException` - The value of the supplied `double` is greater than the maximum value or less than the minimum value of `OracleDecimal`.

## Remarks

`OracleDecimal` contains the following values depending on the provided double value:

- `double.PositiveInfinity`: positive infinity value
- `double.NegativeInfinity`: negative infinity value.
- `double.NaN`: null value

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## OracleDecimal(int)

This constructor creates a new instance of the `OracleDecimal` structure and sets its value to the supplied `Int32` value.

## Declaration

```
// C#  
public OracleDecimal(int intX);
```

## Parameters

- `intX`  
The provided `Int32` value.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## OracleDecimal(float)

This constructor creates a new instance of the `OracleDecimal` structure and sets its value to the supplied `Single` value.

### Declaration

```
// C#  
public OracleDecimal(float floatX);
```

### Parameters

- `floatX`  
The provided `float` value.

### Remarks

`OracleDecimal` contains the following values depending on the provided `float` value:

`float.PositiveInfinity`: positive infinity value

`float.NegativeInfinity`: negative infinity value

`float.NaN`: null value



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## OracleDecimal(long)

This constructor creates a new instance of the `OracleDecimal` structure and sets its value to the supplied `Int64` value.

### Declaration

```
// C#  
public OracleDecimal(long longX);
```

### Parameters

- `longX`  
The provided `Int64` value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## OracleDecimal(string)

This constructor creates a new instance of the `OracleDecimal` structure and sets its value to the supplied `string` value.

### Declaration

```
// C#  
public OracleDecimal(string numStr);
```

### Parameters

- `numStr`

The provided `string` value.

### Exceptions

`ArgumentException` - The `numStr` parameter is an invalid string representation of an `OracleDecimal`.

`ArgumentNullException` - The `numStr` parameter is null.

`OverflowException` - The value of `numStr` is greater than the maximum value or less than the minimum value of `OracleDecimal`.

`input string format is incorrect` - The locale's numeric separator is a comma(,).

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)
- ["OracleGlobalization Class"](#)
- ["Globalization Support "](#)

## OracleDecimal(string, string)

This constructor creates a new instance of the `OracleDecimal` structure with the supplied `string` value and number format.

### Declaration

```
// C#  
public OracleDecimal(string numStr, string format);
```

### Parameters

- `numStr`  
The provided `string` value.
- `format`  
The provided number `format`.

### Exceptions

`ArgumentException` - The `numStr` parameter is an invalid string representation of an `OracleDecimal` or the `numStr` is not in the numeric format specified by `format`.

`ArgumentNullException` - The `numStr` parameter is null.

`OverflowException` - The value of `numStr` parameter is greater than the maximum value or less than the minimum value of `OracleDecimal`.

### Remarks

If the numeric format includes decimal and group separators, then the provided string must use those characters defined by the `OracleGlobalization.NumericCharacters` of the thread.

If the numeric format includes the currency symbol, ISO currency symbol, or the dual currency symbol, then the provided string must use those symbols defined by the `OracleGlobalization.Currency`, `OracleGlobalization.ISOCurrency`, and `OracleGlobalization.DualCurrency` properties respectively.

### Example

```
// C#  
  
using System;  
using Oracle.DataAccess.Client;  
using Oracle.DataAccess.Types;  
  
class OracleDecimalSample  
{  
    static void Main(string[] args)  
    {  
        // Set the nls parameters related to currency  
        OracleGlobalization info = OracleGlobalization.GetClientInfo();  
        info.Currency = "$";  
        info.NumericCharacters = ".,";  
        OracleGlobalization.SetThreadInfo(info);  
    }  
}
```

```
// Construct an OracleDecimal using a valid numeric format
OracleDecimal dec = new OracleDecimal("$2,222.22", "L9G999D99");

// Print "$2,222.22"
Console.WriteLine(dec.ToString());
}
}
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)
- ["OracleGlobalization Class"](#)
- ["Globalization Support "](#)

## OracleDecimal Static Fields

The `OracleDecimal` static fields are listed in [Table 15-51](#).

**Table 15-51 OracleDecimal Static Fields**

Field	Description
<a href="#">MaxPrecision</a>	A constant representing the maximum precision, which is 38
<a href="#">MaxScale</a>	A constant representing the maximum scale, which is 127
<a href="#">MaxValue</a>	A constant representing the maximum value for this structure, which is $9.9\dots9 \times 10^{125}$
<a href="#">MinScale</a>	A constant representing the minimum scale, which is -84
<a href="#">MinValue</a>	A constant representing the minimum value for this structure, which is $-1.0 \times 10^{130}$
<a href="#">NegativeOne</a>	A constant representing the negative one value
<a href="#">Null</a>	Represents a null value that can be assigned to an <code>OracleDecimal</code> instance
<a href="#">One</a>	A constant representing the positive one value
<a href="#">Pi</a>	A constant representing the numeric Pi value
<a href="#">Zero</a>	A constant representing the zero value

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## MaxPrecision

This static field represents the maximum precision, which is 38.

### Declaration

```
// C#  
public static readonly byte MaxPrecision;
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## MaxScale

This static field a constant representing the maximum scale, which is 127.

### Declaration

```
// C#  
public static readonly byte MaxScale;
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## MaxValue

This static field indicates a constant representing the maximum value for this structure, which is  $9.9\dots9 \times 10^{125}$  (38 nines followed by 88 zeroes).

**Declaration**

```
// C#  
public static readonly OracleDecimal MaxValue;
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## MinScale

This static field indicates a constant representing the maximum scale, which is -84.

**Declaration**

```
// C#  
public static readonly int MinScale;
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## MinValue

This static field indicates a constant representing the minimum value for this structure, which is  $-1.0 \times 10^{130}$ .

**Declaration**

```
// C#  
public static readonly OracleDecimal MinValue;
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## NegativeOne

This static field indicates a constant representing the negative one value.

### Declaration

```
// C#  
public static readonly OracleDecimal NegativeOne;
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Null

This static field represents a null value that can be assigned to an `OracleDecimal` instance.

### Declaration

```
// C#  
public static readonly OracleDecimal Null;
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## One

This static field indicates a constant representing the positive one value.

**Declaration**

```
// C#  
public static readonly OracleDecimal One;
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Pi

This static field indicates a constant representing the numeric Pi value.

**Declaration**

```
// C#  
public static readonly OracleDecimal Pi;
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Zero

This static field indicates a constant representing the zero value.

**Declaration**

```
// C#  
public static readonly OracleDecimal Zero;
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## OracleDecimal Static (Comparison) Methods

The `OracleDecimal` static (comparison) methods are listed in [Table 15-52](#).

**Table 15-52 OracleDecimal Static (Comparison) Methods**

Methods	Description
<a href="#">Equals</a>	Determines if two <code>OracleDecimal</code> values are equal (Overloaded)
<a href="#">GreaterThan</a>	Determines if the first of two <code>OracleDecimal</code> values is greater than the second
<a href="#">GreaterThanOrEqual</a>	Determines if the first of two <code>OracleDecimal</code> values is greater than or equal to the second
<a href="#">LessThan</a>	Determines if the first of two <code>OracleDecimal</code> values is less than the second
<a href="#">LessThanOrEqual</a>	Determines if the first of two <code>OracleDecimal</code> values is less than or equal to the second.
<a href="#">NotEquals</a>	Determines if two <code>OracleDecimal</code> values are not equal



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Equals

This method determines if two `OracleDecimal` values are equal.

### Declaration

```
// C#  
public static bool Equals(OracleDecimal value1, OracleDecimal value2);
```

### Parameters

- `value1`  
The first `OracleDecimal`.
- `value2`  
The second `OracleDecimal`.

### Return Value

Returns `true` if two `OracleDecimal` values are equal; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleDecimal` that has a value compares greater than an `OracleDecimal` that has a null value.
- Two `OracleDecimals` that contain a null value are equal.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## GreaterThan

This method determines if the first of two `OracleDecimal` values is greater than the second.

### Declaration

```
// C#  
public static bool GreaterThan(OracleDecimal value1, OracleDecimal value2);
```

### Parameters

- `value1`  
The first `OracleDecimal`.
- `value2`  
The second `OracleDecimal`.

### Return Value

Returns `true` if the first of two `OracleDecimal` values is greater than the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleDecimal` that has a value compares greater than an `OracleDecimal` that has a null value.
- Two `OracleDecimals` that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## GreaterThanOrEqual

This method determines if the first of two `OracleDecimal` values is greater than or equal to the second.

### Declaration

```
// C#  
public static bool GreaterThanOrEqual(OracleDecimal value1, OracleDecimal  
value2);
```

### Parameters

- `value1`  
The first `OracleDecimal`.
- `value2`  
The second `OracleDecimal`.

### Return Value

Returns `true` if the first of two `OracleDecimal` values is greater than or equal to the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleDecimal` that has a value compares greater than an `OracleDecimal` that has a null value.
- Two `OracleDecimals` that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## LessThan

This method determines if the first of two `OracleDecimal` values is less than the second.

### Declaration

```
// C#  
public static bool LessThan(OracleDecimal value1, OracleDecimal value2);
```

### Parameters

- `value1`  
The first `OracleDecimal`.
- `value2`  
The second `OracleDecimal`.

### Return Value

Returns `true` if the first of two `OracleDecimal` values is less than the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleDecimal` that has a value compares greater than an `OracleDecimal` that has a null value.
- Two `OracleDecimals` that contain a null value are equal.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## LessThanOrEqual

This method determines if the first of two `OracleDecimal` values is less than or equal to the second.

### Declaration

```
// C#  
public static bool LessThanOrEqual(OracleDecimal value1, OracleDecimal value2);
```

### Parameters

- `value1`

The first `OracleDecimal`.

- `value2`

The second `OracleDecimal`.

### Return Value

Returns `true` if the first of two `OracleDecimal` values is less than or equal to the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleDecimal` that has a value compares greater than an `OracleDecimal` that has a null value.
- Two `OracleDecimals` that contain a null value are equal.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## NotEquals

This method determines if two `OracleDecimal` values are not equal.

### Declaration

```
// C#  
public static bool NotEquals(OracleDecimal value1, OracleDecimal value2);
```

### Parameters

- `value1`  
The first `OracleDecimal`.
- `value2`  
The second `OracleDecimal`.

### Return Value

Returns `true` if two `OracleDecimal` values are not equal; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleDecimal` that has a value compares greater than an `OracleDecimal` that has a null value.

- Two OracleDecimals that contain a null value are equal.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## OracleDecimal Static (Manipulation) Methods

The `OracleDecimal` static (manipulation) methods are listed in [Table 15-53](#).

**Table 15-53 OracleDecimal Static (Manipulation) Methods**

Methods	Description
<a href="#">Abs</a>	Returns the absolute value of an <code>OracleDecimal</code>
<a href="#">Add</a>	Adds two <code>OracleDecimal</code> structures
<a href="#">AdjustScale</a>	Returns a new <code>OracleDecimal</code> with the specified number of digits and indicates whether or not to round or truncate the number if the scale is less than original
<a href="#">Ceiling</a>	Returns a new <code>OracleDecimal</code> structure with its value set to the ceiling of an <code>OracleDecimal</code> structure
<a href="#">ConvertToPrecScale</a>	Returns a new <code>OracleDecimal</code> structure with a new precision and scale
<a href="#">Divide</a>	Divides one <code>OracleDecimal</code> value by another
<a href="#">Floor</a>	Returns a new <code>OracleDecimal</code> structure with its value set to the floor of an <code>OracleDecimal</code> structure
<a href="#">Max</a>	Returns the maximum value of the two supplied <code>OracleDecimal</code> structures
<a href="#">Min</a>	Returns the minimum value of the two supplied <code>OracleDecimal</code> structures
<a href="#">Mod</a>	Returns a new <code>OracleDecimal</code> structure with its value set to the modulus of two <code>OracleDecimal</code> structures
<a href="#">Multiply</a>	Returns a new <code>OracleDecimal</code> structure with its value set to the result of multiplying two <code>OracleDecimal</code> structures
<a href="#">Negate</a>	Returns a new <code>OracleDecimal</code> structure with its value set to the negation of the supplied <code>OracleDecimal</code> structure
<a href="#">Parse</a>	Converts a string to an <code>OracleDecimal</code>
<a href="#">Round</a>	Returns a new <code>OracleDecimal</code> structure with its value set to that of the supplied <code>OracleDecimal</code> structure and rounded off to the specified place
<a href="#">SetPrecision</a>	Returns a new <code>OracleDecimal</code> structure with a new specified precision.

Table 15-53 (Cont.) OracleDecimal Static (Manipulation) Methods

Methods	Description
<a href="#">Shift</a>	Returns a new <code>OracleDecimal</code> structure with its value set to that of the supplied <code>OracleDecimal</code> structure, and its decimal place shifted to the specified number of places to the right
<a href="#">Sign</a>	Determines the sign of an <code>OracleDecimal</code> structure
<a href="#">Sqrt</a>	Returns a new <code>OracleDecimal</code> structure with its value set to the square root of the supplied <code>OracleDecimal</code> structure
<a href="#">Subtract</a>	Returns a new <code>OracleDecimal</code> structure with its value set to result of subtracting one <code>OracleDecimal</code> structure from another
<a href="#">Truncate</a>	Truncates the <code>OracleDecimal</code> at a specified position

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Abs

This method returns the absolute value of an `OracleDecimal`.

**Declaration**

```
// C#  
public static OracleDecimal Abs(OracleDecimal val);
```

**Parameters**

- `val`  
An `OracleDecimal`.

**Return Value**

The absolute value of an `OracleDecimal`.

**Remarks**

If either argument has a null value, the returned `OracleDecimal` has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Add

This method adds two `OracleDecimal` structures.

### Declaration

```
// C#  
public static OracleDecimal Add(OracleDecimal val1, OracleDecimal val2);
```

### Parameters

- `val1`  
The first `OracleDecimal`.
- `val2`  
The second `OracleDecimal`.

### Return Value

Returns an `OracleDecimal` structure.

### Remarks

If either argument has a null value, the returned `OracleDecimal` has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## AdjustScale

This method returns a new `OracleDecimal` with the specified number of digits and indicates whether or not to round or truncate the number if the scale is less than the original.

## Declaration

```
// C#
public static OracleDecimal AdjustScale(OracleDecimal val, int digits,
    bool fRound);
```

## Parameters

- *val*  
An OracleDecimal.
- *digits*  
The number of digits.
- *fRound*  
Indicates whether or not to round or truncate the number. Setting it to `true` rounds the number and setting it to `false` truncates the number.

## Return Value

An OracleDecimal.

## Remarks

If the supplied OracleDecimal has a null value, the returned OracleDecimal has a null value.

## Example

```
// C#

using System;
using Oracle.DataAccess.Types;

class AdjustScaleSample
{
    static void Main(string[] args)
    {
        OracleDecimal dec1 = new OracleDecimal(5.555);

        // Adjust Scale to 2 with rounding off
        OracleDecimal dec2 = OracleDecimal.AdjustScale(dec1, 2, true);

        // Prints 5.56
        Console.WriteLine(dec2.ToString());

        // Adjust Scale to 2 with truncation
        OracleDecimal dec3 = OracleDecimal.AdjustScale(dec1, 2, false);

        // Prints 5.55
        Console.WriteLine(dec3.ToString());
    }
}
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Ceiling

This method returns a new `OracleDecimal` structure with its value set to the ceiling of the supplied `OracleDecimal`.

### Declaration

```
// C#  
public static OracleDecimal Ceiling(OracleDecimal val);
```

### Parameters

- `val`  
An `OracleDecimal`.

### Return Value

A new `OracleDecimal` structure.

### Remarks

If either argument has a null value, the returned `OracleDecimal` has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## ConvertToPrecScale

This method returns a new `OracleDecimal` structure with a new precision and scale.

### Declaration

```
// C#  
public static OracleDecimal ConvertToPrecScale(OracleDecimal val  
    int precision, int scale);
```

### Parameters

- *val*  
An OracleDecimal structure.
- *precision*  
The precision. Range of precision is 1 to 38.
- *scale*  
The number of digits to the right of the decimal point. Range of scale is -84 to 127.

### Return Value

A new OracleDecimal structure.

### Remarks

If the supplied OracleDecimal has a null value, the returned OracleDecimal has a null value.

### Example

```
// C#  
  
using System;  
using Oracle.DataAccess.Types;  
  
class ConvertToPrecScaleSample  
{  
    static void Main(string[] args)  
    {  
        OracleDecimal dec1 = new OracleDecimal(555.6666);  
  
        // Set the precision of od to 5 and scale to 2  
        OracleDecimal dec2 = OracleDecimal.ConvertToPrecScale(dec1,5,2);  
  
        // Prints 555.67  
        Console.WriteLine(dec2.ToString());  
  
        // Set the precision of od to 3 and scale to 0  
        OracleDecimal dec3 = OracleDecimal.ConvertToPrecScale(dec1,3,0);  
  
        // Prints 556  
        Console.WriteLine(dec3.ToString());  
    }  
}
```



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Divide

This method divides one `OracleDecimal` value by another.

### Declaration

```
// C#  
public static OracleDecimal Divide(OracleDecimal val1, OracleDecimal val2);
```

### Parameters

- `val1`  
An `OracleDecimal`.
- `val2`  
An `OracleDecimal`.

### Return Value

A new `OracleDecimal` structure.

### Remarks

If either argument has a null value, the returned `OracleDecimal` has a null value.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Floor

This method returns a new `OracleDecimal` structure with its value set to the floor of the supplied `OracleDecimal` structure.

### Declaration

```
// C#  
public static OracleDecimal Floor(OracleDecimal val);
```

### Parameters

- `val`  
An `OracleDecimal` structure.

### Return Value

A new `OracleDecimal` structure.

### Remarks

If either argument has a null value, the returned `OracleDecimal` has a null value.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Max

This method returns the maximum value of the two supplied `OracleDecimal` structures.

### Declaration

```
// C#  
public static OracleDecimal Max(OracleDecimal val1, OracleDecimal val2);
```

### Parameters

- `val1`  
An `OracleDecimal` structure.
- `val2`  
An `OracleDecimal` structure.

### Return Value

An `OracleDecimal` structure that has the greater value.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Min

This method returns the minimum value of the two supplied `OracleDecimal` structures.

**Declaration**

```
// C#  
public static OracleDecimal Min(OracleDecimal val1, OracleDecimal val2);
```

**Parameters**

- *val1*  
An OracleDecimal structure.
- *val2*  
An OracleDecimal structure.

**Return Value**

An OracleDecimal structure that has the smaller value.

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Mod

This method returns a new OracleDecimal structure with its value set to the modulus of two OracleDecimal structures.

**Declaration**

```
// C#  
public static OracleDecimal Mod(OracleDecimal val1, OracleDecimal divider);
```

**Parameters**

- *val1*  
An OracleDecimal structure.
- *divider*  
An OracleDecimal structure.

**Return Value**

An OracleDecimal.

**Remarks**

If either argument has a null value, the returned OracleDecimal has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Multiply

This method returns a new `OracleDecimal` structure with its value set to the result of multiplying two `OracleDecimal` structures.

### Declaration

```
// C#  
public static OracleDecimal Multiply(OracleDecimal val1, OracleDecimal val2);
```

### Parameters

- `val1`  
An `OracleDecimal` structure.
- `val2`  
An `OracleDecimal` structure.

### Return Value

A new `OracleDecimal` structure.

### Remarks

If either argument has a null value, the returned `OracleDecimal` has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Negate

This method returns a new `OracleDecimal` structure with its value set to the negation of the supplied `OracleDecimal` structures.

## Declaration

```
// C#  
public static OracleDecimal Negate(OracleDecimal val);
```

## Parameters

- *val*  
An OracleDecimal structure.

## Return Value

A new OracleDecimal structure.

## Remarks

If either argument has a null value, the returned OracleDecimal has a null value.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Parse

This method converts a string to an OracleDecimal.

## Declaration

```
// C#  
public static OracleDecimal Parse (string str);
```

## Parameters

- *str*  
The string being converted.

## Return Value

A new OracleDecimal structure.

## Exceptions

ArgumentException - The *numStr* parameter is an invalid string representation of an OracleDecimal.

ArgumentNullException - The *numStr* parameter is null.

OverflowException - The value of *numStr* is greater than the maximum value or less than the minimum value of OracleDecimal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)
- ["OracleGlobalization Class"](#)
- ["Globalization Support "](#)

## Round

This method returns a new `OracleDecimal` structure with its value set to that of the supplied `OracleDecimal` structure and rounded off to the specified place.

### Declaration

```
// C#  
public static OracleDecimal Round(OracleDecimal val, int decplace);
```

### Parameters

- *val*  
An `OracleDecimal` structure.
- *decplace*  
The specified decimal place. If the value is positive, the function rounds the `OracleDecimal` structure to the right of the decimal point. If the value is negative, the function rounds to the left of the decimal point.

### Return Value

An `OracleDecimal` structure.

### Remarks

If the supplied `OracleDecimal` structure has a null value, the returned `OracleDecimal` has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## SetPrecision

This method returns a new `OracleDecimal` structure with a new specified precision.

### Declaration

```
// C#  
public static OracleDecimal SetPrecision(OracleDecimal val, int precision);
```

### Parameters

- *val*  
An `OracleDecimal` structure.
- *precision*  
The specified precision. Range of precision is 1 to 38.

### Return Value

An `OracleDecimal` structure.

### Remarks

The returned `OracleDecimal` is rounded off if the specified precision is smaller than the precision of *val*.

If *val* has a null value, the returned `OracleDecimal` has a null value.

### Example

```
// C#  
  
using System;  
using Oracle.DataAccess.Types;  
  
class SetPrecisionSample  
{  
    static void Main(string[] args)  
    {  
        OracleDecimal dec1 = new OracleDecimal(555.6666);  
  
        // Set the precision of dec1 to 3  
        OracleDecimal dec2 = OracleDecimal.SetPrecision(dec1, 3);  
  
        // Prints 556  
        Console.WriteLine(dec2.ToString());  
  
        // Set the precision of dec1 to 4  
        OracleDecimal dec3 = OracleDecimal.SetPrecision(dec1, 4);  
  
        // Prints 555.7  
        Console.WriteLine(dec3.ToString());  
    }  
}
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces""Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Shift

This method returns a new `OracleDecimal` structure with its value set to that of the supplied `OracleDecimal` structure, and its decimal place shifted to the specified number of places to the right.

### Declaration

```
// C#  
public static OracleDecimal Shift(OracleDecimal val, int decplaces);
```

### Parameters

- *val*  
An `OracleDecimal` structure.
- *decplaces*  
The specified number of places to be shifted.

### Return Value

An `OracleDecimal` structure.

### Remarks

If the supplied `OracleDecimal` structure has a null value, the returned `OracleDecimal` has a null value.

If *decplaces* is negative, the shift is to the left.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Sign

This method determines the sign of an `OracleDecimal` structure.

### Declaration

```
// C#  
public static int Sign(OracleDecimal val);
```

### Parameters

- `val`  
An `OracleDecimal` structure.

### Return Value

- -1: if the supplied `OracleDecimal` < 0
- 0: if the supplied `OracleDecimal` == 0
- 1: if the supplied `OracleDecimal` > 0

### Exceptions

`OracleNullValueException` - The argument has a null value.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Sqrt

This method returns a new `OracleDecimal` structure with its value set to the square root of the supplied `OracleDecimal` structure.

### Declaration

```
// C#  
public static OracleDecimal Sqrt(OracleDecimal val);
```

### Parameters

- `val`  
An `OracleDecimal` structure.

### Return Value

An `OracleDecimal` structure.

### Exceptions

`ArgumentOutOfRangeException` - The provided `OracleDecimal` structure is less than zero.

### Remarks

If either argument has a null value, the returned `OracleDecimal` has a null value.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Subtract

This method returns a new `OracleDecimal` structure with its value set to result of subtracting one `OracleDecimal` structure from another.

### Declaration

```
// C#  
public static OracleDecimal Subtract(OracleDecimal val1, OracleDecimal val2);
```

### Parameters

- `val1`  
An `OracleDecimal` structure.
- `val2`  
An `OracleDecimal` structure.

### Return Value

An `OracleDecimal` structure.

### Remarks

If either argument has a null value, the returned `OracleDecimal` has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Truncate

This method truncates the `OracleDecimal` at a specified position.

### Declaration

```
// C#  
public static OracleDecimal Truncate(OracleDecimal val, int pos);
```

### Parameters

- *val*  
An `OracleDecimal` structure.
- *pos*  
The specified position. If the value is positive, the function truncates the `OracleDecimal` structure to the right of the decimal point. If the value is negative, it truncates the `OracleDecimal` structure to the left of the decimal point.

### Return Value

An `OracleDecimal` structure.

### Remarks

If the supplied `OracleDecimal` structure has a null value, the returned `OracleDecimal` has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## OracleDecimal Static (Logarithmic) Methods

The `OracleDecimal` static (logarithmic) methods are listed in [Table 15-54](#).

**Table 15-54 OracleDecimal Static (Logarithmic) Methods**

Methods	Description
<a href="#">Exp</a>	Returns a new <code>OracleDecimal</code> structure with its value set to e raised to the supplied power
<a href="#">Log</a>	Returns the supplied <code>OracleDecimal</code> structure with its value set to the logarithm of the supplied <code>OracleDecimal</code> structure (Overloaded)
<a href="#">Pow</a>	Returns a new <code>OracleDecimal</code> structure with its value set to the supplied <code>OracleDecimal</code> structure raised to the supplied power (Overloaded)

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Exp

This method returns a new `OracleDecimal` structure with its value set to e raised to the supplied `OracleDecimal`.

### Declaration

```
// C#  
public static OracleDecimal Exp(OracleDecimal val);
```

### Parameters

- `val`  
An `OracleDecimal` structure.

### Return Value

An `OracleDecimal` structure.

### Remarks

If either argument has a null value, the returned `OracleDecimal` has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Log

Log returns the supplied `OracleDecimal` structure with its value set to the logarithm of the supplied `OracleDecimal` structure.

**Overload List:**

- [Log\(OracleDecimal\)](#)  
This method returns a new `OracleDecimal` structure with its value set to the natural logarithm (base e) of the supplied `OracleDecimal` structure.
- [Log\(OracleDecimal, int\)](#)  
This method returns the supplied `OracleDecimal` structure with its value set to the logarithm of the supplied `OracleDecimal` structure in the supplied base.
- [Log\(OracleDecimal, OracleDecimal\)](#)  
This method returns the supplied `OracleDecimal` structure with its value set to the logarithm of the supplied `OracleDecimal` structure in the supplied base.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Log(OracleDecimal)

This method returns a new `OracleDecimal` structure with its value set to the natural logarithm (base e) of the supplied `OracleDecimal` structure.

**Declaration**

```
// C#  
public static OracleDecimal Log(OracleDecimal val);
```

**Parameters**

- *val*

An `OracleDecimal` structure whose logarithm is to be calculated.

### Return Value

Returns a new `OracleDecimal` structure with its value set to the natural logarithm (base e) of *val*.

### Exceptions

`ArgumentOutOfRangeException` - The supplied `OracleDecimal` value is less than zero.

### Remarks

If the supplied `OracleDecimal` structure has a null value, the returned `OracleDecimal` has a null value.

If the supplied `OracleDecimal` structure has zero value, the result is undefined, and the returned `OracleDecimal` structure has a null value.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Log(OracleDecimal, int)

This method returns the supplied `OracleDecimal` structure with its value set to the logarithm of the supplied `OracleDecimal` structure in the supplied base.

### Declaration

```
// C#  
public static OracleDecimal Log(OracleDecimal val, int logBase);
```

### Parameters

- *val*  
An `OracleDecimal` structure whose logarithm is to be calculated.
- *logBase*  
An `int` that specifies the base of the logarithm.

### Return Value

A new `OracleDecimal` structure with its value set to the logarithm of *val* in the supplied base.

### Exceptions

`ArgumentOutOfRangeException` - Either argument is less than zero.

### Remarks

If either argument has a null value, the returned `OracleDecimal` has a null value.

If both arguments have zero value, the result is undefined, and the returned `OracleDecimal` structure has a null value.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Log(OracleDecimal, OracleDecimal)

This method returns the supplied `OracleDecimal` structure with its value set to the logarithm of the supplied `OracleDecimal` structure in the supplied base.

### Declaration

```
// C#  
public static OracleDecimal Log(OracleDecimal val, OracleDecimal logBase);
```

### Parameters

- *val*  
An `OracleDecimal` structure whose logarithm is to be calculated.
- *logBase*  
An `OracleDecimal` structure that specifies the base of the logarithm.

### Return Value

Returns the logarithm of *val* in the supplied base.

### Exceptions

`ArgumentOutOfRangeException` - Either the *val* or *logBase* parameter is less than zero.

### Remarks

If either argument has a null value, the returned `OracleDecimal` has a null value.

If both arguments have zero value, the result is undefined, and the returned `OracleDecimal` structure has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Pow

`Pow` returns a new `OracleDecimal` structure with its value set to the supplied `OracleDecimal` structure raised to the supplied power.

### Overload List:

- [Pow\(OracleDecimal, int\)](#)  
This method returns a new `OracleDecimal` structure with its value set to the supplied `OracleDecimal` value raised to the supplied `Int32` power.
- [Pow\(OracleDecimal, OracleDecimal\)](#)  
This method returns a new `OracleDecimal` structure with its value set to the supplied `OracleDecimal` structure raised to the supplied `OracleDecimal` power.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Pow(OracleDecimal, int)

This method returns a new `OracleDecimal` structure with its value set to the supplied `OracleDecimal` value raised to the supplied `Int32` power.

### Declaration

```
// C#  
public static OracleDecimal Pow(OracleDecimal val, int power);
```

### Parameters

- `val`  
An `OracleDecimal` structure.
- `power`  
An `int` value that specifies the power.

**Return Value**

An `OracleDecimal` structure.

**Remarks**

If the supplied `OracleDecimal` structure has a null value, the returned `OracleDecimal` has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Pow(OracleDecimal, OracleDecimal)

This method returns a new `OracleDecimal` structure with its value set to the supplied `OracleDecimal` structure raised to the supplied `OracleDecimal` power.

**Declaration**

```
// C#  
public static OracleDecimal Pow(OracleDecimal val, OracleDecimal power);
```

**Parameters**

- *val*  
An `OracleDecimal` structure.
- *power*  
An `OracleDecimal` structure that specifies the power.

**Return Value**

An `OracleDecimal` structure.

**Remarks**

If the supplied `OracleDecimal` structure has a null value, the returned `OracleDecimal` has a null value.

 See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## OracleDecimal Static (Trigonometric) Methods

The `OracleDecimal` static (trigonometric) methods are listed in [Table 15-55](#).

**Table 15-55 OracleDecimal Static (Trigonometric) Methods**

Methods	Description
<a href="#">Acos</a>	Returns an angle in radians whose cosine is the supplied <code>OracleDecimal</code> structure
<a href="#">Asin</a>	Returns an angle in radians whose sine is the supplied <code>OracleDecimal</code> structure
<a href="#">Atan</a>	Returns an angle in radians whose tangent is the supplied <code>OracleDecimal</code> structure
<a href="#">Atan2</a>	Returns an angle in radians whose tangent is the quotient of the two supplied <code>OracleDecimal</code> structures
<a href="#">Cos</a>	Returns the cosine of the supplied angle in radians
<a href="#">Sin</a>	Returns the sine of the supplied angle in radians
<a href="#">Tan</a>	Returns the tangent of the supplied angle in radians
<a href="#">Cosh</a>	Returns the hyperbolic cosine of the supplied angle in radians
<a href="#">Sinh</a>	Returns the hyperbolic sine of the supplied angle in radians
<a href="#">Tanh</a>	Returns the hyperbolic tangent of the supplied angle in radians

 See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

### ACOS

This method returns an angle in radians whose cosine is the supplied `OracleDecimal` structure.

**Declaration**

```
// C#  
public static OracleDecimal Acos(OracleDecimal val);
```

**Parameters**

- *val*  
An OracleDecimal structure. Range is (-1 to 1).

**Return Value**

An OracleDecimal structure that represents an angle in radians.

**Remarks**

If either argument has a null value, the returned OracleDecimal has a null value.

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Asin

This method returns an angle in radians whose sine is the supplied OracleDecimal structure.

**Declaration**

```
// C#  
public static OracleDecimal Asin(OracleDecimal val);
```

**Parameters**

- *val*  
An OracleDecimal structure. Range is (-1 to 1).

**Return Value**

An OracleDecimal structure that represents an angle in radians.

**Remarks**

If either argument has a null value, the returned OracleDecimal has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Atan

This method returns an angle in radians whose tangent is the supplied `OracleDecimal` structure

### Declaration

```
// C#  
public static OracleDecimal Atan(OracleDecimal val);
```

### Parameters

- `val`  
An `OracleDecimal`.

### Return Value

An `OracleDecimal` structure that represents an angle in radians.

### Remarks

If the argument has a null value, the returned `OracleDecimal` has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Atan2

This method returns an angle in radians whose tangent is the quotient of the two supplied `OracleDecimal` structures.

### Declaration

```
// C#  
public static OracleDecimal Atan2(OracleDecimal val1, OracleDecimal val2);
```

**Parameters**

- *val1*  
An `OracleDecimal` structure that represents the y-coordinate.
- *val2*  
An `OracleDecimal` structure that represents the x-coordinate.

**Return Value**

An `OracleDecimal` structure that represents an angle in radians.

**Remarks**

If either argument has a null value, the returned `OracleDecimal` has a null value.

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Cos

This method returns the cosine of the supplied angle in radians.

**Declaration**

```
// C#  
public static OracleDecimal Cos(OracleDecimal val);
```

**Parameters**

- *val*  
An `OracleDecimal` structure that represents an angle in radians.

**Return Value**

An `OracleDecimal` instance.

**Exceptions**

`ArgumentOutOfRangeException` - The *val* parameter is positive or negative infinity.

**Remarks**

If either argument has a null value, the returned `OracleDecimal` has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Sin

This method returns the sine of the supplied angle in radians.

### Declaration

```
// C#  
public static OracleDecimal Sin(OracleDecimal val);
```

### Parameters

- *val*  
An OracleDecimal structure.

### Return Value

An OracleDecimal structure that represents an angle in radians.

### Exceptions

*ArgumentOutOfRangeException* - The *val* parameter is positive or negative infinity.

### Remarks

If either argument has a null value, the returned OracleDecimal has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Tan

This method returns the tangent of the supplied angle in radians.

### Declaration

```
// C#  
public static OracleDecimal Tan(OracleDecimal val);
```

### Parameters

- `val`  
An `OracleDecimal` structure that represents an angle in radians.

### Return Value

An `OracleDecimal` instance.

### Exceptions

`ArgumentOutOfRangeException` - The `val` parameter is positive or negative infinity.

### Remarks

If either argument has a null value, the returned `OracleDecimal` has a null value.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Cosh

This method returns the hyperbolic cosine of the supplied angle in radians.

### Declaration

```
// C#  
public static OracleDecimal Cosh(OracleDecimal val);
```

### Parameters

- `val`  
An `OracleDecimal` structure that represents an angle in radians.

### Return Value

An `OracleDecimal` instance.

### Remarks

If either argument has a null value, the returned `OracleDecimal` has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Sinh

This method returns the hyperbolic sine of the supplied angle in radians.

### Declaration

```
// C#  
public static OracleDecimal Sinh(OracleDecimal val);
```

### Parameters

- *val*  
An `OracleDecimal` structure that represents an angle in radians.

### Return Value

An `OracleDecimal` instance.

### Remarks

If either argument has a null value, the returned `OracleDecimal` has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Tanh

This method returns the hyperbolic tangent of the supplied angle in radians.

### Declaration

```
// C#  
public static OracleDecimal Tanh(OracleDecimal val);
```

### Parameters

- *val*

An `OracleDecimal` structure that represents an angle in radians.

### Return Value

An `OracleDecimal` instance.

### Remarks

If either argument has a null value, the returned `OracleDecimal` has a null value.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## OracleDecimal Static (Comparison) Operators

The `OracleDecimal` static (comparison) operators are listed in [Table 15-56](#).

**Table 15-56 OracleDecimal Static (Comparison) Operators**

Operator	Description
<code>operator +</code>	Adds two <code>OracleDecimal</code> values
<code>operator /</code>	Divides one <code>OracleDecimal</code> value by another
<code>operator ==</code>	Determines if the two <code>OracleDecimal</code> values are equal
<code>operator &gt;</code>	Determines if the first of two <code>OracleDecimal</code> values is greater than the second
<code>operator &gt;=</code>	Determines if the first of two <code>OracleDecimal</code> values is greater than or equal to the second
<code>operator !=</code>	Determines if the two <code>OracleDecimal</code> values are not equal
<code>operator &lt;</code>	Determines if the first of two <code>OracleDecimal</code> values is less than the second
<code>operator &lt;=</code>	Determines if the first of two <code>OracleDecimal</code> values is less than or equal to the second
<code>operator *</code>	Multiplies two <code>OracleDecimal</code> structures
<code>operator -</code>	Subtracts one <code>OracleDecimal</code> structure from another
<code>operator -</code>	Negates an <code>OracleDecimal</code> structure
<code>operator %</code>	Returns a new <code>OracleDecimal</code> structure with its value set to the modulus of two <code>OracleDecimal</code> structures.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## operator +

This method adds two `OracleDecimal` values.

### Declaration

```
// C#  
public static OracleDecimal operator + (OracleDecimal val1, OracleDecimal val2);
```

### Parameters

- `val1`  
The first `OracleDecimal`.
- `val2`  
The second `OracleDecimal`.

### Return Value

An `OracleDecimal` structure.

### Remarks

If either operand has a null value, the returned `OracleDecimal` has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## operator /

This method divides one `OracleDecimal` value by another.

### Declaration

```
/ C#  
public static OracleDecimal operator / (OracleDecimal val1, OracleDecimal val2)
```

### Parameters

- *val1*  
The first OracleDecimal.
- *val2*  
The second OracleDecimal.

### Return Value

An OracleDecimal structure.

### Remarks

If either operand has a null value, the returned OracleDecimal has a null value.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## operator ==

This method determines if two OracleDecimal values are equal.

### Declaration

```
// C#  
public static bool operator == (OracleDecimal val1, OracleDecimal val2);
```

### Parameters

- *val1*  
The first OracleDecimal.
- *val2*  
The second OracleDecimal.

### Return Value

Returns true if their values are equal; otherwise, returns false.

### Remarks

The following rules apply to the behavior of this method.

- Any OracleDecimal that has a value compares greater than an OracleDecimal that has a null value.

- Two OracleDecimals that contain a null value are equal.

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## operator >

This method determines if the first of two OracleDecimal values is greater than the second.

### Declaration

```
// C#  
public static bool operator > (OracleDecimal val1, OracleDecimal val2);
```

### Parameters

- *val1*  
The first OracleDecimal.
- *val2*  
The second OracleDecimal.

### Return Value

Returns true if the two OracleDecimal values are not equal; otherwise, returns false.

### Remarks

The following rules apply to the behavior of this method.

- Any OracleDecimal that has a value compares greater than an OracleDecimal that has a null value.
- Two OracleDecimals that contain a null value are equal.

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## operator >=

This method determines if the first of two `OracleDecimal` values is greater than or equal to the second.

### Declaration

```
// C#  
public static bool operator >= (OracleDecimal val1, OracleDecimal val2);
```

### Parameters

- `val1`  
The first `OracleDecimal`.
- `val2`  
The second `OracleDecimal`.

### Return Value

Returns `true` if the first of two `OracleDecimal` values is greater than or equal to the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleDecimal` that has a value compares greater than an `OracleDecimal` that has a null value.
- Two `OracleDecimals` that contain a null value are equal.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## operator !=

This method determines if the first of two `OracleDecimal` values are not equal.

### Declaration

```
// C#  
public static bool operator != (OracleDecimal val1, OracleDecimal val2);
```

### Parameters

- `val1`

The first `OracleDecimal`.

- `val2`

The second `OracleDecimal`.

### Return Value

Returns `true` if the two `OracleDecimal` values are not equal; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleDecimal` that has a value compares greater than an `OracleDecimal` that has a null value.
- Two `OracleDecimals` that contain a null value are equal.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## operator <

This method determines if the first of two `OracleDecimal` values is less than the second.

### Declaration

```
// C#  
public static bool operator < (OracleDecimal val1, OracleDecimal val2);
```

### Parameters

- `val1`

The first `OracleDecimal`.

- `val2`

The second `OracleDecimal`.

### Return Value

Returns `true` if the first of two `OracleDecimal` values is less than the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleDecimal` that has a value compares greater than an `OracleDecimal` that has a null value.
- Two `OracleDecimals` that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## operator <=

This method determines if the first of two `OracleDecimal` values is less than or equal to the second.

### Declaration

```
// C#  
public static bool operator <= (OracleDecimal val1, OracleDecimal val2);
```

### Parameters

- *val1*  
The first `OracleDecimal`.
- *val2*  
The second `OracleDecimal`.

### Return Value

Returns `true` if the first of two `OracleDecimal` values is less than or equal to the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleDecimal` that has a value compares greater than an `OracleDecimal` that has a null value.
- Two `OracleDecimals` that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## operator \*

This method multiplies two `OracleDecimal` structures.

### Declaration

```
// C#  
public static OracleDecimal operator * (OracleDecimal val1, OracleDecimal val2);
```

### Parameters

- `val1`  
The first `OracleDecimal`.
- `val2`  
The second `OracleDecimal`.

### Return Value

A new `OracleDecimal` structure.

### Remarks

If either operand has a null value, the returned `OracleDecimal` has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## operator -

This method subtracts one `OracleDecimal` structure from another.

### Declaration

```
// C#  
public static OracleDecimal operator - (OracleDecimal val1, OracleDecimal val2);
```

### Parameters

- *val1*  
The first OracleDecimal.
- *val2*  
The second OracleDecimal.

### Return Value

A new OracleDecimal structure.

### Remarks

If either operand has a null value, the returned OracleDecimal has a null value.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## operator -

This method negates the supplied OracleDecimal structure.

### Declaration

```
// C#  
public static OracleDecimal operator - (OracleDecimal val);
```

### Parameters

- *val*  
An OracleDecimal.

### Return Value

A new OracleDecimal structure.

### Remarks

If the supplied OracleDecimal structure has a null value, the returned OracleDecimal has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## operator%

This method returns a new `OracleDecimal` structure with its value set to the modulus of two `OracleDecimal` structures.

### Declaration

```
// C#  
public static OracleDecimal operator % (OracleDecimal val,  
    OracleDecimal divider);
```

### Parameters

- *val*  
An `OracleDecimal`.
- *divider*  
An `OracleDecimal`.

### Return Value

A new `OracleDecimal` structure.

### Remarks

If either operand has a null value, the returned `OracleDecimal` has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## OracleDecimal Static Operators (Conversion from .NET Type to OracleDecimal)

The `OracleDecimal` static operators (Conversion from .NET Type to `OracleDecimal`) are listed in [Table 15-57](#).

**Table 15-57 OracleDecimal Static Operators (Conversion from .NET Type to OracleDecimal)**

Operator	Description
<a href="#">implicit operator OracleDecimal</a>	Converts an instance value to an OracleDecimal structure (Overloaded)
<a href="#">explicit operator OracleDecimal</a>	Converts an instance value to an OracleDecimal structure (Overloaded)

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## implicit operator OracleDecimal

`implicit operator OracleDecimal` returns the OracleDecimal representation of a value.

**Overload List:**

- [implicit operator OracleDecimal\(decimal\)](#)  
This method returns the OracleDecimal representation of a decimal value.
- [implicit operator OracleDecimal\(int\)](#)  
This method returns the OracleDecimal representation of an int value.
- [implicit operator OracleDecimal\(long\)](#)  
This method returns the OracleDecimal representation of a long value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## implicit operator OracleDecimal(decimal)

This method returns the OracleDecimal representation of a decimal value.

### Declaration

```
// C#  
public static implicit operator OracleDecimal(decimal val);
```

### Parameters

- `val`  
A decimal value.

### Return Value

An OracleDecimal.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## implicit operator OracleDecimal(int)

This method returns the OracleDecimal representation of an int value.

### Declaration

```
// C#  
public static implicit operator OracleDecimal(int val);
```

### Parameters

- `val`  
An int value.

### Return Value

An OracleDecimal.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## implicit operator OracleDecimal(long)

This method returns the `OracleDecimal` representation of a long value.

### Declaration

```
// C#  
public static implicit operator OracleDecimal(long val);
```

### Parameters

- `val`  
A long value.

### Return Value

An `OracleDecimal`.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## explicit operator OracleDecimal

`OracleDecimal` returns the `OracleDecimal` representation of a value.

### Overload List:

- [explicit operator OracleDecimal\(double\)](#)  
This method returns the `OracleDecimal` representation of a double.
- [explicit operator OracleDecimal\(string\)](#)  
This method returns the `OracleDecimal` representation of a string.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## explicit operator OracleDecimal(double)

This method returns the `OracleDecimal` representation of a double.

### Declaration

```
// C#  
public static explicit operator OracleDecimal(double val);
```

### Parameters

- `val`  
A double.

### Return Value

An `OracleDecimal`.

### Exceptions

`OverflowException` - The value of the supplied double is greater than the maximum value of `OracleDecimal` or less than the minimum value of `OracleDecimal`.

### Remarks

`OracleDecimal` contains the following values depending on the provided double value:

- `double.PositiveInfinity`: positive infinity value
- `double.NegativeInfinity`: negative infinity value.
- `double.NaN`: null value



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## explicit operator OracleDecimal(string)

This method returns the `OracleDecimal` representation of a string.

### Declaration

```
// C#  
public static explicit operator OracleDecimal(string numStr);
```

### Parameters

- `numStr`

A string that represents a numeric value.

### Return Value

An OracleDecimal.

### Exceptions

ArgumentException - The *numStr* parameter is an invalid string representation of an OracleDecimal.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)
- ["OracleGlobalization Class"](#)
- ["Globalization Support "](#)

## OracleDecimal Static Operators (Conversion from OracleDecimal to .NET)

The OracleDecimal static operators (Conversion from OracleDecimal to .NET) are listed in [Table 15-58](#).

**Table 15-58 OracleDecimal Static Operators (Conversion from OracleDecimal to .NET)**

Operator	Description
<a href="#">explicit operator byte</a>	Returns the byte representation of the OracleDecimal value
<a href="#">explicit operator decimal</a>	Returns the decimal representation of the OracleDecimal value
<a href="#">explicit operator double</a>	Returns the double representation of the OracleDecimal value
<a href="#">explicit operator short</a>	Returns the short representation of the OracleDecimal value
<a href="#">explicit operator int</a>	Returns the int representation of the OracleDecimal value
<a href="#">explicit operator long</a>	Returns the long representation of the OracleDecimal value
<a href="#">explicit operator float</a>	Returns the float representation of the OracleDecimal value

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## explicit operator byte

This method returns the `byte` representation of the `OracleDecimal` value.

### Declaration

```
// C#  
public static explicit operator byte(OracleDecimal val);
```

### Parameters

- `val`  
An `OracleDecimal` structure.

### Return Value

A `byte`.

### Exceptions

`OracleNullValueException` - `OracleDecimal` has a null value.

`OverflowException`- The `byte` cannot represent the supplied `OracleDecimal` structure.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## explicit operator decimal

This method returns the `decimal` representation of the `OracleDecimal` value.

### Declaration

```
// C#  
public static explicit operator decimal(OracleDecimal val);
```

### Parameters

- `val`  
An OracleDecimal structure.

### Return Value

A decimal.

### Exceptions

OracleNullValueException - The OracleDecimal has a null value.

OverflowException - The decimal cannot represent the supplied OracleDecimal structure.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## explicit operator double

This method returns the double representation of the OracleDecimal value.

### Declaration

```
// C#  
public static explicit operator double(OracleDecimal val);
```

### Parameters

- `val`  
An OracleDecimal structure.

### Return Value

A double.

### Exceptions

OracleNullValueException - The OracleDecimal has a null value.

OverflowException - The double cannot represent the supplied OracleDecimal structure.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## explicit operator short

This method returns the `short` representation of the `OracleDecimal` value.

### Declaration

```
// C#  
public static explicit operator short(OracleDecimal val);
```

### Parameters

- `val`  
An `OracleDecimal` structure.

### Return Value

A `short`.

### Exceptions

`OracleNullValueException` - The `OracleDecimal` has a null value.

`OverflowException` - The `short` cannot represent the supplied `OracleDecimal` structure.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## explicit operator int

This method returns the `int` representation of the `OracleDecimal` value.

### Declaration

```
// C#  
public static explicit operator int(OracleDecimal val);
```

### Parameters

- *val*  
An OracleDecimal structure.

### Return Value

An int.

### Exceptions

OracleNullValueException - The OracleDecimal has a null value.

OverflowException - The int cannot represent the supplied OracleDecimal structure.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## explicit operator long

This method returns the long representation of the OracleDecimal value.

### Declaration

```
// C#  
public static explicit operator long(OracleDecimal val);
```

### Parameters

- *val*  
An OracleDecimal structure.

### Return Value

A long.

### Exceptions

OracleNullValueException - The OracleDecimal has a null value.

OverflowException - The long cannot represent the supplied OracleDecimal structure.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## explicit operator float

This method returns the `float` representation of the `OracleDecimal` value.

### Declaration

```
// C#  
public static explicit operator float(OracleDecimal val);
```

### Parameters

- `val`  
An `OracleDecimal` structure.

### Return Value

A `float`.

### Exceptions

`OracleNullValueException` - The `OracleDecimal` has a null value.

`OverflowException` - The `float` cannot represent the supplied `OracleDecimal` structure.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## OracleDecimal Properties

The `OracleDecimal` properties are listed in [Table 15-59](#).

**Table 15-59 OracleDecimal Properties**

Properties	Description
<a href="#">BinData</a>	Returns a byte array that represents the Oracle NUMBER in Oracle internal format
<a href="#">Format</a>	Specifies the format for ToString()
<a href="#">IsInt</a>	Indicates whether or not the current instance is an integer
<a href="#">IsNull</a>	Indicates whether or not the current instance has a null value
<a href="#">IsPositive</a>	Indicates whether or not the current instance is greater than 0
<a href="#">IsZero</a>	Indicates whether or not the current instance has a zero value
<a href="#">Value</a>	Returns a decimal value

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## BinData

This property returns a byte array that represents the Oracle NUMBER in an internal Oracle format.

### Declaration

```
// C#  
public byte[] BinData {get;}
```

### Property Value

A byte array that represents the Oracle NUMBER in an internal Oracle format.

### Exceptions

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Format

This property specifies the format for `ToString()`.

### Declaration

```
// C#  
public string Format {get; set;}
```

### Property Value

The string which specifies the format.

### Remarks

`Format` is used when `ToString()` is called on an instance of an `OracleDecimal`. It is useful if the `ToString()` method needs a specific currency symbol, group, or decimal separator as part of a string.

By default, this property is `null` which indicates that no special formatting is used.

The decimal and group separator characters are specified by the thread's `OracleGlobalization.NumericCharacters`.

The currency symbols are specified by the following thread properties:

- `OracleGlobalization.Currency`
- `OracleGlobalization.ISOCurrency`
- `OracleGlobalization.DualCurrency`



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)
- ["OracleGlobalization Class"](#)
- ["Globalization Support "](#)

## IsInt

This property indicates whether or not the current instance is an integer value.

### Declaration

```
// C#  
public bool IsInt {get;}
```

### Property Value

A `bool` value that returns `true` if the current instance is an integer value; otherwise, returns `false`.

### Exceptions

`OracleNullValueException` - The current instance has a null value.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## IsNull

This property indicates whether or not the current instance has a null value.

### Declaration

```
// C#  
public bool IsNull {get;}
```

### Property Value

A `bool` value that returns `true` if the current instance has a null value; otherwise, returns `false`.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## IsPositive

This property indicates whether or not the value of the current instance is greater than 0.

### Declaration

```
// C#  
public bool IsPositive {get;}
```

### Property Value

A `bool` value that returns `true` if the current instance is greater than 0; otherwise, returns `false`.

### Exceptions

`OracleNullValueException` - The current instance has a null value.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## IsZero

This property indicates whether or not the current instance has a zero value.

### Declaration

```
// C#  
public bool IsZero{get;}
```

### Property Value

A `bool` value that returns `true` if the current instance has a zero value; otherwise, returns `false`.

### Exceptions

`OracleNullValueException` - The current instance has a null value.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Value

This method returns a decimal value.

**Declaration**

```
// C#
public decimal Value {get;}
```

**Property Value**

A decimal value.

**Exceptions**

`OracleNullValueException` - The current instance has a null value.

`OverflowException` - The decimal cannot represent the supplied `OracleDecimal` structure.

**Remarks**

Precision can be lost when the decimal value is obtained from an `OracleDecimal`. See Remarks under "[OracleDecimal Structure](#)" for further information.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## OracleDecimal Instance Methods

The `OracleDecimal` instance methods are listed in [Table 15-60](#).

**Table 15-60 OracleDecimal Instance Methods**

Method	Description
<a href="#">CompareTo</a>	Compares the current instance to the supplied object and returns an integer that represents their relative values
<a href="#">Equals</a>	Determines whether or not an object is an instance of <code>OracleDecimal</code> , and whether or not the value of the object is equal to the current instance (Overloaded)
<a href="#">GetHashCode</a>	Returns a hash code for the current instance
<a href="#">GetType</a>	Inherited from <code>System.Object</code>
<a href="#">ToByte</a>	Returns the <code>byte</code> representation of the current instance
<a href="#">ToDouble</a>	Returns the <code>double</code> representation of the current instance
<a href="#">ToInt16</a>	Returns the <code>Int16</code> representation of the current instance
<a href="#">ToInt32</a>	Returns the <code>Int32</code> representation of the current instance
<a href="#">ToInt64</a>	Returns the <code>Int64</code> representation of the current instance

Table 15-60 (Cont.) OracleDecimal Instance Methods

Method	Description
<a href="#">ToSingle</a>	Returns the <code>Single</code> representation of the current instance
<a href="#">ToString</a>	Overloads <code>Object.ToString()</code> Returns the <code>string</code> representation of the current instance

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## CompareTo

This method compares the current instance to the supplied object and returns an integer that represents their relative values.

### Declaration

```
// C#  
public int CompareTo(object obj);
```

### Parameters

- *obj*  
The supplied instance.

### Return Value

The method returns a number:

- Less than zero: if the value of the current instance is less than *obj*.
- Zero: if the value of the current instance is equal to *obj*.
- Greater than zero: if the value of the current instance is greater than *obj*.

### Implements

`IComparable`

### Exceptions

`ArgumentException` - The parameter is not of type `OracleDecimal`.

### Remarks

The following rules apply to the behavior of this method.

- The comparison must be between `OracleDecimals`. For example, comparing an `OracleDecimal` instance with an `OracleBinary` instance is not allowed. When an `OracleDecimal` is compared with a different type, an `ArgumentException` is thrown.
- Any `OracleDecimal` that has a value compares greater than an `OracleDecimal` that has a null value.
- Two `OracleDecimals` that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## Equals

Overrides `Object`

This method determines whether or not an object is an instance of `OracleDecimal`, and whether or not the value of the object is equal to the current instance.

### Declaration

```
// C#  
public override bool Equals(object obj);
```

### Parameters

- *obj*  
An `OracleDecimal` instance.

### Return Value

Returns `true` if *obj* is an instance of `OracleDecimal`, and the value of *obj* is equal to the current instance; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleDecimal` that has a value compares greater than an `OracleDecimal` that has a null value.
- Two `OracleDecimals` that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## GetHashCode

Overrides `Object`

This method returns a hash code for the current instance.

### Declaration

```
// C#  
public override int GetHashCode();
```

### Return Value

Returns a hash code.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## ToByte

This method returns the `byte` representation of the current instance.

### Declaration

```
// C#  
public byte ToByte();
```

### Return Value

A `byte`.

### Exceptions

`OverflowException` - The `byte` cannot represent the current instance.

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## ToDouble

This method returns the `double` representation of the current instance.

### Declaration

```
// C#  
public double ToDouble();
```

### Return Value

A `double`.

### Exceptions

`OverflowException` - The `double` cannot represent the current instance.

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## ToInt16

This method returns the `Int16` representation of the current instance.

### Declaration

```
// C#  
public short ToInt16();
```

### Return Value

A `short`.

### Exceptions

`OverflowException` - The `short` cannot represent the current instance.

OracleNullValueException - The current instance has a null value.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## ToInt32

This method returns the `Int32` representation of the current instance.

### Declaration

```
// C#  
public int ToInt32();
```

### Return Value

An `int`.

### Exceptions

OverflowException - The `int` cannot represent the current instance.

OracleNullValueException - The current instance has a null value.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## ToInt64

This method returns the `Int64` representation of the current instance.

### Declaration

```
// C#  
public long ToInt64();
```

### Return Value

A `long`.

## Exceptions

`OverflowException` - The `long` cannot represent the current instance.

`OracleNullValueException` - The current instance has a null value.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## ToSingle

This method returns the `Single` representation of the current instance.

### Declaration

```
// C#  
public float ToSingle();
```

### Return Value

A `float`.

### Exceptions

`OverflowException` - The `float` cannot represent the current instance.

`OracleNullValueException` - The current instance has a null value.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)

## ToString

Overrides `Object`

This method returns the `string` representation of the current instance.

### Declaration

```
// C#  
public override string ToString();
```

### Return Value

Returns the number in a string returns and a period (.) as a numeric separator.

### Remarks

If the current instance has a null value, the returned string is "null".

The returned value is a string representation of an `OracleDecimal` in the numeric format specified by the `Format` property.

The decimal and group separator characters are specified by the thread's `OracleGlobalization.NumericCharacters`.

The currency symbols are specified by the following thread properties:

- `OracleGlobalization.Currency`
- `OracleGlobalization.ISOCurrency`
- `OracleGlobalization.DualCurrency`

If the numeric format is not specified, an Oracle default value is used.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleDecimal Members](#)
- [OracleDecimal Structure](#)
- ["OracleGlobalization Class"](#)
- ["Globalization Support "](#)

## OracleIntervalDS Structure

The `OracleIntervalDS` structure represents the Oracle `INTERVAL DAY TO SECOND` data type to be stored in or retrieved from a database. Each `OracleIntervalDS` stores a period of time in term of days, hours, minutes, seconds, and fractional seconds.

### Class Inheritance

```
System.Object
```

```
System.ValueType
```

```
Oracle.DataAccess.Types.OracleIntervalDS
```

## Declaration

```
// C#
public struct OracleIntervalDS : IComparable, INullable, IXmlSerializable
```

## Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

## Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

## Example

```
// C#

using System;
using Oracle.DataAccess.Types;

class OracleIntervalDSSample
{
    static void Main()
    {
        OracleIntervalDS iDSMax = OracleIntervalDS.MaxValue;
        double totalDays = iDSMax.TotalDays;

        totalDays -= 1;
        OracleIntervalDS iDSMax_1 = new OracleIntervalDS(totalDays);

        // Calculate the difference
        OracleIntervalDS iDSDiff = iDSMax - iDSMax_1;

        // Prints "iDSDiff.ToString() = +000000000 23:59:59.999999999"
        Console.WriteLine("iDSDiff.ToString() = " + iDSDiff.ToString());
    }
}
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Members](#)
- [OracleIntervalDS Constructors](#)
- [OracleIntervalDS Static Fields](#)
- [OracleIntervalDS Static Methods](#)
- [OracleIntervalDS Static Operators](#)
- [OracleIntervalDS Type Conversions](#)
- [OracleIntervalDS Properties](#)
- [OracleIntervalDS Methods](#)

## OracleIntervalDS Members

OracleIntervalDS members are listed in the following tables:

### OracleIntervalDS Constructors

OracleIntervalDS constructors are listed in [Table 15-61](#)

**Table 15-61 OracleIntervalDS Constructors**

Constructor	Description
<a href="#">OracleIntervalDS Constructors</a>	Instantiates a new instance of OracleIntervalDS structure (Overloaded)

### OracleIntervalDS Static Fields

The OracleIntervalDS static fields are listed in [Table 15-62](#).

**Table 15-62 OracleIntervalDS Static Fields**

Field	Description
<a href="#">MaxValue</a>	Represents the maximum valid time interval for an OracleIntervalDS structure
<a href="#">MinValue</a>	Represents the minimum valid time interval for an OracleIntervalDS structure
<a href="#">Null</a>	Represents a null value that can be assigned to an OracleIntervalDS instance
<a href="#">Zero</a>	Represents a zero value for an OracleIntervalDS structure

## OracleIntervalDS Static Methods

The `OracleIntervalDS` static methods are listed in [Table 15-63](#).

**Table 15-63** OracleIntervalDS Static Methods

Methods	Description
<a href="#">Equals</a>	Determines whether or not two <code>OracleIntervalDS</code> values are equal (Overloaded)
<a href="#">GreaterThan</a>	Determines whether or not one <code>OracleIntervalDS</code> value is greater than another
<a href="#">GreaterThanOrEqual</a>	Determines whether or not one <code>OracleIntervalDS</code> value is greater than or equal to another
<a href="#">LessThan</a>	Determines whether or not one <code>OracleIntervalDS</code> value is less than another
<a href="#">LessThanOrEqual</a>	Determines whether or not one <code>OracleIntervalDS</code> value is less than or equal to another
<a href="#">NotEquals</a>	Determines whether or not two <code>OracleIntervalDS</code> values are not equal
<a href="#">Parse</a>	Returns an <code>OracleIntervalDS</code> structure and sets its value for time interval using a string
<a href="#">SetPrecision</a>	Returns a new instance of an <code>OracleIntervalDS</code> with the specified day precision and fractional second precision

## OracleIntervalDS Static Operators

The `OracleIntervalDS` static operators are listed in [Table 15-64](#).

**Table 15-64** OracleIntervalDS Static Operators

Operator	Description
<a href="#">operator +</a>	Adds two <code>OracleIntervalDS</code> values
<a href="#">operator ==</a>	Determines whether or not two <code>OracleIntervalDS</code> values are equal
<a href="#">operator &gt;</a>	Determines whether or not one <code>OracleIntervalDS</code> value is greater than another
<a href="#">operator &gt;=</a>	Determines whether or not one <code>OracleIntervalDS</code> value is greater than or equal to another
<a href="#">operator !=</a>	Determines whether or not two <code>OracleIntervalDS</code> values are not equal
<a href="#">operator &lt;</a>	Determines whether or not one <code>OracleIntervalDS</code> value is less than another
<a href="#">operator &lt;=</a>	Determines whether or not one <code>OracleIntervalDS</code> value is less than or equal to another
<a href="#">operator -</a>	Subtracts one <code>OracleIntervalDS</code> value from another
<a href="#">operator -</a>	Negates an <code>OracleIntervalDS</code> structure

**Table 15-64 (Cont.) OracleIntervalDS Static Operators**

Operator	Description
<a href="#">operator *</a>	Multiplies an OracleIntervalDS value by a number
<a href="#">operator /</a>	Divides an OracleIntervalDS value by a number

### OracleIntervalDS Type Conversions

The OracleIntervalDS type conversions are listed in [Table 15-65](#).

**Table 15-65 OracleIntervalDS Type Conversions**

Operator	Description
<a href="#">explicit operator TimeSpan</a>	Converts an OracleIntervalDS structure to a TimeSpan structure
<a href="#">explicit operator OracleIntervalDS</a>	Converts a string to an OracleIntervalDS structure
<a href="#">implicit operator OracleIntervalDS</a>	Converts a TimeSpan structure to an OracleIntervalDS structure

### OracleIntervalDS Properties

The OracleIntervalDS properties are listed in [Table 15-66](#).

**Table 15-66 OracleIntervalDS Properties**

Properties	Description
<a href="#">BinData</a>	Returns an array of bytes that represents the Oracle INTERVAL DAY TO SECOND in Oracle internal format
<a href="#">Days</a>	Gets the days component of an OracleIntervalDS
<a href="#">Hours</a>	Gets the hours component of an OracleIntervalDS
<a href="#">IsNull</a>	Indicates whether or not the current instance has a null value
<a href="#">Milliseconds</a>	Gets the milliseconds component of an OracleIntervalDS
<a href="#">Minutes</a>	Gets the minutes component of an OracleIntervalDS
<a href="#">Nanoseconds</a>	Gets the nanoseconds component of an OracleIntervalDS
<a href="#">Seconds</a>	Gets the seconds component of an OracleIntervalDS
<a href="#">TotalDays</a>	Returns the total number, in days, that represent the time period in the OracleIntervalDS structure

**Table 15-66 (Cont.) OracleIntervalDS Properties**

Properties	Description
<a href="#">Value</a>	Specifies the time interval that is stored in the <code>OracleIntervalDS</code> structure

**OracleIntervalDS Methods**

The `OracleIntervalDS` methods are listed in [Table 15-67](#).

**Table 15-67 OracleIntervalDS Methods**

Methods	Description
<a href="#">CompareTo</a>	Compares the current <code>OracleIntervalDS</code> instance to an object, and returns an integer that represents their relative values
<a href="#">Equals</a>	Determines whether or not the specified object has the same time interval as the current instance (Overloaded)
<a href="#">GetHashCode</a>	Returns a hash code for the <code>OracleIntervalDS</code> instance
<a href="#">GetType</a>	Inherited from <code>System.Object</code>
<a href="#">ToString</a>	Converts the current <code>OracleIntervalDS</code> structure to a string

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)

## OracleIntervalDS Constructors

`OracleIntervalDS` constructors create a new instance of the `OracleIntervalDS` structure.

**Overload List:**

- [OracleIntervalDS\(TimeSpan\)](#)  
This constructor creates a new instance of the `OracleIntervalDS` structure and sets its value using a `TimeSpan` structure.
- [OracleIntervalDS\(string\)](#)  
This constructor creates a new instance of the `OracleIntervalDS` structure and sets its value using a string that indicates a period of time.
- [OracleIntervalDS\(double\)](#)

This constructor creates a new instance of the `OracleIntervalDS` structure and sets its value using the total number of days.

- [OracleIntervalDS\(int, int, int, int, double\)](#)

This constructor creates a new instance of the `OracleIntervalDS` structure and sets its value using the supplied days, hours, minutes, seconds and milliseconds.

- [OracleIntervalDS\(int, int, int, int, int\)](#)

This constructor creates a new instance of the `OracleIntervalDS` structure and sets its value using the supplied days, hours, minutes, seconds, and nanoseconds.

- [OracleIntervalDS\(byte\[ \]\)](#)

This constructor creates a new instance of the `OracleIntervalDS` structure and sets its value to the provided byte array, which is in an internal Oracle `INTERVAL DAY TO SECOND` format.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## OracleIntervalDS(TimeSpan)

This constructor creates a new instance of the `OracleIntervalDS` structure and sets its value using a `TimeSpan` structure.

### Declaration

```
// C#  
public OracleIntervalDS(TimeSpan ts);
```

### Parameters

- `ts`  
A `TimeSpan` structure.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## OracleIntervalDS(string)

This constructor creates a new instance of the `OracleIntervalDS` structure and sets its value using a string that indicates a period of time.

### Declaration

```
// C#  
public OracleIntervalDS(string intervalStr);
```

### Parameters

- *intervalStr*  
A string representing the Oracle `INTERVAL DAY TO SECOND`.

### Exceptions

`ArgumentException` - The *intervalStr* parameter is not in the valid format or has an invalid value.

`ArgumentNullException` - The *intervalStr* parameter is null.

### Remarks

The value specified in the supplied *intervalStr* must be in Day HH:MI:SSxFF format.

### Example

"1 2:3:4.99" means 1 day, 2 hours, 3 minutes, 4 seconds, and 990 milliseconds or 1 day, 2 hours, 3 minutes, 4 seconds, and 990000000 nanoseconds.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## OracleIntervalDS(double)

This constructor creates a new instance of the `OracleIntervalDS` structure and sets its value using the total number of days.

### Declaration

```
// C#  
public OracleIntervalDS(double totalDays);
```

### Parameters

- *totalDays*

The supplied total number of days for a time interval. Range of days is  $-1000,000,000 < totalDays < 1000,000,000$ .

### Exceptions

`ArgumentOutOfRangeException` - The argument value for one or more of the parameters is out of the specified range.

`ArgumentException` - The argument values of the parameters cannot be used to construct a valid `OracleIntervalDS`.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## OracleIntervalDS(int, int, int, int, double)

This constructor creates a new instance of the `OracleIntervalDS` structure and sets its value using the supplied days, hours, minutes, seconds, and milliseconds.

### Declaration

```
// C#  
public OracleIntervalDS (int days, int hours, int minutes, int seconds,  
    double milliSeconds);
```

### Parameters

- *days*  
The days provided. Range of day is (-999,999,999 to 999,999,999).
- *hours*  
The hours provided. Range of hour is (-23 to 23).
- *minutes*  
The minutes provided. Range of minute is (-59 to 59).
- *seconds*  
The seconds provided. Range of second is (-59 to 59).
- *milliSeconds*  
The milliseconds provided. Range of millisecond is (- 999.999999 to 999.999999).

### Exceptions

`ArgumentOutOfRangeException` - The argument value for one or more of the parameters is out of the specified range.

`ArgumentException` - The argument values of the parameters cannot be used to construct a valid `OracleIntervalDS`.

### Remarks

The sign of all the arguments must be the same.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## OracleIntervalDS(int, int, int, int, int)

This constructor creates a new instance of the `OracleIntervalDS` structure and sets its value using the supplied days, hours, minutes, seconds, and nanoseconds.

### Declaration

```
// C#  
public OracleIntervalDS (int days, int hours, int minutes, int seconds,  
    int nanoseconds);
```

### Parameters

- *days*  
The days provided. Range of day is (-999,999,999 to 999,999,999).
- *hours*  
The hours provided. Range of hour is (-23 to 23).
- *minutes*  
The minutes provided. Range of minute is (-59 to 59).
- *seconds*  
The seconds provided. Range of second is (-59 to 59).
- *nanoseconds*  
The nanoseconds provided. Range of nanosecond is (-999,999,999 to 999,999,999)

### Exceptions

`ArgumentOutOfRangeException` - The argument value for one or more of the parameters is out of the specified range.

`ArgumentException` - The argument values of the parameters cannot be used to construct a valid `OracleIntervalDS`.

## Remarks

The sign of all the arguments must be the same.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## OracleIntervalDS(byte[ ])

This constructor creates a new instance of the `OracleIntervalDS` structure and sets its value to the provided byte array, which is in an internal Oracle `INTERVAL DAY TO SECOND` format.

### Declaration

```
// C#  
public OracleIntervalDS (byte[ ] bytes);
```

### Parameters

- *bytes*

A byte array that is in an internal Oracle `INTERVAL DAY TO SECOND` format.

### Exceptions

`ArgumentException` - *bytes* is not in internal Oracle `INTERVAL DAY TO SECOND` format, or *bytes* is not a valid Oracle `INTERVAL DAY TO SECOND`.

`ArgumentNullException` - *bytes* is null.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## OracleIntervalDS Static Fields

The `OracleIntervalDS` static fields are listed in [Table 15-68](#).

**Table 15-68 OracleIntervalDS Static Fields**

Field	Description
<a href="#">MaxValue</a>	Represents the maximum valid time interval for an <code>OracleIntervalDS</code> structure
<a href="#">MinValue</a>	Represents the minimum valid time interval for an <code>OracleIntervalDS</code> structure
<a href="#">Null</a>	Represents a null value that can be assigned to an <code>OracleIntervalDS</code> instance
<a href="#">Zero</a>	Represents a zero value for an <code>OracleIntervalDS</code> structure

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## MaxValue

This static field represents the maximum value for an `OracleIntervalDS` structure.

### Declaration

```
// C#  
public static readonly OracleIntervalDS MaxValue;
```

### Remarks

Maximum values:

- Day: 999999999
- hour: 23
- minute is 59
- second: 59
- nanosecond: 999999999

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## MinValue

This static field represents the minimum value for an `OracleIntervalDS` structure.

### Declaration

```
// C#  
public static readonly OracleIntervalDS MinValue;
```

### Remarks

Minimum values:

- Day: -999999999
- hour: -23
- minute: -59
- second: -59
- nanosecond: -999999999



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## Null

This static field represents a null value that can be assigned to an `OracleIntervalDS` instance.

### Declaration

```
// C#  
public static readonly OracleIntervalDS Null;
```



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## Zero

This static field represents a zero value for an `OracleIntervalDS` structure.

### Declaration

```
// C#
public static readonly OracleIntervalDS Zero;
```

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## OracleIntervalDS Static Methods

The `OracleIntervalDS` static methods are listed in [Table 15-69](#).

**Table 15-69 OracleIntervalDS Static Methods**

Methods	Description
<a href="#">Equals</a>	Determines whether or not two <code>OracleIntervalDS</code> values are equal (Overloaded)
<a href="#">GreaterThan</a>	Determines whether or not one <code>OracleIntervalDS</code> value is greater than another
<a href="#">GreaterThanOrEqual</a>	Determines whether or not one <code>OracleIntervalDS</code> value is greater than or equal to another
<a href="#">LessThan</a>	Determines whether or not one <code>OracleIntervalDS</code> value is less than another
<a href="#">LessThanOrEqual</a>	Determines whether or not one <code>OracleIntervalDS</code> value is less than or equal to another
<a href="#">NotEquals</a>	Determines whether or not two <code>OracleIntervalDS</code> values are not equal
<a href="#">Parse</a>	Returns an <code>OracleIntervalDS</code> structure and sets its value for time interval using a string
<a href="#">SetPrecision</a>	Returns a new instance of an <code>OracleIntervalDS</code> with the specified day precision and fractional second precision

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## Equals

This static method determines whether or not two `OracleIntervalDS` values are equal.

### Declaration

```
// C#  
public static bool Equals(OracleIntervalDS val1, OracleIntervalDS val2);
```

### Parameters

- `val1`  
The first `OracleIntervalDS`.
- `val2`  
The second `OracleIntervalDS`.

### Return Value

If the two `OracleIntervalDS` structures represent the same time interval, returns `true`; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleIntervalDS` that has a value compares greater than an `OracleIntervalDS` that has a null value.
- Two `OracleIntervalDS`s that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## GreaterThan

This static method determines whether or not the first of two `OracleIntervalDS` values is greater than the second.

### Declaration

```
// C#  
public static bool GreaterThan(OracleIntervalDS val1, OracleIntervalDS  
    val2);
```

### Parameters

- `val1`  
The first `OracleIntervalDS`.
- `val2`  
The second `OracleIntervalDS`.

### Return Value

Returns `true` if the first of two `OracleIntervalDS` values is greater than the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleIntervalDS` that has a value compares greater than an `OracleIntervalDS` that has a null value.
- Two `OracleIntervalDS`s that contain a null value are equal.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## GreaterThanOrEqual

This static method determines whether or not the first of two `OracleIntervalDS` values is greater than or equal to the second.

### Declaration

```
// C#  
public static bool GreaterThanOrEqual(OracleIntervalDS val1,  
    OracleIntervalDS val2);
```

### Parameters

- *val1*  
The first OracleIntervalDS.
- *val2*  
The second OracleIntervalDS.

### Return Value

Returns `true` if the first of two OracleIntervalDS values is greater than or equal to the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any OracleIntervalDS that has a value compares greater than an OracleIntervalDS that has a null value.
- Two OracleIntervalDSs that contain a null value are equal.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## LessThan

This static method determines whether or not the first of two OracleIntervalDS values is less than the second.

### Declaration

```
// C#  
public static bool LessThan(OracleIntervalDS val1, OracleIntervalDS val2);
```

### Parameters

- *val1*  
The first OracleIntervalDS.
- *val2*  
The second OracleIntervalDS.

### Return Value

Returns `true` if the first of two OracleIntervalDS values is less than the second; otherwise, returns `false`.

## Remarks

The following rules apply to the behavior of this method.

- Any `OracleIntervalDS` that has a value compares greater than an `OracleIntervalDS` that has a null value.
- Two `OracleIntervalDS`s that contain a null value are equal.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## LessThanOrEqual

This static method determines whether or not the first of two `OracleIntervalDS` values is less than or equal to the second.

### Declaration

```
// C#  
public static bool LessThanOrEqual(OracleIntervalDS val1, OracleIntervalDS val2);
```

### Parameters

- *val1*  
The first `OracleIntervalDS`.
- *val2*  
The second `OracleIntervalDS`.

### Return Value

Returns `true` if the first of two `OracleIntervalDS` values is less than or equal to the second; otherwise, returns `false`.

## Remarks

The following rules apply to the behavior of this method.

- Any `OracleIntervalDS` that has a value compares greater than an `OracleIntervalDS` that has a null value.
- Two `OracleIntervalDS`s that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## NotEquals

This static method determines whether or not two `OracleIntervalDS` values are not equal.

### Declaration

```
// C#  
public static bool NotEquals(OracleIntervalDS val1, OracleIntervalDS val2);
```

### Parameters

- `val1`  
The first `OracleIntervalDS`.
- `val2`  
The second `OracleIntervalDS`.

### Return Value

Returns `true` if two `OracleIntervalDS` values are not equal; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleIntervalDS` that has a value compares greater than an `OracleIntervalDS` that has a null value.
- Two `OracleIntervalDS`s that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## Parse

This static method returns an `OracleIntervalDS` instance and sets its value for time interval using a string.

### Declaration

```
// C#  
public static OracleIntervalDS Parse(string intervalStr);
```

### Parameters

- `intervalStr`  
A string representing the Oracle `INTERVAL DAY TO SECOND`.

### Return Value

Returns an `OracleIntervalDS` instance representing the time interval from the supplied string.

### Exceptions

`ArgumentException` - The `intervalStr` parameter is not in the valid format or `intervalStr` has an invalid value.

`ArgumentNullException` - The `intervalStr` parameter is null.

### Remarks

The value specified in `intervalStr` must be in Day HH:MI:SSxFF format.

### Example

"1 2:3:4.99" means 1 day, 2 hours, 3 minutes, 4 seconds, and 990 milliseconds or 1 day, 2 hours, 3 minutes, 4 seconds, and 990000000 nanoseconds.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## SetPrecision

This static method returns a new instance of an `OracleIntervalDS` with the specified day precision and fractional second precision.

## Declaration

```
// C#  
public static OracleIntervalDS SetPrecision(OracleIntervalDS value1,  
    int dayPrecision, int fracSecPrecision);
```

## Parameters

- *value1*  
An OracleIntervalDS structure.
- *dayPrecision*  
The day precision provided. Range of day precision is (0 to 9).
- *fracSecPrecision*  
The fractional second precision provided. Range of fractional second precision is (0 to 9).

## Return Value

An OracleIntervalDS instance.

## Exceptions

ArgumentOutOfRangeException - An argument value is out of the specified range.

## Remarks

Depending on the value specified in the supplied *dayPrecision*, 0 or more leading zeros are displayed in the string returned by `ToString()`.

The value specified in the supplied *fracSecPrecision* is used to perform a rounding off operation on the supplied OracleIntervalDS value. Depending on this value, 0 or more trailing zeros are displayed in the string returned by `ToString()`.

## Example

The OracleIntervalDS with a value of "1 2:3:4.99" results in the string "001 2:3:4.99000" when `SetPrecision()` is called, with the day precision set to 3 and fractional second precision set to 5.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## OracleIntervalDS Static Operators

The OracleIntervalDS static operators are listed in [Table 15-70](#).

Table 15-70 OracleIntervalDS Static Operators

Operator	Description
<a href="#">operator +</a>	Adds two OracleIntervalDS values
<a href="#">operator ==</a>	Determines whether or not two OracleIntervalDS values are equal
<a href="#">operator &gt;</a>	Determines whether or not one OracleIntervalDS value is greater than another
<a href="#">operator &gt;=</a>	Determines whether or not one OracleIntervalDS value is greater than or equal to another
<a href="#">operator !=</a>	Determines whether or not two OracleIntervalDS values are not equal
<a href="#">operator &lt;</a>	Determines whether or not one OracleIntervalDS value is less than another
<a href="#">operator &lt;=</a>	Determines whether or not one OracleIntervalDS value is less than or equal to another
<a href="#">operator -</a>	Subtracts one OracleIntervalDS value from another
<a href="#">operator -</a>	Negates an OracleIntervalDS structure
<a href="#">operator *</a>	Multiplies an OracleIntervalDS value by a number
<a href="#">operator /</a>	Divides an OracleIntervalDS value by a number

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## operator +

This static operator adds two OracleIntervalDS values.

### Declaration

```
// C#  
public static OracleIntervalDS operator + (OracleIntervalDS val1,  
    OracleIntervalDS val2);
```

### Parameters

- *val1*  
The first OracleIntervalDS.
- *val2*  
The second OracleIntervalDS.

### Return Value

An `OracleIntervalDS`.

### Remarks

If either argument has a null value, the returned `OracleIntervalDS` structure has a null value.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## operator ==

This static operator determines if two `OracleIntervalDS` values are equal.

### Declaration

```
// C#  
public static bool operator == (OracleIntervalDS val1,  
    OracleIntervalDS val2);
```

### Parameters

- `val1`  
The first `OracleIntervalDS`.
- `val2`  
The second `OracleIntervalDS`.

### Return Value

Returns `true` if the two `OracleIntervalDS` values are the same; otherwise returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleIntervalDS` that has a value compares greater than an `OracleIntervalDS` that has a null value.
- Two `OracleIntervalDS`s that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## operator >

This static operator determines if the first of two `OracleIntervalDS` values is greater than the second.

### Declaration

```
// C#  
public static bool operator > (OracleIntervalDS val1,  
    OracleIntervalDS val2);
```

### Parameters

- *val1*  
The first `OracleIntervalDS`.
- *val2*  
The second `OracleIntervalDS`.

### Return Value

Returns `true` if one `OracleIntervalDS` value is greater than another; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleIntervalDS` that has a value compares greater than an `OracleIntervalDS` that has a null value.
- Two `OracleIntervalDS`s that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## operator >=

This static operator determines if the first of two `OracleIntervalDS` values is greater than or equal to the second.

### Declaration

```
// C#  
public static bool operator >= (OracleIntervalDS val1,  
    OracleIntervalDS val2);
```

### Parameters

- `val1`  
The first `OracleIntervalDS`.
- `val2`  
The second `OracleIntervalDS`.

### Return Value

Returns `true` if the first of two `OracleIntervalDS` values is greater than or equal to the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleIntervalDS` that has a value compares greater than an `OracleIntervalDS` that has a null value.
- Two `OracleIntervalDS`s that contain a null value are equal.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## operator !=

This static operator determines if the two `OracleIntervalDS` values are not equal.

### Declaration

```
// C#  
public static bool operator != (OracleIntervalDS val1,  
    OracleIntervalDS val2);
```

### Parameters

- *val1*  
The first `OracleIntervalDS`.
- *val2*  
The second `OracleIntervalDS`.

### Return Value

Returns `true` if the two `OracleIntervalDS` values are not equal; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleIntervalDS` that has a value compares greater than an `OracleIntervalDS` that has a null value.
- Two `OracleIntervalDS`s that contain a null value are equal.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## operator <

This static operator determines if the first of two `OracleIntervalDS` values is less than the second.

### Declaration

```
// C#
public static bool operator < (OracleIntervalDS val1,
    OracleIntervalDS val2);
```

### Parameters

- *val1*  
The first `OracleIntervalDS`.
- *val2*  
The second `OracleIntervalDS`.

### Return Value

Returns `true` if the first of two `OracleIntervalDS` values is less than the second; otherwise, returns `false`.

## Remarks

The following rules apply to the behavior of this method.

- Any `OracleIntervalDS` that has a value compares greater than an `OracleIntervalDS` that has a null value.
- Two `OracleIntervalDS`s that contain a null value are equal.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## operator <=

This static operator determines if the first of two `OracleIntervalDS` values is less than or equal to the second.

### Declaration

```
// C#
public static bool operator <= (OracleIntervalDS val1,
    OracleIntervalDS val2);
```

### Parameters

- `val1`  
The first `OracleIntervalDS`.
- `val2`  
The second `OracleIntervalDS`.

### Return Value

Returns `true` if the first of two `OracleIntervalDS` values is less than or equal to the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleIntervalDS` that has a value compares greater than an `OracleIntervalDS` that has a null value.
- Two `OracleIntervalDS`s that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## operator -

This static operator subtracts one `OracleIntervalDS` structure from another.

### Declaration

```
// C#  
public static OracleIntervalDS operator - (OracleIntervalDS val1,  
    OracleIntervalDS val2);
```

### Parameters

- `val1`  
The first `OracleIntervalDS`.
- `val2`  
The second `OracleIntervalDS`.

### Return Value

An `OracleIntervalDS` structure.

### Remarks

If either argument has a null value, the returned `OracleIntervalDS` structure has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## operator -

This static operator negates the supplied `OracleIntervalDS` structure.

### Declaration

```
// C#  
public static OracleIntervalDS operator - (OracleIntervalDS val);
```

### Parameters

- *val*  
An OracleIntervalDS.

### Return Value

An OracleIntervalDS structure.

### Remarks

If the supplied OracleIntervalDS structure has a null value, the returned OracleIntervalDS structure has a null value.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## operator \*

This static operator multiplies an OracleIntervalDS value by a number.

### Declaration

```
// C#  
public static OracleIntervalDS operator * (OracleIntervalDS val1,  
    int multiplier);
```

### Parameters

- *val1*  
The first OracleIntervalDS.
- *multiplier*  
A multiplier.

### Return Value

A new OracleIntervalDS instance.

### Remarks

If the OracleIntervalDS structure has a null value, the returned OracleIntervalDS structure has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## operator /

This static operator divides an `OracleIntervalDS` value by a number.

### Declaration

```
// C#  
public static OracleIntervalDS operator / (OracleIntervalDS val1,  
    int divisor);
```

### Parameters

- *val1*  
The first `OracleIntervalDS`.
- *divisor*  
A divisor.

### Return Value

An `OracleIntervalDS` structure.

### Remarks

If the `OracleIntervalDS` structure has a null value, the returned `OracleIntervalDS` structure has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## OracleIntervalDS Type Conversions

The `OracleIntervalDS` type conversions are listed in [Table 15-71](#).

**Table 15-71 OracleIntervalDS Type Conversions**

Operator	Description
<a href="#">explicit operator TimeSpan</a>	Converts an <code>OracleIntervalDS</code> structure to a <code>TimeSpan</code> structure
<a href="#">explicit operator OracleIntervalDS</a>	Converts a string to an <code>OracleIntervalDS</code> structure
<a href="#">implicit operator OracleIntervalDS</a>	Converts a <code>TimeSpan</code> structure to an <code>OracleIntervalDS</code> structure

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## explicit operator TimeSpan

This type conversion operator converts an `OracleIntervalDS` structure to a `TimeSpan` structure.

**Declaration**

```
// C#  
public static explicit operator TimeSpan(OracleIntervalDS val);
```

**Parameters**

- `val`  
An `OracleIntervalDS` instance.

**Return Value**

A `TimeSpan` structure.

**Exceptions**

`OracleNullValueException` - The `OracleIntervalDS` structure has a null value.

## Remarks



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## explicit operator OracleIntervalDS

This type conversion operator converts a string to an `OracleIntervalDS` structure.

### Declaration

```
// C#  
public static explicit operator OracleIntervalDS (string intervalStr);
```

### Parameters

- *intervalStr*

A string representation of an Oracle `INTERVAL DAY TO SECOND`.

### Return Value

An `OracleIntervalDS` structure.

### Exceptions

`ArgumentException` - The supplied *intervalStr* parameter is not in the correct format or has an invalid value.

`ArgumentNullException` - The *intervalStr* parameter is null.

### Remarks

The returned `OracleIntervalDS` structure contains the same time interval represented by the supplied *intervalStr*. The value specified in the supplied *intervalStr* must be in Day HH:MI:SSxFF format.

### Example

"1 2:3:4.99" means 1 day, 2 hours, 3 minutes 4 seconds and 990 milliseconds or 1 day, 2 hours, 3 minutes 4 seconds and 990000000 nanoseconds.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## implicit operator OracleIntervalDS

This type conversion operator converts a `TimeSpan` structure to an `OracleIntervalDS` structure.

### Declaration

```
// C#  
public static implicit operator OracleIntervalDS(TimeSpan val);
```

### Parameters

- `val`  
A `TimeSpan` instance.

### Return Value

An `OracleIntervalDS` structure.

### Remarks

The returned `OracleIntervalDS` structure contains the same days, hours, seconds, and milliseconds as the supplied `TimeSpan val`.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## OracleIntervalDS Properties

The `OracleIntervalDS` properties are listed in [Table 15-72](#).

**Table 15-72 OracleIntervalDS Properties**

Properties	Description
<a href="#">BinData</a>	Returns an array of bytes that represents the Oracle INTERVAL DAY TO SECOND in Oracle internal format
<a href="#">Days</a>	Gets the days component of an OracleIntervalDS
<a href="#">Hours</a>	Gets the hours component of an OracleIntervalDS
<a href="#">IsNull</a>	Indicates whether or not the current instance has a null value
<a href="#">Milliseconds</a>	Gets the milliseconds component of an OracleIntervalDS
<a href="#">Minutes</a>	Gets the minutes component of an OracleIntervalDS
<a href="#">Nanoseconds</a>	Gets the nanoseconds component of an OracleIntervalDS
<a href="#">Seconds</a>	Gets the seconds component of an OracleIntervalDS
<a href="#">TotalDays</a>	Returns the total number, in days, that represent the time period in the OracleIntervalDS structure
<a href="#">Value</a>	Specifies the time interval that is stored in the OracleIntervalDS structure

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## BinData

This property returns an array of bytes that represents the Oracle INTERVAL DAY TO SECOND in Oracle internal format.

**Declaration**

```
// C#
public byte[] BinData {get;}
```

**Property Value**

A byte array that represents an Oracle INTERVAL DAY TO SECOND in Oracle internal format.

**Exceptions**

OracleNullValueException - The current instance has a null value.

## Remarks



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## Days

This property gets the days component of an `OracleIntervalDS`.

### Declaration

```
// C#  
public int Days {get;}
```

### Property Value

An `int` representing the days component.

### Exceptions

`OracleNullValueException` - The current instance has a null value.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## Hours

This property gets the hours component of an `OracleIntervalDS`.

### Declaration

```
// C#  
public int Hours {get;}
```

### Property Value

An `int` representing the hours component.

## Exceptions

`OracleNullValueException` - The current instance has a null value.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## IsNull

This property indicates whether or not the current instance has a null value.

### Declaration

```
// C#  
public bool IsNull {get;}
```

### Property Value

Returns `true` if the current instance has a null value; otherwise, returns `false`.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## Milliseconds

This property gets the milliseconds component of an `OracleIntervalDS`.

### Declaration

```
// C#  
public double Milliseconds {get;}
```

### Property Value

A `double` that represents milliseconds component.

### Exceptions

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## Minutes

This property gets the minutes component of an `OracleIntervalDS`.

### Declaration

```
// C#  
public int Minutes {get;}
```

### Property Value

A `int` that represents minutes component.

### Exceptions

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## Nanoseconds

This property gets the nanoseconds component of an `OracleIntervalDS`.

### Declaration

```
// C#  
public int Nanoseconds {get;}
```

### Property Value

An `int` that represents nanoseconds component.

### Exceptions

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## Seconds

This property gets the seconds component of an `OracleIntervalDS`.

### Declaration

```
// C#  
public int Seconds {get;}
```

### Property Value

An `int` that represents seconds component.

### Exceptions

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## TotalDays

This property returns the total number, in days, that represent the time period in the `OracleIntervalDS` structure.

### Declaration

```
// C#  
public double TotalDays {get;}
```

### Property Value

A `double` that represents the total number of days.

### Exceptions

`OracleNullValueException` - The current instance has a null value.

 See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## Value

This property specifies the time interval that is stored in the `OracleIntervalDS` structure.

### Declaration

```
// C#
public TimeSpan Value {get;}
```

### Property Value

A time interval.

### Exceptions

`OracleNullValueException` - The current instance has a null value.

 See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## OracleIntervalDS Methods

The `OracleIntervalDS` methods are listed in [Table 15-73](#).

**Table 15-73 OracleIntervalDS Methods**

Methods	Description
<a href="#">CompareTo</a>	Compares the current <code>OracleIntervalDS</code> instance to an object, and returns an integer that represents their relative values
<a href="#">Equals</a>	Determines whether or not the specified object has the same time interval as the current instance (Overloaded)
<a href="#">GetHashCode</a>	Returns a hash code for the <code>OracleIntervalDS</code> instance
<a href="#">GetType</a>	Inherited from <code>System.Object</code>

Table 15-73 (Cont.) OracleIntervalDS Methods

Methods	Description
<a href="#">ToString</a>	Converts the current <code>OracleIntervalDS</code> structure to a string

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## CompareTo

This method compares the current `OracleIntervalDS` instance to an object, and returns an integer that represents their relative values.

### Declaration

```
// C#  
public int CompareTo(object obj);
```

### Parameters

- *obj*  
The object being compared to.

### Return Value

The method returns:

- Less than zero: if the current `OracleIntervalDS` represents a shorter time interval than *obj*.
- Zero: if the current `OracleIntervalDS` and *obj* represent the same time interval.
- Greater than zero: if the current `OracleIntervalDS` represents a longer time interval than *obj*.

### Implements

`IComparable`

### Exceptions

`ArgumentException` - The *obj* parameter is not of type `OracleIntervalDS`.

### Remarks

The following rules apply to the behavior of this method.

- The comparison must be between `OracleIntervalDS`s. For example, comparing an `OracleIntervalDS` instance with an `OracleBinary` instance is not allowed. When an `OracleIntervalDS` is compared with a different type, an `ArgumentException` is thrown.
- Any `OracleIntervalDS` that has a value compares greater than an `OracleIntervalDS` that has a null value.
- Two `OracleIntervalDS`s that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## Equals

This method determines whether or not the specified `object` has the same time interval as the current instance.

### Declaration

```
// C#  
public override bool Equals(object obj);
```

### Parameters

- `obj`  
The specified object.

### Return Value

Returns `true` if `obj` is of type `OracleIntervalDS` and has the same time interval as the current instance; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleIntervalDS` that has a value compares greater than an `OracleIntervalDS` that has a null value.
- Two `OracleIntervalDS`s that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## GetHashCode

Overrides `Object`

This method returns a hash code for the `OracleIntervalDS` instance.

### Declaration

```
// C#  
public override int GetHashCode();
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## ToString

Overrides `Object`

This method converts the current `OracleIntervalDS` structure to a string.

### Declaration

```
// C#  
public override string ToString();
```

### Return Value

Returns a `string`.

### Remarks

If the current instance has a null value, the returned string contains "null".

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalDS Structure](#)
- [OracleIntervalDS Members](#)

## OracleIntervalYM Structure

The `OracleIntervalYM` structure represents the Oracle `INTERVAL YEAR TO MONTH` data type to be stored in or retrieved from a database. Each `OracleIntervalYM` stores a period of time in years and months.

### Class Inheritance

`System.Object`

`System.ValueType`

`Oracle.DataAccess.Types.OracleIntervalYM`

### Declaration

```
// C#
public struct OracleIntervalYM : IComparable
```

### Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	<code>Oracle.DataAccess.dll</code>	<code>Oracle.ManagedDataAccess.dll</code>	<code>Oracle.ManagedDataAccess.dll</code>
<b>Namespace</b>	<code>Oracle.DataAccess.Client</code>	<code>Oracle.ManagedDataAccess.Client</code>	<code>Oracle.ManagedDataAccess.Client</code>
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

### Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

### Example

```
// C#

using System;
using Oracle.DataAccess.Types;

class OracleIntervalYMSample
```

```

{
    static void Main()
    {
        OracleIntervalYM iYMMax = OracleIntervalYM.MaxValue;
        double totalYears = iYMMax.TotalYears;

        totalYears -= 1;
        OracleIntervalYM iYMMax_1 = new OracleIntervalYM(totalYears);

        // Calculate the difference
        OracleIntervalYM iYMDiff = iYMMax - iYMMax_1;

        // Prints "iYMDiff.ToString() = +000000001-00"
        Console.WriteLine("iYMDiff.ToString() = " + iYMDiff.ToString());
    }
}

```

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Members](#)
- [OracleIntervalYM Constructors](#)
- [OracleIntervalYM Static Fields](#)
- [OracleIntervalYM Static Methods](#)
- [OracleIntervalYM Static Operators](#)
- [OracleIntervalYM Type Conversions](#)
- [OracleIntervalYM Properties](#)
- [OracleIntervalYM Methods](#)

## OracleIntervalYM Members

OracleIntervalYM members are listed in the following tables:

### OracleIntervalYM Constructors

OracleIntervalYM constructors are listed in [Table 15-74](#)

**Table 15-74 OracleIntervalYM Constructors**

Constructor	Description
<a href="#">OracleIntervalYM Constructors</a>	Instantiates a new instance of OracleIntervalYM structure (Overloaded)

### OracleIntervalYM Static Fields

The OracleIntervalYM static fields are listed in [Table 15-75](#).

**Table 15-75 OracleIntervalYM Static Fields**

Field	Description
<a href="#">MaxValue</a>	Represents the maximum value for an OracleIntervalYM structure
<a href="#">MinValue</a>	Represents the minimum value for an OracleIntervalYM structure
<a href="#">Null</a>	Represents a null value that can be assigned to an OracleIntervalYM instance
<a href="#">Zero</a>	Represents a zero value for an OracleIntervalYM structure

**OracleIntervalYM Static Methods**

The OracleIntervalYM static methods are listed in [Table 15-76](#).

**Table 15-76 OracleIntervalYM Static Methods**

Methods	Description
<a href="#">Equals</a>	Determines whether or not two OracleIntervalYM values are equal (Overloaded)
<a href="#">GreaterThan</a>	Determines whether or not one OracleIntervalYM value is greater than another
<a href="#">GreaterThanOrEqual</a>	Determines whether or not one OracleIntervalYM value is greater than or equal to another
<a href="#">LessThan</a>	Determines whether or not one OracleIntervalYM value is less than another
<a href="#">LessThanOrEqual</a>	Determines whether or not one OracleIntervalYM value is less than or equal to another
<a href="#">NotEquals</a>	Determines whether two OracleIntervalYM values are not equal
<a href="#">Parse</a>	Returns an OracleIntervalYM structure and sets its value for time interval using a string
<a href="#">SetPrecision</a>	Returns a new instance of an OracleIntervalYM with the specified year precision.

**OracleIntervalYM Static Operators**

The OracleIntervalYM static operators are listed in [Table 15-77](#).

**Table 15-77 OracleIntervalYM Static Operators**

Operator	Description
<a href="#">operator +</a>	Adds two OracleIntervalYM values

**Table 15-77 (Cont.) OracleIntervalYM Static Operators**

Operator	Description
<a href="#">operator ==</a>	Determines whether or not two OracleIntervalYM values are equal
<a href="#">operator &gt;</a>	Determines whether or not one OracleIntervalYM value is greater than another
<a href="#">operator &gt;=</a>	Determines whether or not one OracleIntervalYM value is greater than or equal to another
<a href="#">operator !=</a>	Determines whether two OracleIntervalYM values are not equal
<a href="#">operator &lt;</a>	Determines whether or not one OracleIntervalYM value is less than another
<a href="#">operator &lt;=</a>	Determines whether or not one OracleIntervalYM value is less than or equal to another
<a href="#">operator -</a>	Subtracts one OracleIntervalYM value from another
<a href="#">operator -</a>	Negates an OracleIntervalYM structure
<a href="#">operator *</a>	Multiplies an OracleIntervalYM value by a number
<a href="#">operator /</a>	Divides an OracleIntervalYM value by a number

**OracleIntervalYM Type Conversions**

The OracleIntervalYM conversions are listed in [Table 15-78](#).

**Table 15-78 OracleIntervalYM Type Conversions**

Operator	Description
<a href="#">explicit operator long</a>	Converts an OracleIntervalYM structure to a number
<a href="#">explicit operator OracleIntervalYM</a>	Converts a string to an OracleIntervalYM structure
<a href="#">implicit operator OracleIntervalYM</a>	Converts the number of months to an OracleIntervalYM structure

**OracleIntervalYM Properties**

The OracleIntervalYM properties are listed in [Table 15-79](#).

**Table 15-79 OracleIntervalYM Properties**

Properties	Description
<a href="#">BinData</a>	Returns an array of bytes that represents the Oracle INTERVAL YEAR TO MONTH in an Oracle internal format

Table 15-79 (Cont.) OracleIntervalYM Properties

Properties	Description
<a href="#">IsNull</a>	Indicates whether or not the current instance has a null value
<a href="#">Months</a>	Gets the months component of an OracleIntervalYM
<a href="#">TotalYears</a>	Returns the total number, in years, that represents the period of time in the current OracleIntervalYM structure
<a href="#">Value</a>	Specifies the total number of months that is stored in the OracleIntervalYM structure
<a href="#">Years</a>	Gets the years component of an OracleIntervalYM

### OracleIntervalYM Methods

The OracleIntervalYM methods are listed in [Table 15-80](#).

Table 15-80 OracleIntervalYM Methods

Methods	Description
<a href="#">CompareTo</a>	Compares the current OracleIntervalYM instance to the supplied object, and returns an integer that represents their relative values
<a href="#">Equals</a>	Determines whether or not the specified object has the same time interval as the current instance (Overloaded)
<a href="#">GetHashCode</a>	Returns a hash code for the OracleIntervalYM instance
<a href="#">GetType</a>	Inherited from System.Object
<a href="#">ToString</a>	Converts the current OracleIntervalYM structure to a string

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)

## OracleIntervalYM Constructors

The OracleIntervalYM constructors creates a new instance of the OracleIntervalYM structure.

**Overload List:**

- [OracleIntervalYM\(long\)](#)  
This method creates a new instance of the `OracleIntervalYM` structure using the supplied total number of months for a period of time.
- [OracleIntervalYM\(string\)](#)  
This method creates a new instance of the `OracleIntervalYM` structure and sets its value using the supplied string.
- [OracleIntervalYM\(double\)](#)  
This method creates a new instance of the `OracleIntervalYM` structure and sets its value using the total number of years.
- [OracleIntervalYM\(int, int\)](#)  
This method creates a new instance of the `OracleIntervalYM` structure and sets its value using years and months.
- [OracleIntervalYM\(byte\[\]\)](#)  
This method creates a new instance of the `OracleIntervalYM` structure and sets its value to the provided byte array, which is in an internal Oracle `INTERVAL DAY TO SECOND` format.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## OracleIntervalYM(long)

This method creates a new instance of the `OracleIntervalYM` structure using the supplied total number of months for a period of time.

**Declaration**

```
// C#  
public OracleIntervalYM (long totalMonths);
```

**Parameters**

- *totalMonths*  
The number of total months for a time interval. Range is  $-12,000,000,000 < totalMonths < 12,000,000,000$ .

**Exceptions**

`ArgumentOutOfRangeException` - The *totalMonths* parameter is out of the specified range.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## OracleIntervalYM(string)

This method creates a new instance of the `OracleIntervalYM` structure and sets its value using the supplied string.

### Declaration

```
// C#  
public OracleIntervalYM (string intervalStr);
```

### Parameters

- *intervalStr*  
A string representing the Oracle `INTERVAL YEAR TO MONTH`.

### Remarks

The value specified in the supplied *intervalStr* must be in Year-Month format.

### Exceptions

`ArgumentException` - The *intervalStr* parameter is not in the valid format or *intervalStr* has an invalid value.

`ArgumentNullException` - The *intervalStr* parameter is null.

### Example

"1-2" means 1 year and 2 months.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## OracleIntervalYM(double)

This method creates a new instance of the `OracleIntervalYM` structure and sets its value using the total number of years.

### Declaration

```
// C#  
public OracleIntervalYM (double totalYears);
```

### Parameters

- *totalYears*  
Number of total years. Range is  $-1,000,000,000 < totalYears > 1,000,000,000$ .

### Exceptions

*ArgumentOutOfRangeException* - The *totalYears* parameter is out of the specified range.

*ArgumentException* - The *totalYears* parameter cannot be used to construct a valid *OracleIntervalYM*.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## OracleIntervalYM(int, int)

This method creates a new instance of the *OracleIntervalYM* structure and sets its value using years and months.

### Declaration

```
// C#  
public OracleIntervalYM (int years, int months);
```

### Parameters

- *years*  
Number of years. Range of year is  $(-999,999,999 \text{ to } 999,999,999)$ .
- *months*  
Number of months. Range of month is  $(-11 \text{ to } 11)$ .

### Remarks

The sign of all the arguments must be the same.

### Exceptions

*ArgumentOutOfRangeException* - The argument value for one or more of the parameters is out of the specified range.

`ArgumentException` - The argument values of the parameters cannot be used to construct a valid `OracleIntervalYM`.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## OracleIntervalYM(byte[ ])

This method creates a new instance of the `OracleIntervalYM` structure and sets its value to the provided byte array, which is in an internal Oracle `INTERVAL DAY TO SECOND` format.

### Declaration

```
// C#  
public OracleIntervalYM (byte[] bytes);
```

### Parameters

- *bytes*  
A byte array that is in an internal Oracle `INTERVAL YEAR TO MONTH` format.

### Exceptions

`ArgumentException` - The supplied byte array is not in an internal Oracle `INTERVAL YEAR TO MONTH` format or the supplied byte array has an invalid value.

`ArgumentNullException` - *bytes* is null.

### Remarks

The supplied byte array must be in an internal Oracle `INTERVAL YEAR TO MONTH` format.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## OracleIntervalYM Static Fields

The `OracleIntervalYM` static fields are listed in [Table 15-81](#).

**Table 15-81 OracleIntervalYM Static Fields**

Field	Description
<a href="#">MaxValue</a>	Represents the maximum value for an OracleIntervalYM structure
<a href="#">MinValue</a>	Represents the minimum value for an OracleIntervalYM structure
<a href="#">Null</a>	Represents a null value that can be assigned to an OracleIntervalYM instance
<a href="#">Zero</a>	Represents a zero value for an OracleIntervalYM structure

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## MaxValue

This static field represents the maximum value for an OracleIntervalYM structure.

### Declaration

```
// C#  
public static readonly OracleIntervalYM MaxValue;
```

### Remarks

Year is 999999999 and Month is 11.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## MinValue

This static field represents the minimum value for an OracleIntervalYM structure.

### Declaration

```
// C#  
public static readonly OracleIntervalYM MinValue;
```

**Remarks**

Year is -999999999 and Month is -11.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## Null

This static field represents a null value that can be assigned to an `OracleIntervalYM` instance.

**Declaration**

```
// C#  
public static readonly OracleIntervalYM Null;
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## Zero

This static field represents a zero value for an `OracleIntervalYM` structure.

**Declaration**

```
// C#  
public static readonly OracleIntervalDS Zero;
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## OracleIntervalYM Static Methods

The `OracleIntervalYM` static methods are listed in [Table 15-82](#).

**Table 15-82 OracleIntervalYM Static Methods**

Methods	Description
<a href="#">Equals</a>	Determines whether or not two <code>OracleIntervalYM</code> values are equal (Overloaded)
<a href="#">GreaterThan</a>	Determines whether or not one <code>OracleIntervalYM</code> value is greater than another
<a href="#">GreaterThanOrEqual</a>	Determines whether or not one <code>OracleIntervalYM</code> value is greater than or equal to another
<a href="#">LessThan</a>	Determines whether or not one <code>OracleIntervalYM</code> value is less than another
<a href="#">LessThanOrEqual</a>	Determines whether or not one <code>OracleIntervalYM</code> value is less than or equal to another
<a href="#">NotEquals</a>	Determines whether two <code>OracleIntervalYM</code> values are not equal
<a href="#">Parse</a>	Returns an <code>OracleIntervalYM</code> structure and sets its value for time interval using a string
<a href="#">SetPrecision</a>	Returns a new instance of an <code>OracleIntervalYM</code> with the specified year precision.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## Equals

This static method determines whether or not two `OracleIntervalYM` values are equal.

### Declaration

```
// C#
public static bool Equals(OracleIntervalYM val1, OracleIntervalYM val2);
```

### Parameters

- `val1`  
An `OracleIntervalYM` structure.
- `val2`  
An `OracleIntervalYM` structure.

### Return Value

Returns `true` if two `OracleIntervalYM` values represent the same time interval, otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleIntervalYM` that has a value compares greater than an `OracleIntervalYM` that has a null value.
- Two `OracleIntervalYMs` that contain a null value are equal.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## GreaterThan

This static method determines whether or not the first of two `OracleIntervalYM` values is greater than the second.

### Declaration

```
// C#  
public static bool GreaterThan(OracleIntervalYM val1, OracleIntervalYM val2);
```

### Parameters

- *val1*  
The first `OracleIntervalYM`.
- *val2*  
The second `OracleIntervalYM`.

### Return Value

Returns `true` if the first of two `OracleIntervalYM` values is greater than the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleIntervalYM` that has a value compares greater than an `OracleIntervalYM` that has a null value.
- Two `OracleIntervalYMs` that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## GreaterThanOrEqual

This static method determines whether or not the first of two `OracleIntervalYM` values is greater than or equal to the second.

### Declaration

```
// C#  
public static bool GreaterThanOrEqual(OracleIntervalYM val1,  
    OracleIntervalYM val2);
```

### Parameters

- *val1*  
The first `OracleIntervalYM`.
- *val2*  
The second `OracleIntervalYM`.

### Return Value

Returns `true` if the first of two `OracleIntervalYM` values is greater than or equal to the second; otherwise returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleIntervalYM` that has a value compares greater than an `OracleIntervalYM` that has a null value.
- Two `OracleIntervalYMs` that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## LessThan

This static method determines whether or not the first of two `OracleIntervalYM` values is less than the second.

### Declaration

```
// C#  
public static bool LessThan(OracleIntervalYM val1, OracleIntervalYM val2);
```

### Parameters

- `val1`  
The first `OracleIntervalYM`.
- `val2`  
The second `OracleIntervalYM`.

### Return Value

Returns `true` if the first of two `OracleIntervalYM` values is less than the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleIntervalYM` that has a value compares greater than an `OracleIntervalYM` that has a null value.
- Two `OracleIntervalYMs` that contain a null value are equal.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## LessThanOrEqual

This static method determines whether or not the first of two `OracleIntervalYM` values is less than or equal to the second.

### Declaration

```
// C#  
public static bool LessThanOrEqual(OracleIntervalYM val1, OracleIntervalYM val2);
```

### Parameters

- `val1`

The first `OracleIntervalYM`.

- `val2`

The second `OracleIntervalYM`.

### Return Value

Returns `true` if the first of two `OracleIntervalYM` values is less than or equal to the second. Returns `false` otherwise.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleIntervalYM` that has a value compares greater than an `OracleIntervalYM` that has a null value.
- Two `OracleIntervalYMs` that contain a null value are equal.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## NotEquals

This static method determines whether two `OracleIntervalYM` values are not equal.

### Declaration

```
// C#  
public static bool NotEquals(OracleIntervalYM val1, OracleIntervalYM val2);
```

### Parameters

- `val1`

The first `OracleIntervalYM`.

- `val2`

The second `OracleIntervalYM`.

### Return Value

Returns `true` if two `OracleIntervalYM` values are not equal. Returns `false` otherwise.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleIntervalYM` that has a value compares greater than an `OracleIntervalYM` that has a null value.

- Two OracleIntervalYMs that contain a null value are equal.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## Parse

This static method returns an OracleIntervalYM structure and sets its value for time interval using a string.

### Declaration

```
// C#  
public static OracleIntervalYM Parse (string intervalStr);
```

### Parameters

- *intervalStr*

A string representing the Oracle INTERVAL YEAR TO MONTH.

### Return Value

Returns an OracleIntervalYM structure.

### Exceptions

ArgumentException - The *intervalStr* parameter is not in the valid format or *intervalStr* has an invalid value.

ArgumentNullException - The *intervalStr* parameter is null.

### Remarks

The value specified in the supplied *intervalStr* must be in the Year-Month format.

### Example

"1-2" means 1 year and 2 months.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## SetPrecision

This static method returns a new instance of an `OracleIntervalYM` with the specified year precision.

### Declaration

```
// C#
public static OracleIntervalYM SetPrecision(OracleIntervalYM value1,
    int yearPrecision);
```

### Parameters

- `value1`  
An `OracleIntervalYM` structure.
- `yearPrecision`  
The year precision provided. Range of year precision is (0 to 9).

### Return Value

An `OracleIntervalDS` instance.

### Exceptions

`ArgumentOutOfRangeException` - `yearPrecision` is out of the specified range.

### Remarks

Depending on the value specified in the supplied `yearPrecision`, 0 or more leading zeros are displayed in the string returned by `ToString()`.

### Example

An `OracleIntervalYM` with a value of "1-2" results in the string "001-2" when `SetPrecision()` is called with the year precision set to 3.

 See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## OracleIntervalYM Static Operators

The `OracleIntervalYM` static operators are listed in [Table 15-83](#).

**Table 15-83 OracleIntervalYM Static Operators**

Operator	Description
<code>operator +</code>	Adds two <code>OracleIntervalYM</code> values
<code>operator ==</code>	Determines whether or not two <code>OracleIntervalYM</code> values are equal
<code>operator &gt;</code>	Determines whether or not one <code>OracleIntervalYM</code> value is greater than another
<code>operator &gt;=</code>	Determines whether or not one <code>OracleIntervalYM</code> value is greater than or equal to another
<code>operator !=</code>	Determines whether two <code>OracleIntervalYM</code> values are not equal
<code>operator &lt;</code>	Determines whether or not one <code>OracleIntervalYM</code> value is less than another
<code>operator &lt;=</code>	Determines whether or not one <code>OracleIntervalYM</code> value is less than or equal to another
<code>operator -</code>	Subtracts one <code>OracleIntervalYM</code> value from another
<code>operator -</code>	Negates an <code>OracleIntervalYM</code> structure
<code>operator *</code>	Multiplies an <code>OracleIntervalYM</code> value by a number
<code>operator /</code>	Divides an <code>OracleIntervalYM</code> value by a number

 See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## operator +

This static operator adds two `OracleIntervalYM` values.

### Declaration

```
// C#  
public static OracleIntervalYM operator + (OracleIntervalYM val1,  
    OracleIntervalYM val2);
```

### Parameters

- `val1`  
The first `OracleIntervalYM`.
- `val2`  
The second `OracleIntervalYM`.

### Return Value

`OracleIntervalYM`

### Remarks

If either argument has a null value, the returned `OracleIntervalYM` structure has a null value.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## operator ==

This static operator determines if two `OracleIntervalYM` values are equal.

### Declaration

```
// C#  
public static bool operator == (OracleIntervalYM val1, OracleIntervalYM val2);
```

### Parameters

- `val1`  
The first `OracleIntervalYM`.
- `val2`  
The second `OracleIntervalYM`.

### Return Value

Returns `true` if they are equal; otherwise returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleIntervalYM` that has a value compares greater than an `OracleIntervalYM` that has a null value.
- Two `OracleIntervalYMs` that contain a null value are equal.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## operator >

This static operator determines if the first of two `OracleIntervalYM` values is greater than the second.

### Declaration

```
// C#  
public static bool operator > (OracleIntervalYM val1, OracleIntervalYM val2);
```

### Parameters

- `val1`  
The first `OracleIntervalYM`.
- `val2`  
The second `OracleIntervalYM`.

### Return Value

Returns `true` if one `OracleIntervalYM` value is greater than another; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleIntervalYM` that has a value compares greater than an `OracleIntervalYM` that has a null value.
- Two `OracleIntervalYMs` that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## operator >=

This static operator determines if the first of two `OracleIntervalYM` values is greater than or equal to the second.

### Declaration

```
// C#  
public static bool operator >= (OracleIntervalYM val1, OracleIntervalYM val2);
```

### Parameters

- `val1`  
The first `OracleIntervalYM`.
- `val2`  
The second `OracleIntervalYM`.

### Return Value

Returns `true` if one `OracleIntervalYM` value is greater than or equal to another; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleIntervalYM` that has a value compares greater than an `OracleIntervalYM` that has a null value.
- Two `OracleIntervalYMs` that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## operator !=

This static operator determines whether two `OracleIntervalYM` values are not equal.

### Declaration

```
// C#  
public static bool operator != (OracleIntervalYM val1, OracleIntervalYM val2)
```

### Parameters

- `val1`  
The first `OracleIntervalYM`.
- `val2`  
The second `OracleIntervalYM`.

### Return Value

Returns `true` if two `OracleIntervalYM` values are not equal; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleIntervalYM` that has a value compares greater than an `OracleIntervalYM` that has a null value.
- Two `OracleIntervalYMs` that contain a null value are equal.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## operator <

This static operator determines if the first of two `OracleIntervalYM` values is less than the second.

### Declaration

```
// C#  
public static bool operator < (OracleIntervalYM val1, OracleIntervalYM val2);
```

### Parameters

- `val1`  
The first `OracleIntervalYM`.

- *val2*  
The second OracleIntervalYM.

### Return Value

Returns `true` if the first of two OracleIntervalYM values is less than the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any OracleIntervalYM that has a value compares greater than an OracleIntervalYM that has a null value.
- Two OracleIntervalYMs that contain a null value are equal.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## operator <=

This static operator determines if the first of two OracleIntervalYM values is less than or equal to the second.

### Declaration

```
// C#  
public static bool operator <= (OracleIntervalYM val1, OracleIntervalYM val2);
```

### Parameters

- *val1*  
The first OracleIntervalYM.
- *val2*  
The second OracleIntervalYM.

### Return Value

Returns `true` if the first of two OracleIntervalYM values is less than or equal to the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any OracleIntervalYM that has a value compares greater than an OracleIntervalYM that has a null value.
- Two OracleIntervalYMs that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## operator -

This static operator subtracts one OracleIntervalYM structure from another.

### Declaration

```
// C#  
public static OracleIntervalYM operator - (OracleIntervalYM val1,  
OracleIntervalYM val2);
```

### Parameters

- *val1*  
The first OracleIntervalYM.
- *val2*  
The second OracleIntervalYM.

### Return Value

An OracleIntervalYM structure.

### Remarks

If either argument has a null value, the returned OracleIntervalYM structure has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## operator -

This static operator negates an `OracleIntervalYM` structure.

### Declaration

```
// C#  
public static OracleIntervalYM operator - (OracleIntervalYM val);
```

### Parameters

- *val*  
An `OracleIntervalYM`.

### Return Value

An `OracleIntervalYM` structure.

### Remarks

If the supplied `OracleIntervalYM` structure has a null value, the returned `OracleIntervalYM` structure has a null value.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## operator \*

This static operator multiplies an `OracleIntervalYM` value by a number.

### Declaration

```
// C#  
public static OracleIntervalYM operator * (OracleIntervalYM vall, int multiplier);
```

### Parameters

- *vall*  
The first `OracleIntervalYM`.
- *multiplier*  
A multiplier.

### Return Value

An `OracleIntervalYM` structure.

### Remarks

If the supplied `OracleIntervalYM` structure has a null value, the returned `OracleIntervalYM` structure has a null value.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## operator /

This static operator divides an `OracleIntervalYM` value by a number.

### Declaration

```
// C#  
public static OracleIntervalYM operator / (OracleIntervalYM val1, int divisor);
```

### Parameters

- *val1*  
The first `OracleIntervalYM`.
- *divisor*  
A divisor.

### Return Value

An `OracleIntervalYM` structure.

### Remarks

If the supplied `OracleIntervalYM` structure has a null value, the returned `OracleIntervalYM` structure has a null value.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## OracleIntervalYM Type Conversions

The `OracleIntervalYM` conversions are listed in [Table 15-84](#).

**Table 15-84 OracleIntervalYM Type Conversions**

Operator	Description
<a href="#">explicit operator long</a>	Converts an <code>OracleIntervalYM</code> structure to a number
<a href="#">explicit operator OracleIntervalYM</a>	Converts a string to an <code>OracleIntervalYM</code> structure
<a href="#">implicit operator OracleIntervalYM</a>	Converts the number of months to an <code>OracleIntervalYM</code> structure

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

### explicit operator long

This type conversion operator converts an `OracleIntervalYM` to a number that represents the number of months in the time interval.

#### Declaration

```
// C#  
public static explicit operator long (OracleIntervalYM val);
```

#### Parameters

- `val`  
An `OracleIntervalYM` structure.

#### Return Value

A long number in months.

#### Exceptions

`OracleNullValueException` - The `OracleIntervalYM` structure has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## explicit operator OracleIntervalYM

This type conversion operator converts the string *intervalStr* to an OracleIntervalYM structure.

### Declaration

```
// C#  
public static explicit operator OracleIntervalYM (string intervalStr);
```

### Parameters

- *intervalStr*

A string representation of an Oracle INTERVAL YEAR TO MONTH.

### Return Value

An OracleIntervalYM structure.

### Exceptions

ArgumentException - The supplied *intervalStr* parameter is not in the correct format or has an invalid value.

ArgumentNullException - The *intervalStr* parameter is null.

### Remarks

The returned OracleIntervalDS structure contains the same time interval represented by the supplied *intervalStr*. The value specified in the supplied *intervalStr* must be in Year-Month format.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## implicit operator OracleIntervalYM

This type conversion operator converts the total number of months as time interval to an `OracleIntervalYM` structure.

### Declaration

```
// C#
public static implicit operator OracleIntervalYM (long months);
```

### Parameters

- `months`**  
 The number of months to be converted. Range is  $(-999,999,999 * 12) - 11 \leq months \leq (999,999,999 * 12) + 11$ .

### Return Value

An `OracleIntervalYM` structure.

### Exceptions

`ArgumentOutOfRangeException` - The `months` parameter is out of the specified range.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## OracleIntervalYM Properties

The `OracleIntervalYM` properties are listed in [Table 15-85](#).

**Table 15-85 OracleIntervalYM Properties**

Properties	Description
<a href="#">BinData</a>	Returns an array of bytes that represents the Oracle <code>INTERVAL YEAR TO MONTH</code> in an Oracle internal format
<a href="#">IsNull</a>	Indicates whether or not the current instance has a null value
<a href="#">Months</a>	Gets the months component of an <code>OracleIntervalYM</code>
<a href="#">TotalYears</a>	Returns the total number, in years, that represents the period of time in the current <code>OracleIntervalYM</code> structure
<a href="#">Value</a>	Specifies the total number of months that is stored in the <code>OracleIntervalYM</code> structure
<a href="#">Years</a>	Gets the years component of an <code>OracleIntervalYM</code>

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## BinData

This property returns an array of bytes that represents the Oracle `INTERVAL YEAR TO MONTH` in Oracle internal format.

### Declaration

```
// C#  
public byte[] BinData {get;}
```

### Property Value

A byte array that represents an Oracle `INTERVAL YEAR TO MONTH` in Oracle internal format.

### Exceptions

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## IsNull

This property indicates whether or not the value has a null value.

### Declaration

```
// C#  
public bool IsNull {get;}
```

### Property Value

Returns `true` if value has a null value; otherwise, returns `false`.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## Months

This property gets the months component of an `OracleIntervalYM`.

### Declaration

```
// C#  
public int Months {get;}
```

### Property Value

An `int` representing the months component.

### Exceptions

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## TotalYears

This property returns the total number, in years, that represents the period of time in the current `OracleIntervalYM` structure.

### Declaration

```
// C#  
public double TotalYears {get;}
```

### Property Value

A `double` representing the total number of years.

### Exceptions

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## Value

This property gets the total number of months that is stored in the `OracleIntervalYM` structure.

### Declaration

```
// C#  
public long Value {get;}
```

### Property Value

The total number of months representing the time interval.

### Exceptions

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## Years

This property gets the years component of an `OracleIntervalYM`.

### Declaration

```
// C#  
public int Years {get;}
```

### Property Value

An `int` representing the years component.

### Exceptions

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## OracleIntervalYM Methods

The `OracleIntervalYM` methods are listed in [Table 15-86](#).

**Table 15-86 OracleIntervalYM Methods**

Methods	Description
<a href="#">CompareTo</a>	Compares the current <code>OracleIntervalYM</code> instance to the supplied object, and returns an integer that represents their relative values
<a href="#">Equals</a>	Determines whether or not the specified object has the same time interval as the current instance (Overloaded)
<a href="#">GetHashCode</a>	Returns a hash code for the <code>OracleIntervalYM</code> instance
<a href="#">GetType</a>	Inherited from <code>System.Object</code>
<a href="#">ToString</a>	Converts the current <code>OracleIntervalYM</code> structure to a string

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## CompareTo

This method compares the current `OracleIntervalYM` instance to the supplied object, and returns an integer that represents their relative values.

### Declaration

```
// C#
public int CompareTo(object obj);
```

### Parameters

- `obj`  
The supplied object.

### Return Value

The method returns a number:

Less than zero: if the current `OracleIntervalYM` represents a shorter time interval than `obj`.

Zero: if the current `OracleIntervalYM` and `obj` represent the same time interval.

Greater than zero: if the current `OracleIntervalYM` represents a longer time interval than `obj`.

### Implements

`IComparable`

### Exceptions

`ArgumentException` - The `obj` parameter is not of type `OracleIntervalYM`.

### Remarks

The following rules apply to the behavior of this method.

- The comparison must be between `OracleIntervalYMs`. For example, comparing an `OracleIntervalYM` instance with an `OracleBinary` instance is not allowed. When an `OracleIntervalYM` is compared with a different type, an `ArgumentException` is thrown.
- Any `OracleIntervalYM` that has a value compares greater than an `OracleIntervalYM` that has a null value.
- Two `OracleIntervalYMs` that contain a null value are equal.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## Equals

Overrides `Object`

This method determines whether or not the specified object has the same time interval as the current instance.

### Declaration

```
// C#  
public override bool Equals(object obj);
```

### Parameters

- *obj*  
The supplied object.

### Return Value

Returns `true` if the specified object instance is of type `OracleIntervalYM` and has the same time interval; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleIntervalYM` that has a value compares greater than an `OracleIntervalYM` that has a null value.
- Two `OracleIntervalYMs` that contain a null value are equal.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## GetHashCode

Overrides `Object`

This method returns a hash code for the `OracleIntervalYM` instance.

### Declaration

```
// C#  
public override int GetHashCode();
```

### Return Value

An `int` representing a hash code.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## ToString

Overrides `Object`

This method converts the current `OracleIntervalYM` structure to a string.

### Declaration

```
// C#
public override string ToString();
```

### Return Value

A string that represents the current `OracleIntervalYM` structure.

### Remarks

If the current instance has a null value, the returned string contain "null".



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleIntervalYM Structure](#)
- [OracleIntervalYM Members](#)

## OracleString Structure

The `OracleString` structure represents a variable-length stream of characters to be stored in or retrieved from a database.

### Class Inheritance

`System.Object`

`System.ValueType`

`Oracle.DataAccess.Types.OracleString`

### Declaration

```
// C#
public struct OracleString : IComparable, INullable, IXmlSerializable
```

### Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll

---

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Namespace</b>	Oracle.DataAccess .Client	Oracle.ManagedDat aAccess.Client	Oracle.ManagedDat aAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

---

### Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

### Example

```
// C#  
  
using System;  
using Oracle.DataAccess.Types;  
  
class OracleStringSample  
{  
    static void Main()  
    {  
        // Initialize OracleString structs  
        OracleString string1 = new OracleString("AAA");  
  
        // Display the string "AAA"  
        Console.WriteLine("{0} has length of {1}", string1, string1.Length);  
  
        // Contatenate characters to string1 until the length is 5  
        while (string1.Length < 5)  
            string1 = OracleString.Concat(string1, "a");  
  
        // Display the string of "AAAaa"  
        Console.WriteLine("{0} has length of {1}", string1, string1.Length);  
    }  
}
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Members](#)
- [OracleString Constructors](#)
- [OracleString Static Fields](#)
- [OracleString Static Methods](#)
- [OracleString Static Operators](#)
- [OracleString Type Conversions](#)
- [OracleString Properties](#)
- [OracleString Methods](#)

## OracleString Members

OracleString members are listed in the following tables:

### OracleString Constructors

OracleString constructors are listed in [Table 15-87](#)

**Table 15-87 OracleString Constructors**

Constructor	Description
<a href="#">OracleString Constructors</a>	Instantiates a new instance of OracleString structure (Overloaded)

### OracleString Static Fields

The OracleString static fields are listed in [Table 15-88](#).

**Table 15-88 OracleString Static Fields**

Field	Description
<a href="#">Null</a>	Represents a null value that can be assigned to an instance of the OracleString structure

### OracleString Static Methods

The OracleString static methods are listed in [Table 15-89](#).

**Table 15-89 OracleString Static Methods**

Methods	Description
<a href="#">Concat</a>	Concatenates two <code>OracleString</code> instances and returns a new <code>OracleString</code> instance that represents the result
<a href="#">Equals</a>	Determines if two <code>OracleString</code> values are equal (Overloaded)
<a href="#">GreaterThan</a>	Determines whether or not the first of two <code>OracleString</code> values is greater than the second
<a href="#">GreaterThanOrEqual</a>	Determines whether or not the first of two <code>OracleString</code> values is greater than or equal to the second
<a href="#">LessThan</a>	Determines whether or not the first of two <code>OracleString</code> values is less than the second
<a href="#">LessThanOrEqual</a>	Determines whether or not the first of two <code>OracleString</code> values is less than or equal to the second
<a href="#">NotEquals</a>	Determines whether two <code>OracleString</code> values are not equal

### OracleString Static Operators

The `OracleString` static operators are listed in [Table 15-90](#).

**Table 15-90 OracleString Static Operators**

Operator	Description
<a href="#">operator +</a>	Concatenates two <code>OracleString</code> values
<a href="#">operator ==</a>	Determines if two <code>OracleString</code> values are equal
<a href="#">operator &gt;</a>	Determines if the first of two <code>OracleString</code> values is greater than the second
<a href="#">operator &gt;=</a>	Determines if the first of two <code>OracleString</code> values is greater than or equal to the second
<a href="#">operator !=</a>	Determines if the two <code>OracleString</code> values are not equal
<a href="#">operator &lt;</a>	Determines if the first of two <code>OracleString</code> values is less than the second
<a href="#">operator &lt;=</a>	Determines if two <code>OracleString</code> values are not equal

### OracleString Type Conversions

The `OracleString` type conversions are listed in [Table 15-91](#).

**Table 15-91 OracleString Type Conversions**

Operator	Description
<a href="#">explicit operator string</a>	Converts the supplied <code>OracleString</code> to a <code>string</code> instance
<a href="#">implicit operator OracleString</a>	Converts the supplied <code>string</code> to an <code>OracleString</code> instance

**OracleString Properties**

The `OracleString` properties are listed in [Table 15-92](#).

**Table 15-92 OracleString Properties**

Properties	Description
<a href="#">IsCaseIgnored</a>	Indicates whether or not case should be ignored when performing string comparison
<a href="#">IsNull</a>	Indicates whether or not the current instance has a null value
<a href="#">Item</a>	Obtains the particular character in an <code>OracleString</code> using an index.
<a href="#">Length</a>	Returns the length of the <code>OracleString</code>
<a href="#">Value</a>	Returns the string data that is stored in the <code>OracleString</code> structure.

**OracleString Methods**

The `OracleString` methods are listed in [Table 15-93](#).

**Table 15-93 OracleString Methods**

Methods	Description
<a href="#">Clone</a>	Returns a copy of the current <code>OracleString</code> instance
<a href="#">CompareTo</a>	Compares the current <code>OracleString</code> instance to the supplied object, and returns an integer that represents their relative values
<a href="#">Equals</a>	Determines whether or not an object has the same string value as the current <code>OracleString</code> structure (Overloaded)
<a href="#">GetHashCode</a>	Returns a hash code for the <code>OracleString</code> instance
<a href="#">GetNonUnicodeBytes</a>	Returns an array of bytes, containing the contents of the <code>OracleString</code> , in the client character set format
<a href="#">GetType</a>	Inherited from <code>System.Object</code>

Table 15-93 (Cont.) OracleString Methods

Methods	Description
<a href="#">GetUnicodeBytes</a>	Returns an array of bytes, containing the contents of the <code>OracleString</code> , in Unicode format
<a href="#">ToString</a>	Converts the current <code>OracleString</code> instance to a string

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)

## OracleString Constructors

The `OracleString` constructors create new instances of the `OracleString` structure.

**Overload List:**

- [OracleString\(string\)](#)

This constructor creates a new instance of the `OracleString` structure and sets its value using a string.

- [OracleString\(string, bool\)](#)

This constructor creates a new instance of the `OracleString` structure and sets its value using a string and specifies if case is ignored in comparison.

- [OracleString\(byte \[\], bool\)](#)

This constructor creates a new instance of the `OracleString` structure and sets its value using a byte array and specifies if the supplied byte array is Unicode encoded.

- [OracleString\(byte \[\], bool, bool\)](#)

This constructor creates a new instance of the `OracleString` structure and sets its value using a byte array and specifies the following: if the supplied byte array is Unicode encoded and if case is ignored in comparison.

- [OracleString\(byte \[\], int, int, bool\)](#)

This constructor creates a new instance of the `OracleString` structure and sets its value using a byte array, and specifies the following: the starting index in the byte array, the number of bytes to copy from the byte array, and if the supplied byte array is Unicode encoded.

- [OracleString\(byte \[\], int, int, bool, bool\)](#)

This constructor creates a new instance of the `OracleString` structure and sets its value using a byte array, and specifies the following: the starting index in the byte array, the number of bytes to copy from the byte array, if the supplied byte array is Unicode encoded, and if case is ignored in comparison.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## OracleString(string)

This constructor creates a new instance of the `OracleString` structure and sets its value using a string.

### Declaration

```
// C#  
public OracleString(string data);
```

### Parameters

- *data*  
A string value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## OracleString(string, bool)

This constructor creates a new instance of the `OracleString` structure and sets its value using a string and specifies if case is ignored in comparison.

### Declaration

```
// C#  
public OracleString(string data, bool isCaseIgnored);
```

### Parameters

- *data*  
A string value.
- *isCaseIgnored*  
Specifies if case is ignored in comparison. Specifies `true` if case is to be ignored; otherwise, specifies `false`.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## OracleString(byte [], bool)

This constructor creates a new instance of the `OracleString` structure and sets its value using a byte array and specifies if the supplied byte array is Unicode encoded.

### Declaration

```
// C#  
public OracleString(byte[] data, bool fUnicode);
```

### Parameters

- *data*  
Byte array data for the new `OracleString`.
- *fUnicode*  
Specifies if the supplied *data* is Unicode encoded. Specifies `true` if Unicode encoded; otherwise, `false`.

### Exceptions

`ArgumentNullException` - The *data* parameter is null.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## OracleString(byte [], bool, bool)

This constructor creates a new instance of the `OracleString` structure and sets its value using a byte array and specifies the following: if the supplied byte array is Unicode encoded and if case is ignored in comparison.

### Declaration

```
// C#  
public OracleString(byte[] data, bool fUnicode, bool isCaseIgnored);
```

### Parameters

- *data*  
Byte array data for the new `OracleString`.
- *fUnicode*  
Specifies if the supplied *data* is Unicode encoded. Specifies `true` if Unicode encoded; otherwise, `false`.
- *isCaseIgnored*  
Specifies if case is ignored in comparison. Specifies `true` if case is to be ignored; otherwise, specifies `false`.

### Exceptions

`ArgumentNullException` - The *data* parameter is null.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## OracleString(byte [ ], int, int, bool)

This constructor creates a new instance of the `OracleString` structure and sets its value using a byte array, and specifies the following: the starting index in the byte array, the number of bytes to copy from the byte array, and if the supplied byte array is Unicode encoded.

### Declaration

```
// C#  
public OracleString(byte[] data, int index, int count, bool fUnicode);
```

### Parameters

- *data*  
Byte array data for the new `OracleString`.
- *index*  
The starting index to copy from *data*.
- *count*  
The number of bytes to copy.
- *fUnicode*

Specifies if the supplied `data` is Unicode encoded. Specifies `true` if Unicode encoded; otherwise, `false`.

### Exceptions

`ArgumentNullException` - The `data` parameter is null.

`ArgumentOutOfRangeException` - The `count` parameter is less than zero.

`IndexOutOfRangeException` - The `index` parameter is greater than or equal to the length of `data` or less than zero.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## OracleString(byte [ ], int, int, bool, bool)

This constructor creates a new instance of the `OracleString` structure and sets its value using a byte array, and specifies the following: the starting index in the byte array, the number of bytes to copy from the byte array, if the supplied byte array is Unicode encoded, and if case is ignored in comparison.

### Declaration

```
// C#  
public OracleString(byte[] data, int index, int count, bool fUnicode,  
    bool isCaseIgnored);
```

### Parameters

- `data`  
Byte array data for the new `OracleString`.
- `index`  
The starting index to copy from `data`.
- `count`  
The number of bytes to copy.
- `fUnicode`  
Specifies if the supplied `data` is Unicode encoded. Specifies `true` if Unicode encoded; otherwise, `false`.
- `isCaseIgnored`  
Specifies if case is ignored in comparison. Specifies `true` if case is to be ignored; otherwise, specifies `false`.

## Exceptions

`ArgumentNullException` - The `data` parameter is null.

`ArgumentOutOfRangeException` - The `count` parameter is less than zero.

`IndexOutOfRangeException` - The `index` parameter is greater than or equal to the length of `data` or less than zero.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## OracleString Static Fields

The `OracleString` static fields are listed in [Table 15-94](#).

**Table 15-94 OracleString Static Fields**

Field	Description
<a href="#">Null</a>	Represents a null value that can be assigned to an instance of the <code>OracleString</code> structure

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## Null

This static field represents a null value that can be assigned to an instance of the `OracleString` structure.

### Declaration

```
// C#  
public static readonly OracleString Null;
```

 See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## OracleString Static Methods

The `OracleString` static methods are listed in [Table 15-95](#).

**Table 15-95 OracleString Static Methods**

Methods	Description
<a href="#">Concat</a>	Concatenates two <code>OracleString</code> instances and returns a new <code>OracleString</code> instance that represents the result
<a href="#">Equals</a>	Determines if two <code>OracleString</code> values are equal (Overloaded)
<a href="#">GreaterThan</a>	Determines whether or not the first of two <code>OracleString</code> values is greater than the second
<a href="#">GreaterThanOrEqual</a>	Determines whether or not the first of two <code>OracleString</code> values is greater than or equal to the second
<a href="#">LessThan</a>	Determines whether or not the first of two <code>OracleString</code> values is less than the second
<a href="#">LessThanOrEqual</a>	Determines whether or not the first of two <code>OracleString</code> values is less than or equal to the second
<a href="#">NotEquals</a>	Determines whether two <code>OracleString</code> values are not equal

 See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

### Concat

This static method concatenates two `OracleString` instances and returns a new `OracleString` instance that represents the result.

#### Declaration

```
// C#
public static OracleString Concat(OracleString str1, OracleString str2);
```

**Parameters**

- *str1*  
The first `OracleString`.
- *str2*  
The second `OracleString`.

**Return Value**

An `OracleString`.

**Remarks**

If either argument has a null value, the returned `OracleString` structure has a null value.

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## Equals

Overloads `Object`

This static method determines whether or not the two `OracleStrings` being compared are equal.

**Declaration**

```
// C#  
public static bool Equals(OracleString str1, OracleString str2);
```

**Parameters**

- *str1*  
The first `OracleString`.
- *str2*  
The second `OracleString`.

**Return Value**

Returns `true` if the two `OracleStrings` being compared are equal; returns `false` otherwise.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleString` that has a value is greater than an `OracleString` that has a null value.
- Two `OracleStrings` that contain a null value are equal.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## GreaterThan

This static method determines whether or not the first of two `OracleString` values is greater than the second.

### Declaration

```
// C#  
public static bool GreaterThan(OracleString str1, OracleString str2);
```

### Parameters

- *str1*  
The first `OracleString`.
- *str2*  
The second `OracleString`.

### Return Value

Returns `true` if the first of two `OracleStrings` is greater than the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleString` that has a value is greater than an `OracleString` that has a null value.
- Two `OracleStrings` that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## GreaterThanOrEqual

This static method determines whether or not the first of two `OracleString` values is greater than or equal to the second.

### Declaration

```
// C#  
public static bool GreaterThanOrEqual(OracleString str1,  
    OracleString str2);
```

### Parameters

- `str1`  
The first `OracleString`.
- `str2`  
The second `OracleString`.

### Return Value

Returns `true` if the first of two `OracleStrings` is greater than or equal to the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleString` that has a value is greater than an `OracleString` that has a null value.
- Two `OracleStrings` that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## LessThan

This static method determines whether or not the first of two `OracleString` values is less than the second.

### Declaration

```
// C#  
public static bool LessThan(OracleString str1, OracleString str2);
```

### Parameters

- `str1`  
The first `OracleString`.
- `str2`  
The second `OracleString`.

### Return Value

Returns `true` if the first is less than the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleString` that has a value is greater than an `OracleString` that has a null value.
- Two `OracleStrings` that contain a null value are equal.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## LessThanOrEqual

This static method determines whether or not the first of two `OracleString` values is less than or equal to the second.

### Declaration

```
// C#  
public static bool LessThanOrEqual(OracleString str1, OracleString str2);
```

### Parameters

- `str1`  
The first `OracleString`.

- *str2*  
The second `OracleString`.

### Return Value

Returns `true` if the first is less than or equal to the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleString` that has a value is greater than an `OracleString` that has a null value.
- Two `OracleStrings` that contain a null value are equal.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## NotEquals

This static method determines whether two `OracleString` values are not equal.

### Declaration

```
// C#  
public static bool NotEquals(OracleString str1, OracleString str2);
```

### Parameters

- *str1*  
The first `OracleString`.
- *str2*  
The second `OracleString`.

### Return Value

Returns `true` if the two `OracleString` instances are not equal; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleString` that has a value is greater than an `OracleString` that has a null value.
- Two `OracleStrings` that contain a null value are equal.

 See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## OracleString Static Operators

The `OracleString` static operators are listed in [Table 15-96](#).

**Table 15-96** OracleString Static Operators

Operator	Description
<code>operator +</code>	Concatenates two <code>OracleString</code> values
<code>operator ==</code>	Determines if two <code>OracleString</code> values are equal
<code>operator &gt;</code>	Determines if the first of two <code>OracleString</code> values is greater than the second
<code>operator &gt;=</code>	Determines if the first of two <code>OracleString</code> values is greater than or equal to the second
<code>operator !=</code>	Determines if the two <code>OracleString</code> values are not equal
<code>operator &lt;</code>	Determines if the first of two <code>OracleString</code> values is less than the second
<code>operator &lt;=</code>	Determines if two <code>OracleString</code> values are not equal

 See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

### operator +

This static operator concatenates two `OracleString` values.

#### Declaration

```
// C#  
public static OracleString operator + (OracleString value1, OracleString value2);
```

### Parameters

- *value1*  
The first `OracleString`.
- *value2*  
The second `OracleString`.

### Return Value

An `OracleString`.

### Remarks

If either argument has a null value, the returned `OracleString` structure has a null value.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## operator ==

This static operator determines if two `OracleString` values are equal.

### Declaration

```
// C#  
public static bool operator == (OracleString value1, OracleString value2);
```

### Parameters

- *value1*  
The first `OracleString`.
- *value2*  
The second `OracleString`.

### Return Value

Returns `true` if two `OracleString` values are equal; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleString` that has a value is greater than an `OracleString` that has a null value.

- Two OracleStrings that contain a null value are equal.

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## operator >

This static operator determines if the first of two `OracleString` values is greater than the second.

### Declaration

```
// C#  
public static bool operator > (OracleString value1, OracleString value2);
```

### Parameters

- `value1`  
The first `OracleString`.
- `value2`  
The second `OracleString`.

### Return Value

Returns `true` if the first of two `OracleString` values is greater than the second; otherwise returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleString` that has a value is greater than an `OracleString` that has a null value.
- Two `OracleStrings` that contain a null value are equal.

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## operator >=

This static operator determines if the first of two `OracleString` values is greater than or equal to the second.

### Declaration

```
// C#  
public static bool operator >= (OracleString value1, OracleString value2);
```

### Parameters

- `value1`  
The first `OracleString`.
- `value2`  
The second `OracleString`.

### Return Value

Returns `true` if the first of two `OracleString` values is greater than or equal to the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleString` that has a value is greater than an `OracleString` that has a null value.
- Two `OracleStrings` that contain a null value are equal.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## operator !=

This static operator determines if two `OracleString` values are not equal.

### Declaration

```
// C#  
public static bool operator != (OracleString value1, OracleString value2);
```

### Parameters

- `value1`

The first `OracleString`.

- `value2`

The second `OracleString`.

### Return Value

Returns `true` if two `OracleString` values are not equal; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleString` that has a value is greater than an `OracleString` that has a null value.
- Two `OracleStrings` that contain a null value are equal.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## operator <

This static operator determines if the first of two `OracleStrings` is less than the second.

### Declaration

```
// C#  
public static bool operator < (OracleString value1, OracleString value2);
```

### Parameters

- `value1`

The first `OracleString`.

- `value2`

The second `OracleString`.

### Return Value

Returns `true` if the first of two `OracleStrings` is less than the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleString` that has a value is greater than an `OracleString` has a null value.
- Two `OracleStrings` that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## operator <=

This static operator determines if the first of two `OracleString` values is less than or equal to the second.

### Declaration

```
// C#  
public static bool operator <= (OracleString value1, OracleString value2);
```

### Parameters

- `value1`  
The first `OracleString`.
- `value2`  
The second `OracleString`.

### Return Value

Returns `true` if the first of two `OracleString` values is less than or equal to the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleString` that has a value is greater than an `OracleString` that has a null value.
- Two `OracleStrings` that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## OracleString Type Conversions

The `OracleString` type conversions are listed in [Table 15-97](#).

**Table 15-97** OracleString Type Conversions

Operator	Description
<a href="#">explicit operator string</a>	Converts the supplied <code>OracleString</code> to a <code>string</code> instance
<a href="#">implicit operator OracleString</a>	Converts the supplied <code>string</code> to an <code>OracleString</code> instance



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

### explicit operator string

This type conversion operator converts the supplied `OracleString` to a `string`.

#### Declaration

```
//C#  
public static explicit operator string (OracleString value1);
```

#### Parameters

- `value1`  
The supplied `OracleString`.

#### Return Value

`string`

#### Exceptions

`OracleNullValueException` - The `OracleString` structure has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## implicit operator OracleString

This type conversion operator converts the supplied `string` to an `OracleString`.

### Declaration

```
// C#
public static implicit operator OracleString (string value1);
```

### Parameters

- `value1`  
The supplied string.

### Return Value

An `OracleString`.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## OracleString Properties

The `OracleString` properties are listed in [Table 15-98](#).

**Table 15-98 OracleString Properties**

Properties	Description
<a href="#">IsCaseIgnored</a>	Indicates whether or not case should be ignored when performing string comparison
<a href="#">IsNull</a>	Indicates whether or not the current instance has a null value
<a href="#">Item</a>	Obtains the particular character in an <code>OracleString</code> using an index.
<a href="#">Length</a>	Returns the length of the <code>OracleString</code>

**Table 15-98 (Cont.) OracleString Properties**

Properties	Description
<a href="#">Value</a>	Returns the string data that is stored in the <code>OracleString</code> structure.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## IsCaseIgnored

This property indicates whether or not case should be ignored when performing string comparison.

### Declaration

```
//C#  
public bool IsCaseIgnored {get;set;}
```

### Property Value

Returns `true` if string comparison must ignore case; otherwise `false`.

### Remarks

Default value is `true`.

### Example

```
// C#  
  
using System;  
using Oracle.DataAccess.Types;  
  
class IsCaseIgnoredSample  
{  
    static void Main()  
    {  
        OracleString string1 = new OracleString("aAaAa");  
        OracleString string2 = new OracleString("AaAaA");  
  
        // Ignore case for comparisons  
        string1.IsCaseIgnored = true;  
        string2.IsCaseIgnored = true;  
  
        // Same; Prints 0  
        Console.WriteLine(string1.CompareTo(string2));  
  
        // Make comparisons case sensitive
```

```
// Note that IsCaseIgnored must be set to false for both
//   OracleStrings; otherwise an exception is thrown
string1.IsCaseIgnored = false;
string2.IsCaseIgnored = false;

// Different; Prints nonzero value
Console.WriteLine(string1.CompareTo(string2));
}
}
```



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## IsNull

This property indicates whether or not the current instance contains a null value.

#### Declaration

```
// C#
public bool IsNull {get;}
```

#### Property Value

Returns `true` if the current instance contains has a null value; otherwise, returns `false`.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## Item

This property obtains the particular character in an `OracleString` using an index.

#### Declaration

```
// C#
public char Item {get;}
```

**Property Value**

A `char` value.

**Exceptions**

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## Length

This property returns the length of the `OracleString`.

**Declaration**

```
// C#  
public int Length {get;}
```

**Property Value**

A `int` value.

**Exceptions**

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## Value

This property returns the string data that is stored in the `OracleString`.

**Declaration**

```
// C#  
public string Value {get;}
```

**Property Value**

The stored string value

**Exceptions**

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## OracleString Methods

The `OracleString` methods are listed in [Table 15-99](#).

**Table 15-99 OracleString Methods**

Methods	Description
<a href="#">Clone</a>	Returns a copy of the current <code>OracleString</code> instance
<a href="#">CompareTo</a>	Compares the current <code>OracleString</code> instance to the supplied object, and returns an integer that represents their relative values
<a href="#">Equals</a>	Determines whether or not an object has the same string value as the current <code>OracleString</code> structure (Overloaded)
<a href="#">GetHashCode</a>	Returns a hash code for the <code>OracleString</code> instance
<a href="#">GetNonUnicodeBytes</a>	Returns an array of bytes, containing the contents of the <code>OracleString</code> , in the client character set format
<a href="#">GetType</a>	Inherited from <code>System.Object</code>
<a href="#">GetUnicodeBytes</a>	Returns an array of bytes, containing the contents of the <code>OracleString</code> , in Unicode format
<a href="#">ToString</a>	Converts the current <code>OracleString</code> instance to a string

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## Clone

This method creates a copy of an `OracleString` instance.

### Declaration

```
// C#  
public OracleString Clone();
```

### Return Value

An `OracleString` structure.

### Remarks

The cloned object has the same property values as that of the object being cloned.

### Example

```
// C#  
  
using System;  
using Oracle.DataAccess.Types;  
  
class CloneSample  
{  
    static void Main()  
    {  
        OracleString str1 = new OracleString("aAaAa");  
        OracleString str2 = str1.Clone();  
  
        // The OracleStrings are same; Prints 0  
        Console.WriteLine(str1.CompareTo(str2));  
    }  
}
```



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## CompareTo

This method compares the current `OracleString` instance to the supplied object, and returns an integer that represents their relative values.

### Declaration

```
// C#  
public int CompareTo(object obj);
```

### Parameters

- *obj*  
The object being compared to the current instance.

### Return Value

The method returns a number that is:

- Less than zero: if the current `OracleString` value is less than *obj*.
- Zero: if the current `OracleString` value is equal to *obj*.
- Greater than zero: if the current `OracleString` value is greater than *obj*.

### Implements

`IComparable`

### Exceptions

`ArgumentException` - The *obj* parameter is not of type `OracleString`.

### Remarks

The following rules apply to the behavior of this method.

- The comparison must be between `OracleStrings`. For example, comparing an `OracleString` instance with an `OracleBinary` instance is not allowed. When an `OracleString` is compared with a different type, an `ArgumentException` is thrown.
- Any `OracleString` that has a value is greater than an `OracleString` that has a null value.
- Two `OracleStrings` that contain a null value are equal.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## Equals

This method determines whether or not supplied object is an instance of `OracleString` and has the same values as the current `OracleString` instance.

### Declaration

```
// C#  
public override bool Equals(object obj);
```

### Parameters

- *obj*  
An object being compared.

### Return Value

Returns `true` if the supplied object is an instance of `OracleString` and has the same values as the current `OracleString` instance; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleString` that has a value is greater than an `OracleString` that has a null value.
- Two `OracleStrings` that contain a null value are equal.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## GetHashCode

Overrides `Object`

This method returns a hash code for the `OracleString` instance.

### Declaration

```
// C#  
public override int GetHashCode();
```

### Return Value

A number that represents the hash code.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## GetNonUnicodeBytes

This method returns an array of bytes, containing the contents of the `OracleString`, in the client character set format.

### Declaration

```
// C#  
public byte[] GetNonUnicodeBytes();
```

### Return Value

A byte array that contains the contents of the `OracleString` in the client character set format.

### Remarks

If the current instance has a null value, an `OracleNullValueException` is thrown.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## GetUnicodeBytes

This method returns an array of bytes, containing the contents of the `OracleString` in Unicode format.

### Declaration

```
// C#  
public byte[] GetUnicodeBytes();
```

### Return Value

A byte array that contains the contents of the `OracleString` in Unicode format.

### Remarks

If the current instance has a null value, an `OracleNullValueException` is thrown.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## ToString

Overrides `Object`

This method converts the current `OracleString` instance to a string.

### Declaration

```
// C#  
public override string ToString();
```

### Return Value

A string.

### Remarks

If the current `OracleString` instance has a null value, the string contains "null".

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleString Structure](#)
- [OracleString Members](#)

## OracleTimeStamp Structure

The `OracleTimeStamp` structure represents the Oracle `TIMESTAMP` data type to be stored in or retrieved from a database. Each `OracleTimeStamp` stores the following information: year, month, day, hour, minute, second, and nanosecond.

### Class Inheritance

`System.Object`

`System.ValueType`

`Oracle.DataAccess.Types.OracleTimeStamp`

## Declaration

```
// C#public struct OracleTimeStamp : IComparable, INullable, IXmlSerializable
```

## Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

## Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

## Example

```
// C#

using System;
using Oracle.DataAccess.Types;

class OracleTimeStampSample
{
    static void Main()
    {
        OracleTimeStamp tsCurrent1 = OracleTimeStamp.GetSysDate();
        OracleTimeStamp tsCurrent2 = DateTime.Now;

        // Calculate the difference between tsCurrent1 and tsCurrent2
        OracleIntervalDS idsDiff = tsCurrent2.GetDaysBetween(tsCurrent1);

        // Calculate the difference using AddNanoseconds()
        int nanoDiff = 0;
        while (tsCurrent2 > tsCurrent1)
        {
            nanoDiff += 10;
            tsCurrent1 = tsCurrent1.AddNanoseconds(10);
        }
        Console.WriteLine("idsDiff.Nanoseconds = " + idsDiff.Nanoseconds);
        Console.WriteLine("nanoDiff = " + nanoDiff);
    }
}
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Members](#)
- [OracleTimeStamp Constructors](#)
- [OracleTimeStamp Static Fields](#)
- [OracleTimeStamp Static Methods](#)
- [OracleTimeStamp Static Operators](#)
- [OracleTimeStamp Static Type Conversions](#)
- [OracleTimeStamp Properties](#)
- [OracleTimeStamp Methods](#)

## OracleTimeStamp Members

OracleTimeStamp members are listed in the following tables:

### OracleTimeStamp Constructors

OracleTimeStamp constructors are listed in [Table 15-100](#)

**Table 15-100 OracleTimeStamp Constructors**

Constructor	Description
<a href="#">OracleTimeStamp Constructors</a>	Instantiates a new instance of OracleTimeStamp structure (Overloaded)

### OracleTimeStamp Static Fields

The OracleTimeStamp static fields are listed in [Table 15-101](#).

**Table 15-101 OracleTimeStamp Static Fields**

Field	Description
<a href="#">MaxValue</a>	Represents the maximum valid date for an OracleTimeStamp structure, which is December 31, 9999 23:59:59.999999999
<a href="#">MinValue</a>	Represents the minimum valid date for an OracleTimeStamp structure, which is January 1, -4712 0:0:0
<a href="#">Null</a>	Represents a null value that can be assigned to an instance of the OracleTimeStamp structure

## OracleTimeStamp Static Methods

The `OracleTimeStamp` static methods are listed in [Table 15-102](#).

**Table 15-102 OracleTimeStamp Static Methods**

Methods	Description
<a href="#">Equals</a>	Determines if two <code>OracleTimeStamp</code> values are equal (Overloaded)
<a href="#">GreaterThan</a>	Determines if the first of two <code>OracleTimeStamp</code> values is greater than the second
<a href="#">GreaterThanOrEqual</a>	Determines if the first of two <code>OracleTimeStamp</code> values is greater than or equal to the second
<a href="#">LessThan</a>	Determines if the first of two <code>OracleTimeStamp</code> values is less than the second
<a href="#">LessThanOrEqual</a>	Determines if the first of two <code>OracleTimeStamp</code> values is less than or equal to the second
<a href="#">NotEquals</a>	Determines if two <code>OracleTimeStamp</code> values are not equal
<a href="#">GetSysDate</a>	Gets an <code>OracleTimeStamp</code> structure that represents the current date and time
<a href="#">Parse</a>	Gets an <code>OracleTimeStamp</code> structure and sets its value using the supplied string
<a href="#">SetPrecision</a>	Returns a new instance of an <code>OracleTimeStamp</code> with the specified fractional second precision

## OracleTimeStamp Static Operators

The `OracleTimeStamp` static operators are listed in [Table 15-103](#).

**Table 15-103 OracleTimeStamp Static Operators**

Operator	Description
<a href="#">operator +</a>	Adds the supplied instance value to the supplied <code>OracleTimeStamp</code> and returns a new <code>OracleTimeStamp</code> structure (Overloaded)
<a href="#">operator ==</a>	Determines if two <code>OracleTimeStamp</code> values are equal
<a href="#">operator &gt;</a>	Determines if the first of two <code>OracleTimeStamp</code> values is greater than the second
<a href="#">operator &gt;=</a>	Determines if the first of two <code>OracleTimeStamp</code> values is greater than or equal to the second
<a href="#">operator !=</a>	Determines if the two <code>OracleTimeStamp</code> values are not equal
<a href="#">operator &lt;</a>	Determines if the first of two <code>OracleTimeStamp</code> values is less than the second

**Table 15-103 (Cont.) OracleTimeStamp Static Operators**

Operator	Description
<a href="#">operator &lt;=</a>	Determines if the first of two <code>OracleTimeStamp</code> values is less than or equal to the second
<a href="#">operator -</a>	Subtracts the supplied instance value from the supplied <code>OracleTimeStamp</code> and returns a new <code>OracleTimeStamp</code> structure (Overloaded)

**OracleTimeStamp Static Type Conversions**

The `OracleTimeStamp` static type conversions are listed in [Table 15-104](#).

**Table 15-104 OracleTimeStamp Static Type Conversions**

Operator	Description
<a href="#">explicit operator OracleTimeStamp</a>	Converts an instance value to an <code>OracleTimeStamp</code> structure (Overloaded)
<a href="#">implicit operator OracleTimeStamp</a>	Converts an instance value to an <code>OracleTimeStamp</code> structure (Overloaded)
<a href="#">explicit operator DateTime</a>	Converts an <code>OracleTimeStamp</code> value to a <code>DateTime</code> structure

**OracleTimeStamp Properties**

The `OracleTimeStamp` properties are listed in [Table 15-105](#).

**Table 15-105 OracleTimeStamp Properties**

Properties	Description
<a href="#">BinData</a>	Returns an array of bytes that represents an Oracle <code>TIMESTAMP</code> in Oracle internal format
<a href="#">Day</a>	Specifies the day component of an <code>OracleTimeStamp</code>
<a href="#">IsNull</a>	Indicates whether or not the <code>OracleTimeStamp</code> instance has a null value
<a href="#">Hour</a>	Specifies the hour component of an <code>OracleTimeStamp</code>
<a href="#">Millisecond</a>	Specifies the millisecond component of an <code>OracleTimeStamp</code>
<a href="#">Minute</a>	Specifies the minute component of an <code>OracleTimeStamp</code>
<a href="#">Month</a>	Specifies the month component of an <code>OracleTimeStamp</code>
<a href="#">Nanosecond</a>	Specifies the nanosecond component of an <code>OracleTimeStamp</code>
<a href="#">Second</a>	Specifies the second component of an <code>OracleTimeStamp</code>

**Table 15-105 (Cont.) OracleTimeStamp Properties**

Properties	Description
<a href="#">Value</a>	Specifies the date and time that is stored in the <code>OracleTimeStamp</code> structure
<a href="#">Year</a>	Specifies the year component of an <code>OracleTimeStamp</code>

**OracleTimeStamp Methods**

The `OracleTimeStamp` methods are listed in [Table 15-106](#).

**Table 15-106 OracleTimeStamp Methods**

Methods	Description
<a href="#">AddDays</a>	Adds the supplied number of days to the current instance
<a href="#">AddHours</a>	Adds the supplied number of hours to the current instance
<a href="#">AddMilliseconds</a>	Adds the supplied number of milliseconds to the current instance
<a href="#">AddMinutes</a>	Adds the supplied number of minutes to the current instance
<a href="#">AddMonths</a>	Adds the supplied number of months to the current instance
<a href="#">AddNanoseconds</a>	Adds the supplied number of nanoseconds to the current instance
<a href="#">AddSeconds</a>	Adds the supplied number of seconds to the current instance
<a href="#">AddYears</a>	Adds the supplied number of years to the current instance
<a href="#">CompareTo</a>	Compares the current <code>OracleTimeStamp</code> instance to an object, and returns an integer that represents their relative values
<a href="#">Equals</a>	Determines whether or not an object has the same date and time as the current <code>OracleTimeStamp</code> instance (Overloaded)
<a href="#">GetHashCode</a>	Returns a hash code for the <code>OracleTimeStamp</code> instance
<a href="#">GetDaysBetween</a>	Subtracts an <code>OracleTimeStamp</code> value from the current instance and returns an <code>OracleIntervalDS</code> that represents the time difference between the supplied <code>OracleTimeStamp</code> and the current instance
<a href="#">GetYearsBetween</a>	Subtracts <code>value1</code> from the current instance and returns an <code>OracleIntervalYM</code> that represents the difference between <code>value1</code> and the current instance using <code>OracleIntervalYM</code>
<a href="#">GetType</a>	Inherited from <code>System.Object</code>

Table 15-106 (Cont.) OracleTimeStamp Methods

Methods	Description
<a href="#">ToOracleDate</a>	Converts the current <code>OracleTimeStamp</code> structure to an <code>OracleDate</code> structure
<a href="#">ToOracleTimeStampLTZ</a>	Converts the current <code>OracleTimeStamp</code> structure to an <code>OracleTimeStampLTZ</code> structure
<a href="#">ToOracleTimeStampTZ</a>	Converts the current <code>OracleTimeStamp</code> structure to an <code>OracleTimeStampTZ</code> structure
<a href="#">ToString</a>	Converts the current <code>OracleTimeStamp</code> structure to a string

 See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)

## OracleTimeStamp Constructors

The `OracleTimeStamp` constructors create new instances of the `OracleTimeStamp` structure.

### Overload List:

- [OracleTimeStamp\(DateTime\)](#)

This constructor creates a new instance of the `OracleTimeStamp` structure and sets its value for date and time using the supplied `DateTime` value.
- [OracleTimeStamp\(string\)](#)

This constructor creates a new instance of the `OracleTimeStamp` structure and sets its value using the supplied string.
- [OracleTimeStamp\(int, int, int\)](#)

This constructor creates a new instance of the `OracleTimeStamp` structure and sets its value for date using year, month, and day.
- [OracleTimeStamp\(int, int, int, int, int, int\)](#)

This constructor creates a new instance of the `OracleTimeStamp` structure and sets its value for date and time using year, month, day, hour, minute, and second.
- [OracleTimeStamp\(int, int, int, int, int, int, double\)](#)

This constructor creates a new instance of the `OracleTimeStamp` structure and sets its value for date and time using year, month, day, hour, minute, second, and millisecond.
- [OracleTimeStamp\(int, int, int, int, int, int, int\)](#)

This constructor creates a new instance of the `OracleTimeStamp` structure and sets its value for date and time using year, month, day, hour, minute, second, and nanosecond.

- [OracleTimeStamp\(byte \[ \]\)](#)

This constructor creates a new instance of the `OracleTimeStamp` structure and sets its value to the provided byte array, which is in the internal Oracle `TIMESTAMP` format.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## OracleTimeStamp(DateTime)

This constructor creates a new instance of the `OracleTimeStamp` structure and sets its value for date and time using the supplied `DateTime` value.

### Declaration

```
// C#  
public OracleTimeStamp (DateTime dt);
```

### Parameters

- *dt*  
The supplied `DateTime` value.

### Exceptions

`ArgumentException` - The *dt* parameter cannot be used to construct a valid `OracleTimeStamp`.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## OracleTimeStamp(string)

This constructor creates a new instance of the `OracleTimeStamp` structure and sets its value using the supplied string.

## Declaration

```
// C#  
public OracleTimeStamp (string tsStr);
```

## Parameters

- *tsStr*  
A string that represents an Oracle `TIMESTAMP`.

## Exceptions

`ArgumentException` - The *tsStr* value is an invalid string representation of an Oracle `TIMESTAMP` or the supplied *tsStr* is not in the timestamp format specified by the `OracleGlobalization.TimeStampFormat` property of the thread, which represents the Oracle `NLS_TIMESTAMP_FORMAT` parameter.

`ArgumentNullException` - The *tsStr* value is null.

## Remarks

The names and abbreviations used for months and days are in the language specified by the `DateLanguage` and `Calendar` properties of the thread's `OracleGlobalization` object. If any of the thread's globalization properties are set to null or an empty string, the client computer's settings are used.

## Example

```
// C#  
  
using System;  
using Oracle.DataAccess.Types;  
using Oracle.DataAccess.Client;  
  
class OracleTimeStampSample  
{  
    static void Main()  
    {  
        // Set the nls_timestamp_format for the OracleTimeStamp(string)  
        // constructor  
        OracleGlobalization info = OracleGlobalization.GetClientInfo();  
        info.TimeStampFormat = "DD-MON-YYYY HH:MI:SS.FF AM";  
        OracleGlobalization.SetThreadInfo(info);  
  
        // construct OracleTimeStamp from a string using the format specified.  
        OracleTimeStamp ts = new OracleTimeStamp("11-NOV-1999 11:02:33.444 AM");  
  
        // Set the nls_timestamp_format for the ToString() method  
        info.TimeStampFormat = "YYYY-MON-DD HH:MI:SS.FF AM";  
        OracleGlobalization.SetThreadInfo(info);  
  
        // Prints "1999-NOV-11 11:02:33.444000000 AM"  
        Console.WriteLine(ts.ToString());  
    }  
}
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)
- ["OracleGlobalization Class"](#)
- ["Globalization Support "](#)
- *Oracle Database SQL Language Reference* for further information on date format elements

## OracleTimeStamp(int, int, int)

This constructor creates a new instance of the `OracleTimeStamp` structure and sets its value for date using year, month, and day.

### Declaration

```
// C#  
public OracleTimeStamp(int year, int month, int day);
```

### Parameters

- `year`  
The year provided. Range of `year` is (-4712 to 9999).
- `month`  
The month provided. Range of `month` is (1 to 12).
- `day`  
The day provided. Range of `day` is (1 to 31).

### Exceptions

`ArgumentOutOfRangeException` - The argument value for one or more of the parameters is out of the specified range.

`ArgumentException` - The argument values of the parameters cannot be used to construct a valid `OracleTimeStamp` (that is, the day is out of range for the month).

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## OracleTimeStamp(int, int, int, int, int, int)

This constructor creates a new instance of the `OracleTimeStamp` structure and sets its value for date and time using year, month, day, hour, minute, and second.

### Declaration

```
// C#  
public OracleTimeStamp (int year, int month, int day, int hour,  
    int minute, int second);
```

### Parameters

- *year*  
The year provided. Range of *year* is (-4712 to 9999).
- *month*  
The month provided. Range of *month* is (1 to 12).
- *day*  
The day provided. Range of *day* is (1 to 31).
- *hour*  
The hour provided. Range of *hour* is (0 to 23).
- *minute*  
The minute provided. Range of *minute* is (0 to 59).
- *second*  
The second provided. Range of *second* is (0 to 59).

### Exceptions

`ArgumentOutOfRangeException` - The argument value for one or more of the parameters is out of the specified range.

`ArgumentException` - The argument values of the parameters cannot be used to construct a valid `OracleTimeStamp` (that is, the day is out of range for the month).



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## OracleTimeStamp(int, int, int, int, int, double)

This constructor creates a new instance of the `OracleTimeStamp` structure and sets its value for date and time using year, month, day, hour, minute, second, and millisecond.

### Declaration

```
// C#  
public OracleTimeStamp(int year, int month, int day, int hour,  
    int minute, int second, double millisecond);
```

### Parameters

- *year*  
The year provided. Range of *year* is (-4712 to 9999).
- *month*  
The month provided. Range of *month* is (1 to 12).
- *day*  
The day provided. Range of *day* is (1 to 31).
- *hour*  
The hour provided. Range of *hour* is (0 to 23).
- *minute*  
The minute provided. Range of *minute* is (0 to 59).
- *second*  
The second provided. Range of *second* is (0 to 59).
- *milliseconds*  
The milliseconds provided. Range of *millisecond* is (0 to 999.999999).

### Exceptions

`ArgumentOutOfRangeException` - The argument value for one or more of the parameters is out of the specified range.

`ArgumentException` - The argument values of the parameters cannot be used to construct a valid `OracleTimeStamp` (that is, the day is out of range for the month).



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## OracleTimeStamp(int, int, int, int, int, int)

This constructor creates a new instance of the `OracleTimeStamp` structure and sets its value for date and time using year, month, day, hour, minute, second, and nanosecond.

### Declaration

```
// C#  
public OracleTimeStamp (int year, int month, int day, int hour,  
    int minute, int second, int nanosecond);
```

### Parameters

- *year*  
The year provided. Range of *year* is (-4712 to 9999).
- *month*  
The month provided. Range of *month* is (1 to 12).
- *day*  
The day provided. Range of *day* is (1 to 31).
- *hour*  
The hour provided. Range of *hour* is (0 to 23).
- *minute*  
The minute provided. Range of *minute* is (0 to 59).
- *second*  
The second provided. Range of *second* is (0 to 59).
- *nanosecond*  
The nanosecond provided. Range of *nanosecond* is (0 to 999999999).

### Exceptions

`ArgumentOutOfRangeException` - The argument value for one or more of the parameters is out of the specified range.

`ArgumentException` - The argument values of the parameters cannot be used to construct a valid `OracleTimeStamp` (that is, the day is out of range for the month).

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## OracleTimeStamp(byte [ ])

This constructor creates a new instance of the `OracleTimeStamp` structure and sets its value to the provided byte array, which is in the internal Oracle `TIMESTAMP` format.

### Declaration

```
// C#  
public OracleTimeStamp (byte[] bytes);
```

### Parameters

- *bytes*

A byte array that represents an Oracle `TIMESTAMP` in Oracle internal format.

### Exceptions

`ArgumentException` - *bytes* is not in an internal Oracle `TIMESTAMP` format or *bytes* is not a valid Oracle `TIMESTAMP`.

`ArgumentNullException` - *bytes* is null.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## OracleTimeStamp Static Fields

The `OracleTimeStamp` static fields are listed in [Table 15-107](#).

**Table 15-107 OracleTimeStamp Static Fields**

Field	Description
<a href="#">MaxValue</a>	Represents the maximum valid date for an <code>OracleTimeStamp</code> structure, which is December 31, 9999 23:59:59.999999999
<a href="#">MinValue</a>	Represents the minimum valid date for an <code>OracleTimeStamp</code> structure, which is January 1, -4712 0:0:0
<a href="#">Null</a>	Represents a null value that can be assigned to an instance of the <code>OracleTimeStamp</code> structure

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## MaxValue

This static field represents the maximum valid date and time for an `OracleTimeStamp` structure, which is December 31, 9999 23:59:59.999999999.

### Declaration

```
// C#  
public static readonly OraTimestamp MaxValue;
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## MinValue

This static field represents the minimum valid date and time for an `OracleTimeStamp` structure, which is January 1, -4712 0:0:0.

### Declaration

```
// C#  
public static readonly OracleTimeStamp MinValue;
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## Null

This static field represents a null value that can be assigned to an instance of the `OracleTimeStamp` structure.

### Declaration

```
// C#
public static readonly OracleTimeStamp Null;
```

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## OracleTimeStamp Static Methods

The `OracleTimeStamp` static methods are listed in [NOT\\_SUPPORTED](#).

### NOT\_SUPPORTED

Methods	Description
<a href="#">Equals</a>	Determines if two <code>OracleTimeStamp</code> values are equal (Overloaded)
<a href="#">GreaterThan</a>	Determines if the first of two <code>OracleTimeStamp</code> values is greater than the second
<a href="#">GreaterThanOrEqual</a>	Determines if the first of two <code>OracleTimeStamp</code> values is greater than or equal to the second
<a href="#">LessThan</a>	Determines if the first of two <code>OracleTimeStamp</code> values is less than the second
<a href="#">LessThanOrEqual</a>	Determines if the first of two <code>OracleTimeStamp</code> values is less than or equal to the second
<a href="#">NotEquals</a>	Determines if two <code>OracleTimeStamp</code> values are not equal
<a href="#">GetSysDate</a>	Gets an <code>OracleTimeStamp</code> structure that represents the current date and time
<a href="#">Parse</a>	Gets an <code>OracleTimeStamp</code> structure and sets its value using the supplied string
<a href="#">SetPrecision</a>	Returns a new instance of an <code>OracleTimeStamp</code> with the specified fractional second precision

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## Equals

This static method determines if two `OracleTimeStamp` values are equal.

### Declaration

```
// C#  
public static bool Equals(OracleTimeStamp value1, OracleTimeStamp value2);
```

### Parameters

- `value1`  
The first `OracleTimeStamp`.
- `value2`  
The second `OracleTimeStamp`.

### Return Value

Returns `true` if two `OracleTimeStamp` values are equal; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleTimeStamp` that has a value is greater than an `OracleTimeStamp` that has a null value.
- Two `OracleTimeStamp`s that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## GreaterThan

This static method determines if the first of two `OracleTimeStamp` values is greater than the second.

### Declaration

```
// C#  
public static bool GreaterThan(OracleTimeStamp value1,  
    OracleTimeStamp value2);
```

### Parameters

- *value1*  
The first OracleTimeStamp.
- *value2*  
The second OracleTimeStamp.

### Return Value

Returns `true` if the first of two OracleTimeStamp values is greater than the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any OracleTimeStamp that has a value is greater than an OracleTimeStamp that has a null value.
- Two OracleTimeStamps that contain a null value are equal.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## GreaterThanOrEqual

This static method determines if the first of two OracleTimeStamp values is greater than or equal to the second.

### Declaration

```
// C#  
public static bool GreaterThanOrEqual(OracleTimeStamp value1,  
    OracleTimeStamp value2);
```

### Parameters

- *value1*  
The first OracleTimeStamp.
- *value2*

The second `OracleTimeStamp`.

### Return Value

Returns `true` if the first of two `OracleTimeStamp` values is greater than or equal to the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleTimeStamp` that has a value is greater than an `OracleTimeStamp` that has a null value.
- Two `OracleTimeStamps` that contain a null value are equal.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## LessThan

This static method determines if the first of two `OracleTimeStamp` values is less than the second.

### Declaration

```
// C#  
public static bool LessThan(OracleTimeStamp value1,  
    OracleTimeStamp value2);
```

### Parameters

- *value1*  
The first `OracleTimeStamp`.
- *value2*  
The second `OracleTimeStamp`.

### Return Value

Returns `true` if the first of two `OracleTimeStamp` values is less than the second. Returns `false` otherwise.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleTimeStamp` that has a value is greater than an `OracleTimeStamp` that has a null value.

- Two OracleTimeStamps that contain a null value are equal.

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## LessThanOrEqual

This static method determines if the first of two OracleTimeStamp values is less than or equal to the second.

**Declaration**

```
// C#
public static bool LessThanOrEqual(OracleTimeStamp value1,
    OracleTimeStamp value2);
```

**Parameters**

- *value1*  
The first OracleTimeStamp.
- *value2*  
The second OracleTimeStamp.

**Return Value**

Returns `true` if the first of two OracleTimeStamp values is less than or equal to the second. Returns `false` otherwise.

**Remarks**

The following rules apply to the behavior of this method.

- Any OracleTimeStamp that has a value is greater than an OracleTimeStamp that has a null value.
- Two OracleTimeStamps that contain a null value are equal.

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## NotEquals

This static method determines if two `OracleTimeStamp` values are not equal.

### Declaration

```
// C#  
public static bool NotEquals(OracleTimeStamp value1,  
    OracleTimeStamp value2);
```

### Parameters

- `value1`  
The first `OracleTimeStamp`.
- `value2`  
The second `OracleTimeStamp`.

### Return Value

Returns `true` if two `OracleTimeStamp` values are not equal. Returns `false` otherwise.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleTimeStamp` that has a value is greater than an `OracleTimeStamp` that has a null value.
- Two `OracleTimeStamp`s that contain a null value are equal.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## GetSysDate

This static method gets an `OracleTimeStamp` structure that represents the current date and time.

### Declaration

```
// C#  
public static OracleTimeStamp GetSysDate();
```

### Return Value

An `OracleTimeStamp` structure that represents the current date and time.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## Parse

This static method gets an `OracleTimeStamp` structure and sets its value using the supplied string.

### Declaration

```
// C#  
public static OracleTimeStamp Parse(string datetime);
```

### Parameters

- *datetime*  
A string that represents an Oracle `TIMESTAMP`.

### Return Value

An `OracleTimeStamp` structure.

### Exceptions

`ArgumentException` - The *tsStr* is an invalid string representation of an Oracle `TIMESTAMP` or the supplied *tsStr* is not in the timestamp format specified by the `OracleGlobalization.TimeStampFormat` property of the thread, which represents the Oracle `NLS_TIMESTAMP_FORMAT` parameter.

`ArgumentNullException` - The *tsStr* value is null.

### Remarks

The names and abbreviations used for months and days are in the language specified by the `DateLanguage` and `Calendar` properties of the thread's `OracleGlobalization` object. If any of the thread's globalization properties are set to null or an empty string, the client computer's settings are used.

### Example

```
// C#  
  
using System;  
using Oracle.DataAccess.Types;  
using Oracle.DataAccess.Client;  
  
class ParseSample  
{  
    static void Main()  
    {  
        // ...  
    }  
}
```

```
{
    // Set the nls_timestamp_format for the Parse() method
    OracleGlobalization info = OracleGlobalization.GetClientInfo();
    info.TimestampFormat = "DD-MON-YYYY HH:MI:SS.FF AM";
    OracleGlobalization.SetThreadInfo(info);

    // construct OracleTimeStamp from a string using the format specified.
    OracleTimeStamp ts =
        OracleTimeStamp.Parse("11-NOV-1999 11:02:33.444 AM");

    // Set the nls_timestamp_format for the ToString() method
    info.TimestampFormat = "YYYY-MON-DD HH:MI:SS.FF AM";
    OracleGlobalization.SetThreadInfo(info);

    // Prints "1999-NOV-11 11:02:33.444000000 AM"
    Console.WriteLine(ts.ToString());
}
}
```

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)
- ["OracleGlobalization Class"](#)
- ["Globalization Support "](#)

## SetPrecision

This static method returns a new instance of an `OracleTimeStamp` with the specified fractional second precision.

### Declaration

```
// C#
public static OracleTimeStamp SetPrecision(OracleTimeStamp value1,
    int fracSecPrecision);
```

### Parameters

- *value1*  
The provided `OracleTimeStamp` object.
- *fracSecPrecision*  
The fractional second precision provided. Range of fractional second precision is (0 to 9).

### Return Value

An `OracleTimeStamp` structure with the specified fractional second precision.

## Exceptions

`ArgumentOutOfRangeException` - `fracSecPrecision` is out of the specified range.

## Remarks

The value specified in the supplied `fracSecPrecision` is used to perform a rounding off operation on the supplied `OracleTimeStamp` value. Depending on this value, 0 or more trailing zeros are displayed in the string returned by `ToString()`.

## Example

The `OracleTimeStamp` with a value of "December 31, 9999 23:59:59.99" results in the string "December 31, 9999 23:59:59.99000" when `SetPrecision()` is called with the fractional second precision set to 5.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## OracleTimeStamp Static Operators

The `OracleTimeStamp` static operators are listed in [Table 15-109](#).

**Table 15-109 OracleTimeStamp Static Operators**

Operator	Description
<code>operator +</code>	Adds the supplied instance value to the supplied <code>OracleTimeStamp</code> and returns a new <code>OracleTimeStamp</code> structure (Overloaded)
<code>operator ==</code>	Determines if two <code>OracleTimeStamp</code> values are equal
<code>operator &gt;</code>	Determines if the first of two <code>OracleTimeStamp</code> values is greater than the second
<code>operator &gt;=</code>	Determines if the first of two <code>OracleTimeStamp</code> values is greater than or equal to the second
<code>operator !=</code>	Determines if the two <code>OracleTimeStamp</code> values are not equal
<code>operator &lt;</code>	Determines if the first of two <code>OracleTimeStamp</code> values is less than the second
<code>operator &lt;=</code>	Determines if the first of two <code>OracleTimeStamp</code> values is less than or equal to the second
<code>operator -</code>	Subtracts the supplied instance value from the supplied <code>OracleTimeStamp</code> and returns a new <code>OracleTimeStamp</code> structure (Overloaded)

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## operator +

`operator+` adds the supplied object to the `OracleTimeStamp` and returns a new `OracleTimeStamp` structure.

### Overload List:

- [operator + \(OracleTimeStamp, OracleIntervalDS\)](#)  
This static operator adds the supplied `OracleIntervalDS` to the `OracleTimeStamp` and returns a new `OracleTimeStamp` structure.
- [operator + \(OracleTimeStamp, OracleIntervalYM\)](#)  
This static operator adds the supplied `OracleIntervalYM` to the supplied `OracleTimeStamp` and returns a new `OracleTimeStamp` structure.
- [operator + \(OracleTimeStamp, TimeSpan\)](#)  
This static operator adds the supplied `TimeSpan` to the supplied `OracleTimeStamp` and returns a new `OracleTimeStamp` structure.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## operator + (OracleTimeStamp, OracleIntervalDS)

This static operator adds the supplied `OracleIntervalDS` to the `OracleTimeStamp` and returns a new `OracleTimeStamp` structure.

### Declaration

```
// C#  
public static operator + (OracleTimeStamp value1, OracleIntervalDS value2);
```

### Parameters

- `value1`

An OracleTimeStamp.

- *value2*

An OracleIntervalDS.

### Return Value

An OracleTimeStamp.

### Remarks

If either parameter has a null value, the returned OracleTimeStamp has a null value.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## operator + (OracleTimeStamp, OracleIntervalYM)

This static operator adds the supplied OracleIntervalYM to the supplied OracleTimeStamp and returns a new OracleTimeStamp structure.

### Declaration

```
// C#  
public static operator + (OracleTimeStamp value1, OracleIntervalYM value2);
```

### Parameters

- *value1*

An OracleTimeStamp.

- *value2*

An OracleIntervalYM.

### Return Value

An OracleTimeStamp.

### Remarks

If either parameter has a null value, the returned OracleTimeStamp has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## operator + (OracleTimeStamp, TimeSpan)

This static operator adds the supplied `TimeSpan` to the supplied `OracleTimeStamp` and returns a new `OracleTimeStamp` structure.

### Declaration

```
// C#  
public static operator + (OracleTimeStamp value1, TimeSpan value2);
```

### Parameters

- *value1*  
An `OracleTimeStamp`.
- *value2*  
A `TimeSpan`.

### Return Value

An `OracleTimeStamp`.

### Remarks

If the `OracleTimeStamp` instance has a null value, the returned `OracleTimeStamp` has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## operator ==

This static operator determines if two `OracleTimeStamp` values are equal.

### Declaration

```
// C#
public static bool operator == (OracleTimeStamp value1,
    OracleTimeStamp value2);
```

### Parameters

- *value1*  
The first OracleTimeStamp.
- *value2*  
The second OracleTimeStamp.

### Return Value

Returns `true` if they are the same; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any OracleTimeStamp that has a value is greater than an OracleTimeStamp that has a null value.
- Two OracleTimeStamps that contain a null value are equal.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## operator >

This static operator determines if the first of two OracleTimeStamp values is greater than the second.

### Declaration

```
// C#
public static bool operator > (OracleTimeStamp value1,
    OracleTimeStamp value2);
```

### Parameters

- *value1*  
The first OracleTimeStamp.
- *value2*

The second `OracleTimeStamp`.

### Return Value

Returns `true` if the first `OracleTimeStamp` value is greater than the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleTimeStamp` that has a value is greater than an `OracleTimeStamp` that has a null value.
- Two `OracleTimeStamps` that contain a null value are equal.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## operator >=

This static operator determines if the first of two `OracleTimeStamp` values is greater than or equal to the second.

### Declaration

```
// C#  
public static bool operator >= (OracleTimeStamp value1,  
    OracleTimeStamp value2);
```

### Parameters

- *value1*  
The first `OracleTimeStamp`.
- *value2*  
The second `OracleTimeStamp`.

### Return Value

Returns `true` if the first `OracleTimeStamp` is greater than or equal to the second; otherwise returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleTimeStamp` that has a value is greater than an `OracleTimeStamp` that has a null value.

- Two OracleTimeStamps that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## operator !=

This static operator determines if two OracleTimeStamp values are not equal.

### Declaration

```
// C#  
public static bool operator != (OracleTimeStamp value1,  
    OracleTimeStamp value2);
```

### Parameters

- *value1*  
The first OracleTimeStamp.
- *value2*  
The second OracleTimeStamp.

### Return Value

Returns true if two OracleTimeStamp values are not equal; otherwise, returns false.

### Remarks

The following rules apply to the behavior of this method.

- Any OracleTimeStamp that has a value is greater than an OracleTimeStamp that has a null value.
- Two OracleTimeStamps that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## operator <

This static operator determines if the first of two `OracleTimeStamp` values is less than the second.

### Declaration

```
// C#
public static bool operator < (OracleTimeStamp value1,
    OracleTimeStamp value2);
```

### Parameters

- `value1`  
The first `OracleTimeStamp`.
- `value2`  
The second `OracleTimeStamp`.

### Return Value

Returns `true` if the first `OracleTimeStamp` is less than the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleTimeStamp` that has a value is greater than an `OracleTimeStamp` that has a null value.
- Two `OracleTimeStamp`s that contain a null value are equal.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## operator <=

This static operator determines if the first of two `OracleTimeStamp` values is less than or equal to the second.

### Declaration

```
// C#
public static bool operator <= (OracleTimeStamp value1,
    OracleTimeStamp value2);
```

### Parameters

- *value1*  
The first OracleTimeStamp.
- *value2*  
The second OracleTimeStamp.

### Return Value

Returns `true` if the first OracleTimeStamp is less than or equal to the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any OracleTimeStamp that has a value is greater than an OracleTimeStamp that has a null value.
- Two OracleTimeStamps that contain a null value are equal.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## operator -

`operator-` subtracts the supplied value, from the supplied OracleTimeStamp value, and returns a new OracleTimeStamp structure.

### Overload List:

- [operator - \(OracleTimeStamp, OracleIntervalDS\)](#)  
This static operator subtracts the supplied OracleIntervalDS value, from the supplied OracleTimeStamp value, and return a new OracleTimeStamp structure.
- [operator - \(OracleTimeStamp, OracleIntervalYM\)](#)  
This static operator subtracts the supplied OracleIntervalYM value, from the supplied OracleTimeStamp value, and returns a new OracleTimeStamp structure.
- [operator - \(OracleTimeStamp, TimeSpan\)](#)  
This static operator subtracts the supplied TimeSpan value, from the supplied OracleTimeStamp value, and returns a new OracleTimeStamp structure.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## operator - (OracleTimeStamp, OracleIntervalDS)

This static operator subtracts the supplied `OracleIntervalDS` value, from the supplied `OracleTimeStamp` value, and return a new `OracleTimeStamp` structure.

### Declaration

```
// C#  
public static operator - (OracleTimeStamp value1, OracleIntervalDS value2);
```

### Parameters

- *value1*  
An `OracleTimeStamp`.
- *value2*  
An `OracleIntervalDS` instance.

### Return Value

An `OracleTimeStamp` structure.

### Remarks

If either parameter has a null value, the returned `OracleTimeStamp` has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## operator - (OracleTimeStamp, OracleIntervalYM)

This static operator subtracts the supplied `OracleIntervalYM` value, from the supplied `OracleTimeStamp` value, and returns a new `OracleTimeStamp` structure.

**Declaration**

```
// C#  
public static operator - (OracleTimeStamp value1, OracleIntervalYM value2);
```

**Parameters**

- *value1*  
An OracleTimeStamp.
- *value2*  
An OracleIntervalYM instance.

**Return Value**

An OracleTimeStamp structure.

**Remarks**

If either parameter has a null value, the returned OracleTimeStamp has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

**operator - (OracleTimeStamp, TimeSpan)**

This static operator subtracts the supplied TimeSpan value, from the supplied OracleTimeStamp value, and returns a new OracleTimeStamp structure.

**Declaration**

```
// C#  
public static operator - (OracleTimeStamp value1, TimeSpan value2);
```

**Parameters**

- *value1*  
An OracleTimeStamp.
- *value2*  
A TimeSpan instance.

**Return Value**

An OracleTimeStamp structure.

**Remarks**

If the `OracleTimeStamp` instance has a null value, the returned `OracleTimeStamp` structure has a null value.

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## OracleTimeStamp Static Type Conversions

The `OracleTimeStamp` static type conversions are listed in [Table 15-110](#).

**Table 15-110 OracleTimeStamp Static Type Conversions**

Operator	Description
<a href="#">explicit operator OracleTimeStamp</a>	Converts an instance value to an <code>OracleTimeStamp</code> structure (Overloaded)
<a href="#">implicit operator OracleTimeStamp</a>	Converts an instance value to an <code>OracleTimeStamp</code> structure (Overloaded)
<a href="#">explicit operator DateTime</a>	Converts an <code>OracleTimeStamp</code> value to a <code>DateTime</code> structure

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

### explicit operator OracleTimeStamp

`explicit operator OracleTimeStamp` converts the supplied value to an `OracleTimeStamp` structure

**Overload List:**

- [explicit operator OracleTimeStamp\(OracleTimeStampLTZ\)](#)

This static type conversion operator converts an `OracleTimeStampLTZ` value to an `OracleTimeStamp` structure.

- [explicit operator OracleTimeStamp\(OracleTimeStampTZ\)](#)  
This static type conversion operator converts an `OracleTimeStampTZ` value to an `OracleTimeStamp` structure.
- [explicit operator OracleTimeStamp\(string\)](#)  
This static type conversion operator converts the supplied string to an `OracleTimeStamp` structure.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## explicit operator OracleTimeStamp(OracleTimeStampLTZ)

This static type conversion operator converts an `OracleTimeStampLTZ` value to an `OracleTimeStamp` structure.

### Declaration

```
// C#  
public static explicit operator OracleTimeStamp(OracleTimeStampLTZ value1);
```

### Parameters

- *value1*  
An `OracleTimeStampLTZ` instance.

### Return Value

The returned `OracleTimeStamp` contains the date and time of the `OracleTimeStampLTZ` structure.

### Remarks

If the `OracleTimeStampLTZ` structure has a null value, the returned `OracleTimeStamp` structure also has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## explicit operator OracleTimeStamp(OracleTimeStampTZ)

This static type conversion operator converts an `OracleTimeStampTZ` value to an `OracleTimeStamp` structure.

### Declaration

```
// C#  
public static explicit operator OracleTimeStamp(OracleTimeStampTZ value1);
```

### Parameters

- `value1`  
An `OracleTimeStampTZ` instance.

### Return Value

The returned `OracleTimeStamp` contains the date and time information from `value1`, but the time zone information from `value1` is truncated.

### Remarks

If the `OracleTimeStampTZ` structure has a null value, the returned `OracleTimeStamp` structure also has a null value.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## explicit operator OracleTimeStamp(string)

This static type conversion operator converts the supplied string to an `OracleTimeStamp` structure.

### Declaration

```
// C#  
public static explicit operator OracleTimeStamp(string tsStr);
```

### Parameters

- `tsStr`  
A string representation of an Oracle `TIMESTAMP`.

### Return Value

An `OracleTimeStamp`.

## Exceptions

`ArgumentException` - The `tsStr` is an invalid string representation of an Oracle `TimeStamp` or the `tsStr` is not in the timestamp format specified by the thread's `OracleGlobalization.TimeStampFormat` property, which represents the Oracle `NLS_TIMESTAMP_FORMAT` parameter.

## Remarks

The names and abbreviations used for months and days are in the language specified by the `DateLanguage` and `Calendar` properties of the thread's `OracleGlobalization` object. If any of the thread's globalization properties are set to null or an empty string, the client computer's settings are used.

## Example

```
// C#

using System;
using Oracle.DataAccess.Types;
using Oracle.DataAccess.Client;

class OracleTimeStampSample
{
    static void Main()
    {
        // Set the nls_timestamp_format for the explicit
        // operator OracleTimeStamp(string)
        OracleGlobalization info = OracleGlobalization.GetClientInfo();
        info.TimeStampFormat = "DD-MON-YYYY HH:MI:SS.FF AM";
        OracleGlobalization.SetThreadInfo(info);

        // construct OracleTimeStamp from a string using the format specified.
        OracleTimeStamp ts = new OracleTimeStamp("11-NOV-1999 11:02:33.444 AM");

        // Set the nls_timestamp_format for the ToString method
        info.TimeStampFormat = "YYYY-MON-DD HH:MI:SS.FF AM";
        OracleGlobalization.SetThreadInfo(info);

        // Prints "1999-NOV-11 11:02:33.44400000 AM"
        Console.WriteLine(ts.ToString());
    }
}
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)
- ["OracleGlobalization Class"](#)
- ["Globalization Support "](#)
- *Oracle Database SQL Language Reference* for further information on datetime format elements

## implicit operator OracleTimeStamp

This static type conversion operator converts a value to an `OracleTimeStamp` structure.

**Overload List:**

- [implicit operator OracleTimeStamp\(OracleDate\)](#)  
This static type conversion operator converts an `OracleDate` value to an `OracleTimeStamp` structure.
- [implicit operator OracleTimeStamp\(DateTime\)](#)  
This static type conversion operator converts a `DateTime` value to an `OracleTimeStamp` structure.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## implicit operator OracleTimeStamp(OracleDate)

This static type conversion operator converts an `OracleDate` value to an `OracleTimeStamp` structure.

**Declaration**

```
// C#  
public static implicit operator OracleTimeStamp (OracleDate value1);
```

**Parameters**

- `value1`

An `OracleDate` instance.

### Return Value

An `OracleTimeStamp` structure that contains the date and time of the `OracleDate` structure, *value1*.

### Remarks

If the `OracleDate` structure has a null value, the returned `OracleTimeStamp` structure also has a null value.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## implicit operator OracleTimeStamp(DateTime)

This static type conversion operator converts a `DateTime` value to an `OracleTimeStamp` structure.

### Declaration

```
// C#  
public static implicit operator OracleTimeStamp(DateTime value);
```

### Parameters

- *value*  
A `DateTime` instance.

### Return Value

An `OracleTimeStamp` structure.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## explicit operator DateTime

This static type conversion operator converts an `OracleTimeStamp` value to a `DateTime` structure.

### Declaration

```
// C#
public static explicit operator DateTime(OracleTimeStamp value1);
```

### Parameters

- `value1`  
An `OracleTimeStamp` instance.

### Return Value

A `DateTime` containing the date and time in the current instance.

### Exceptions

`OracleNullValueException` - The `OracleTimeStamp` structure has a null value.

### Remarks

The precision of the `OracleTimeStamp` can be lost during the conversion.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## OracleTimeStamp Properties

The `OracleTimeStamp` properties are listed in [Table 15-111](#).

**Table 15-111 OracleTimeStamp Properties**

Properties	Description
<a href="#">BinData</a>	Returns an array of bytes that represents an Oracle <code>TIMESTAMP</code> in Oracle internal format
<a href="#">Day</a>	Specifies the day component of an <code>OracleTimeStamp</code>
<a href="#">IsNull</a>	Indicates whether or not the <code>OracleTimeStamp</code> instance has a null value
<a href="#">Hour</a>	Specifies the hour component of an <code>OracleTimeStamp</code>
<a href="#">Millisecond</a>	Specifies the millisecond component of an <code>OracleTimeStamp</code>

Table 15-111 (Cont.) OracleTimeStamp Properties

Properties	Description
<a href="#">Minute</a>	Specifies the minute component of an OracleTimeStamp
<a href="#">Month</a>	Specifies the month component of an OracleTimeStamp
<a href="#">Nanosecond</a>	Specifies the nanosecond component of an OracleTimeStamp
<a href="#">Second</a>	Specifies the second component of an OracleTimeStamp
<a href="#">Value</a>	Specifies the date and time that is stored in the OracleTimeStamp structure
<a href="#">Year</a>	Specifies the year component of an OracleTimeStamp

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## BinData

This property returns an array of bytes that represents an Oracle `TIMESTAMP` in Oracle internal format.

### Declaration

```
// C#  
public byte[] BinData {get;}
```

### Property Value

A byte array that represents an Oracle `TIMESTAMP` in an internal format.

### Exceptions

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## Day

This property specifies the day component of an `OracleTimeStamp`.

### Declaration

```
// C#  
public int Day{get;}
```

### Property Value

A number that represents the day. Range of `Day` is (1 to 31).

### Exceptions

`OracleNullValueException` - The current instance has a null value.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## IsNull

This property indicates whether or not the current instance has a null value.

### Declaration

```
// C#  
public bool IsNull{get;}
```

### Property Value

Returns `true` if the current instance has a null value; otherwise, returns `false`.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## Hour

This property specifies the hour component of an `OracleTimeStamp`.

**Declaration**

```
// C#  
public int Hour{get;}
```

**Property Value**

A number that represents the hour. Range of `hour` is (0 to 23).

**Exceptions**

`OracleNullValueException` - The current instance has a null value.

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## Millisecond

This property gets the millisecond component of an `OracleTimeStamp`.

**Declaration**

```
// C#  
public double Millisecond{get;}
```

**Property Value**

A number that represents a millisecond. Range of `Millisecond` is (0 to 999.999999).

**Exceptions**

`OracleNullValueException` - The current instance has a null value.

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## Minute

This property gets the minute component of an `OracleTimeStamp`.

**Declaration**

```
// C#  
public int Minute{get;}
```

**Property Value**

A number that represent a minute. Range of `Minute` is (0 to 59).

**Exceptions**

`OracleNullValueException` - The current instance has a null value.

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## Month

This property gets the month component of an `OracleTimeStamp`.

**Declaration**

```
// C#  
public int Month{get;}
```

**Property Value**

A number that represents a month. Range of `Month` is (1 to 12).

**Exceptions**

`OracleNullValueException` - The current instance has a null value.

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## Nanosecond

This property gets the nanosecond component of an `OracleTimeStamp`.

**Declaration**

```
// C#  
public int Nanosecond{get;}
```

**Property Value**

A number that represents a nanosecond. Range of `Nanosecond` is (0 to 999999999).

**Exceptions**

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## Second

This property gets the second component of an `OracleTimeStamp`.

**Declaration**

```
// C#  
public int Second{get;}
```

**Property Value**

A number that represents a second. Range of `Second` is (0 to 59).

**Exceptions**

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## Value

This property specifies the date and time that is stored in the `OracleTimeStamp` structure.

### Declaration

```
// C#  
public DateTime Value{get;}
```

### Property Value

A `DateTime`.

### Exceptions

`OracleNullValueException` - The current instance has a null value.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## Year

This property gets the year component of an `OracleTimeStamp`.

### Declaration

```
// C#  
public int Year{get;}
```

### Property Value

A number that represents a year. The range of `Year` is (-4712 to 9999).

### Exceptions

`OracleNullValueException` - The current instance has a null value.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## OracleTimeStamp Methods

The `OracleTimeStamp` methods are listed in [Table 15-112](#).

**Table 15-112 OracleTimeStamp Methods**

Methods	Description
<a href="#">AddDays</a>	Adds the supplied number of days to the current instance
<a href="#">AddHours</a>	Adds the supplied number of hours to the current instance
<a href="#">AddMilliseconds</a>	Adds the supplied number of milliseconds to the current instance
<a href="#">AddMinutes</a>	Adds the supplied number of minutes to the current instance
<a href="#">AddMonths</a>	Adds the supplied number of months to the current instance
<a href="#">AddNanoseconds</a>	Adds the supplied number of nanoseconds to the current instance
<a href="#">AddSeconds</a>	Adds the supplied number of seconds to the current instance
<a href="#">AddYears</a>	Adds the supplied number of years to the current instance
<a href="#">CompareTo</a>	Compares the current <code>OracleTimeStamp</code> instance to an object, and returns an integer that represents their relative values
<a href="#">Equals</a>	Determines whether or not an object has the same date and time as the current <code>OracleTimeStamp</code> instance (Overloaded)
<a href="#">GetHashCode</a>	Returns a hash code for the <code>OracleTimeStamp</code> instance
<a href="#">GetDaysBetween</a>	Subtracts an <code>OracleTimeStamp</code> value from the current instance and returns an <code>OracleIntervalDS</code> that represents the time difference between the supplied <code>OracleTimeStamp</code> and the current instance
<a href="#">GetYearsBetween</a>	Subtracts <code>value1</code> from the current instance and returns an <code>OracleIntervalYM</code> that represents the difference between <code>value1</code> and the current instance using <code>OracleIntervalYM</code>
<a href="#">GetType</a>	Inherited from <code>System.Object</code>
<a href="#">ToOracleDate</a>	Converts the current <code>OracleTimeStamp</code> structure to an <code>OracleDate</code> structure
<a href="#">ToOracleTimeStampLTZ</a>	Converts the current <code>OracleTimeStamp</code> structure to an <code>OracleTimeStampLTZ</code> structure
<a href="#">ToOracleTimeStampTZ</a>	Converts the current <code>OracleTimeStamp</code> structure to an <code>OracleTimeStampTZ</code> structure
<a href="#">ToString</a>	Converts the current <code>OracleTimeStamp</code> structure to a string

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## AddDays

This method adds the supplied number of days to the current instance.

### Declaration

```
// C#  
public OracleTimeStamp AddDays(double days);
```

### Parameters

- *days*  
The supplied number of days. Range is  $(-1,000,000,000 < days < 1,000,000,000)$

### Return Value

An `OracleTimeStamp`.

### Exceptions

`ArgumentOutOfRangeException` - The argument value is out of the specified range.

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## AddHours

This method adds the supplied number of hours to the current instance.

### Declaration

```
// C#  
public OracleTimeStamp AddHours(double hours);
```

### Parameters

- *hours*  
The supplied number of hours. Range is  $(-24,000,000,000 < hours < 24,000,000,000)$ .

### Return Value

An OracleTimeStamp.

### Exceptions

ArgumentOutOfRangeException - The argument value is out of the specified range.

OracleNullValueException - The current instance has a null value.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## AddMilliseconds

This method adds the supplied number of milliseconds to the current instance.

### Declaration

```
// C#  
public OracleTimeStamp AddMilliseconds(double milliseconds);
```

### Parameters

- *milliseconds*  
The supplied number of milliseconds. Range is  $(-8.64 * 1016 < milliseconds < 8.64 * 1016)$ .

### Return Value

An OracleTimeStamp.

### Exceptions

ArgumentOutOfRangeException - The argument value is out of the specified range.

OracleNullValueException - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## AddMinutes

This method adds the supplied number of minutes to the current instance.

### Declaration

```
// C#  
public OracleTimeStamp AddMinutes(double minutes);
```

### Parameters

- *minutes*

The supplied number of minutes. Range is  $(-1,440,000,000,000 < minutes < 1,440,000,000,000)$ .

### Return Value

An `OracleTimeStamp`.

### Exceptions

`ArgumentOutOfRangeException` - The argument value is out of the specified range.

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## AddMonths

This method adds the supplied number of months to the current instance.

### Declaration

```
// C#  
public OracleTimeStamp AddMonths(long months);
```

### Parameters

- *months*

The supplied number of months. Range is  $(-12,000,000,000 < months < 12,000,000,000)$ .

### Return Value

An OracleTimeStamp.

### Exceptions

ArgumentOutOfRangeException - The argument value is out of the specified range.

OracleNullValueException - The current instance has a null value.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## AddNanoseconds

This method adds the supplied number of nanoseconds to the current instance.

### Declaration

```
// C#  
public OracleTimeStamp AddNanoseconds(long nanoseconds);
```

### Parameters

- *nanoseconds*

The supplied number of nanoseconds.

### Return Value

An OracleTimeStamp.

### Exceptions

OracleNullValueException - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## AddSeconds

This method adds the supplied number of seconds to the current instance.

### Declaration

```
// C#  
public OracleTimeStamp AddSeconds(double seconds);
```

### Parameters

- *seconds*

The supplied number of seconds. Range is  $(-8.64 * 10^{13} < \text{seconds} < 8.64 * 10^{13})$ .

### Return Value

An `OracleTimeStamp`.

### Exceptions

`ArgumentOutOfRangeException` - The argument value is out of the specified range.

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## AddYears

This method adds the supplied number of years to the current instance.

### Declaration

```
// C#  
public OracleTimeStamp AddYears(int years);
```

### Parameters

- *years*  
The supplied number of years. Range is  $(-999,999,999 \leq \text{years} \leq 999,999,999)$

### Return Value

An `OracleTimeStamp`.

### Exceptions

`ArgumentOutOfRangeException` - The argument value is out of the specified range.

`OracleNullValueException` - The current instance has a null value.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## CompareTo

This method compares the current `OracleTimeStamp` instance to an object, and returns an integer that represents their relative values.

### Declaration

```
// C#  
public int CompareTo(object obj);
```

### Parameters

- *obj*  
The object being compared to the current `OracleTimeStamp` instance.

### Return Value

The method returns a number that is:

Less than zero: if the current `OracleTimeStamp` instance value is less than that of *obj*.

Zero: if the current `OracleTimeStamp` instance and *obj* values are equal.

Greater than zero: if the current `OracleTimeStamp` instance value is greater than that of *obj*.

### Implements

`IComparable`

## Exceptions

`ArgumentException` - The `obj` parameter is not of type `OracleTimeStamp`.

## Remarks

The following rules apply to the behavior of this method.

- The comparison must be between `OracleTimeStamps`. For example, comparing an `OracleTimeStamp` instance with an `OracleBinary` instance is not allowed. When an `OracleTimeStamp` is compared with a different type, an `ArgumentException` is thrown.
- Any `OracleTimeStamp` that has a value is greater than an `OracleTimeStamp` that has a null value.
- Two `OracleTimeStamps` that contain a null value are equal.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## Equals

Overrides `Object`

This method determines whether or not an object has the same date and time as the current `OracleTimeStamp` instance.

## Declaration

```
// C#  
public override bool Equals(object obj);
```

## Parameters

- `obj`  
The object being compared to the current `OracleTimeStamp` instance.

## Return Value

Returns `true` if the `obj` is of type `OracleTimeStamp` and represents the same date and time; otherwise, returns `false`.

## Remarks

The following rules apply to the behavior of this method.

- Any `OracleTimeStamp` that has a value is greater than an `OracleTimeStamp` that has a null value.

- Two OracleTimeStamp values that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## GetHashCode

Overrides Object

This method returns a hash code for the OracleTimeStamp instance.

### Declaration

```
// C#  
public override int GetHashCode();
```

### Return Value

A number that represents the hash code.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## GetDaysBetween

This method subtracts an OracleTimeStamp value from the current instance and returns an OracleIntervalDS that represents the time difference between the supplied OracleTimeStamp structure and the current instance.

### Declaration

```
// C#  
public OracleIntervalDS GetDaysBetween(OracleTimeStamp value1);
```

### Parameters

- *value1*  
The OracleTimeStamp value being subtracted.

### Return Value

An `OracleIntervalDS` that represents the interval between two `OracleTimeStamp` values.

### Remarks

If either the current instance or the parameter has a null value, the returned `OracleIntervalDS` has a null value.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## GetYearsBetween

This method subtracts an `OracleTimeStamp` value from the current instance and returns an `OracleIntervalYM` that represents the time difference between the `OracleTimeStamp` value and the current instance.

### Declaration

```
// C#  
public OracleIntervalYM GetYearsBetween(OracleTimeStamp value1);
```

### Parameters

- `value1`  
The `OracleTimeStamp` value being subtracted.

### Return Value

An `OracleIntervalYM` that represents the interval between two `OracleTimeStamp` values.

### Remarks

If either the current instance or the parameter has a null value, the returned `OracleIntervalYM` has a null value.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## ToOracleDate

This method converts the current `OracleTimeStamp` structure to an `OracleDate` structure.

### Declaration

```
// C#  
public OracleDate ToOracleDate();
```

### Return Value

The returned `OracleDate` contains the date and time in the current instance.

### Remarks

The precision of the `OracleTimeStamp` value can be lost during the conversion.

If the value of the `OracleTimeStamp` has a null value, the value of the returned `OracleDate` structure has a null value.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## ToOracleTimeStampLTZ

This method converts the current `OracleTimeStamp` structure to an `OracleTimeStampLTZ` structure.

### Declaration

```
// C#  
public OracleTimeStampLTZ ToOracleTimeStampLTZ();
```

### Return Value

The returned `OracleTimeStampLTZ` contains date and time in the current instance.

### Remarks

If the value of the current instance has a null value, the value of the returned `OracleTimeStampLTZ` structure has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)

## ToOracleTimeStampTZ

This method converts the current `OracleTimeStamp` structure to an `OracleTimeStampTZ` structure.

### Declaration

```
// C#  
public OracleTimeStampTZ ToOracleTimeStampTZ();
```

### Return Value

The returned `OracleTimeStampTZ` contains the date and time from the `OracleTimeStamp` and the time zone from the `OracleGlobalization.TimeZone` of the thread.

### Remarks

If the value of the current instance has a null value, the value of the returned `OracleTimeStampTZ` structure has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)
- ["OracleGlobalization Class"](#)
- ["Globalization Support "](#)

## ToString

Overrides `Object`

This method converts the current `OracleTimeStamp` structure to a string.

### Declaration

```
// C#  
public override string ToString();
```

## Return Value

A string that represents the same date and time as the current `OracleTimeStamp` structure.

## Remarks

The returned value is a string representation of an `OracleTimeStamp` in the format specified by the `OracleGlobalization.TimeStampFormat` property of the thread.

The names and abbreviations used for months and days are in the language specified by the `OracleGlobalization's DateLanguage` and `Calendar` properties of the thread. If any of the thread's globalization properties are set to null or an empty string, the client computer's settings are used.

## Example

```
// C#

using System;
using Oracle.DataAccess.Types;
using Oracle.DataAccess.Client;

class ToStringSample
{
    static void Main()
    {
        // Set the nls_timestamp_format for the OracleTimeStamp(string)
        // constructor
        OracleGlobalization info = OracleGlobalization.GetClientInfo();
        info.TimeStampFormat = "DD-MON-YYYY HH:MI:SS.FF AM";
        OracleGlobalization.SetThreadInfo(info);

        // construct OracleTimeStamp from a string using the format specified.
        OracleTimeStamp ts = new OracleTimeStamp("11-NOV-1999 11:02:33.444 AM");

        // Set the nls_timestamp_format for the ToString() method
        info.TimeStampFormat = "YYYY-MON-DD HH:MI:SS.FF AM";
        OracleGlobalization.SetThreadInfo(info);

        // Prints "1999-NOV-11 11:02:33.44400000 AM"
        Console.WriteLine(ts.ToString());
    }
}
```

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStamp Structure](#)
- [OracleTimeStamp Members](#)
- ["OracleGlobalization Class"](#)
- ["Globalization Support "](#)

# OracleTimeStampLTZ Structure

The `OracleTimeStampLTZ` structure represents the Oracle `TIMESTAMP WITH LOCAL TIME ZONE` data type to be stored in or retrieved from a database. Each `OracleTimeStampLTZ` stores the following information: year, month, day, hour, minute, second, and nanosecond.

## Class Inheritance

`System.Object`

`System.ValueType`

`Oracle.DataAccess.Types.OracleTimeStampLTZ`

## Declaration

```
// C#
public struct OracleTimeStampLTZ : IComparable, INullable, IXmlSerializable
```

## Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

## Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

## Example

```
// C#

using System;
using Oracle.DataAccess.Types;
using Oracle.DataAccess.Client;

class OracleTimeStampLTZSample
{
    static void Main()
    {
        // Illustrates usage of OracleTimeStampLTZ
        // Display Local Time Zone Name
        Console.WriteLine("Local Time Zone Name = " +
            OracleTimeStampLTZ.GetLocalTimeZoneName());
        OracleTimeStampLTZ tsLocal1 = OracleTimeStampLTZ.GetSysDate();
        OracleTimeStampLTZ tsLocal2 = DateTime.Now;
    }
}
```

```
// Calculate the difference between tsLocal1 and tsLocal2
OracleIntervalDS idsDiff = tsLocal2.GetDaysBetween(tsLocal1);

// Calculate the difference using AddNanoseconds()
int nanoDiff = 0;
while (tsLocal2 > tsLocal1)
{
    nanoDiff += 10;
    tsLocal1 = tsLocal1.AddNanoseconds(10);
}
Console.WriteLine("idsDiff.Nanoseconds = " + idsDiff.Nanoseconds);
Console.WriteLine("nanoDiff = " + nanoDiff);
}
}
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Members](#)
- [OracleTimeStampLTZ Constructors](#)
- [OracleTimeStampLTZ Static Fields](#)
- [OracleTimeStampLTZ Static Methods](#)
- [OracleTimeStampLTZ Static Operators](#)
- [OracleTimeStampLTZ Static Type Conversions](#)
- [OracleTimeStampLTZ Properties](#)
- [OracleTimeStampLTZ Methods](#)

## OracleTimeStampLTZ Members

OracleTimeStampLTZ members are listed in the following tables:

### OracleTimeStampLTZ Constructors

OracleTimeStampLTZ constructors are listed in [Table 15-113](#)

**Table 15-113 OracleTimeStampLTZConstructors**

Constructor	Description
<a href="#">OracleTimeStampLTZ Constructors</a>	Instantiates a new instance of OracleTimeStampLTZ structure (Overloaded)

### OracleTimeStampLTZ Static Fields

The OracleTimeStampLTZ static fields are listed in [Table 15-114](#).

**Table 15-114 OracleTimeStampLTZ Static Fields**

Field	Description
<a href="#">MaxValue</a>	Represents the maximum valid date for an <code>OracleTimeStampLTZ</code> structure, which is December 31, 9999 23:59:59.999999999
<a href="#">MinValue</a>	Represents the minimum valid date for an <code>OracleTimeStampLTZ</code> structure, which is January 1, -4712 0:0:0
<a href="#">Null</a>	Represents a null value that can be assigned to an instance of the <code>OracleTimeStampLTZ</code> structure

**OracleTimeStampLTZ Static Methods**

The `OracleTimeStampLTZ` static methods are listed in [Table 15-115](#).

**Table 15-115 OracleTimeStampLTZ Static Methods**

Methods	Description
<a href="#">Equals</a>	Determines if two <code>OracleTimeStampLTZ</code> values are equal (Overloaded)
<a href="#">GetLocalTimeZoneName</a>	Gets the client's local time zone name
<a href="#">GetLocalTimeZoneOffset</a>	Gets the client's local time zone offset relative to UTC
<a href="#">GetSysDate</a>	Gets an <code>OracleTimeStampLTZ</code> structure that represents the current date and time
<a href="#">GreaterThan</a>	Determines if the first of two <code>OracleTimeStampLTZ</code> values is greater than the second
<a href="#">GreaterThanOrEqual</a>	Determines if the first of two <code>OracleTimeStampLTZ</code> values is greater than or equal to the second
<a href="#">LessThan</a>	Determines if the first of two <code>OracleTimeStampLTZ</code> values is less than the second
<a href="#">LessThanOrEqual</a>	Determines if the first of two <code>OracleTimeStampLTZ</code> values is less than or equal to the second
<a href="#">NotEquals</a>	Determines if two <code>OracleTimeStampLTZ</code> values are not equal
<a href="#">Parse</a>	Gets an <code>OracleTimeStampLTZ</code> structure and sets its value for date and time using the supplied string
<a href="#">SetPrecision</a>	Returns a new instance of an <code>OracleTimeStampLTZ</code> with the specified fractional second precision

**OracleTimeStampLTZ Static Operators**

The `OracleTimeStampLTZ` static operators are listed in [Table 15-116](#).

**Table 15-116 OracleTimeStampLTZ Static Operators**

Operator	Description
<code>operator +</code>	Adds the supplied instance value to the supplied OracleTimeStampLTZ and returns a new OracleTimeStampLTZ structure (Overloaded)
<code>operator ==</code>	Determines if two OracleTimeStampLTZ values are equal
<code>operator &gt;</code>	Determines if the first of two OracleTimeStampLTZ values is greater than the second
<code>operator &gt;=</code>	Determines if the first of two OracleTimeStampLTZ values is greater than or equal to the second
<code>operator !=</code>	Determines if two OracleTimeStampLTZ values are not equal
<code>operator &lt;</code>	Determines if the first of two OracleTimeStampLTZ values is less than the second
<code>operator &lt;=</code>	Determines if the first of two OracleTimeStampLTZ values is less than or equal to the second
<code>operator -</code>	Subtracts the supplied instance value from the supplied OracleTimeStampLTZ and returns a new OracleTimeStampLTZ structure (Overloaded)

**OracleTimeStampLTZ Static Type Conversions**

The OracleTimeStampLTZ static type conversions are listed in [Table 15-117](#).

**Table 15-117 OracleTimeStampLTZ Static Type Conversions**

Operator	Description
<code>explicit operator OracleTimeStampLTZ</code>	Converts an instance value to an OracleTimeStampLTZ structure (Overloaded)
<code>implicit operator OracleTimeStampLTZ</code>	Converts an instance value to an OracleTimeStampLTZ structure (Overloaded)
<code>explicit operator DateTime</code>	Converts an OracleTimeStampLTZ value to a DateTime structure

**OracleTimeStampLTZ Properties**

The OracleTimeStampLTZ properties are listed in [Table 15-118](#).

**Table 15-118 OracleTimeStampLTZ Properties**

Properties	Description
<a href="#">BinData</a>	Returns an array of bytes that represents an Oracle <code>TIMESTAMP WITH LOCAL TIME ZONE</code> in Oracle internal format
<a href="#">Day</a>	Specifies the day component of an <code>OracleTimeStampLTZ</code>
<a href="#">IsNull</a>	Indicates whether or not the <code>OracleTimeStampLTZ</code> instance has a null value
<a href="#">Hour</a>	Specifies the hour component of an <code>OracleTimeStampLTZ</code>
<a href="#">Millisecond</a>	Specifies the millisecond component of an <code>OracleTimeStampLTZ</code>
<a href="#">Minute</a>	Specifies the minute component of an <code>OracleTimeStampLTZ</code>
<a href="#">Month</a>	Specifies the month component of an <code>OracleTimeStampLTZ</code>
<a href="#">Nanosecond</a>	Specifies the nanosecond component of an <code>OracleTimeStampLTZ</code>
<a href="#">Second</a>	Specifies the second component of an <code>OracleTimeStampLTZ</code>
<a href="#">Value</a>	Specifies the date and time that is stored in the <code>OracleTimeStampLTZ</code> structure
<a href="#">Year</a>	Specifies the year component of an <code>OracleTimeStampLTZ</code>

**OracleTimeStampLTZ Methods**

The `OracleTimeStampLTZ` methods are listed in [Table 15-119](#).

**Table 15-119 OracleTimeStampLTZ Methods**

Methods	Description
<a href="#">AddDays</a>	Adds the supplied number of days to the current instance
<a href="#">AddHours</a>	Adds the supplied number of hours to the current instance
<a href="#">AddMilliseconds</a>	Adds the supplied number of milliseconds to the current instance
<a href="#">AddMinutes</a>	Adds the supplied number of minutes to the current instance
<a href="#">AddMonths</a>	Adds the supplied number of months to the current instance
<a href="#">AddNanoseconds</a>	Adds the supplied number of nanoseconds to the current instance

Table 15-119 (Cont.) OracleTimeStampLTZ Methods

Methods	Description
<a href="#">AddSeconds</a>	Adds the supplied number of seconds to the current instance
<a href="#">AddYears</a>	Adds the supplied number of years to the current instance
<a href="#">CompareTo</a>	Compares the current <code>OracleTimeStampLTZ</code> instance to an object and returns an integer that represents their relative values
<a href="#">Equals</a>	Determines whether or not an object has the same date and time as the current <code>OracleTimeStampLTZ</code> instance (Overloaded)
<a href="#">GetHashCode</a>	Returns a hash code for the <code>OracleTimeStampLTZ</code> instance
<a href="#">GetDaysBetween</a>	Subtracts an <code>OracleTimeStampLTZ</code> from the current instance and returns an <code>OracleIntervalDS</code> that represents the difference
<a href="#">GetYearsBetween</a>	Subtracts an <code>OracleTimeStampLTZ</code> from the current instance and returns an <code>OracleIntervalYM</code> that represents the difference
<a href="#">GetType</a>	Inherited from <code>System.Object</code>
<a href="#">ToOracleDate</a>	Converts the current <code>OracleTimeStampLTZ</code> structure to an <code>OracleDate</code> structure
<a href="#">ToOracleTimeStamp</a>	Converts the current <code>OracleTimeStampLTZ</code> structure to an <code>OracleTimeStamp</code> structure
<a href="#">ToOracleTimeStampTZ</a>	Converts the current <code>OracleTimeStampLTZ</code> structure to an <code>OracleTimeStampTZ</code> structure
<a href="#">ToString</a>	Converts the current <code>OracleTimeStampLTZ</code> structure to a string
<a href="#">ToUniversalTime</a>	Converts the current local time to Coordinated Universal Time (UTC)

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)

## OracleTimeStampLTZ Constructors

The `OracleTimeStampLTZ` constructors create new instances of the `OracleTimeStampLTZ` structure.

**Overload List:**

- [OracleTimeStampLTZ\(DateTime\)](#)  
This constructor creates a new instance of the `OracleTimeStampLTZ` structure and sets its value for date and time using the supplied `DateTime` value.
- [OracleTimeStampLTZ\(string\)](#)  
This constructor creates a new instance of the `OracleTimeStampLTZ` structure and sets its value for date and time using the supplied string.
- [OracleTimeStampLTZ\(int, int, int\)](#)  
This constructor creates a new instance of the `OracleTimeStampLTZ` structure and sets its value for date using year, month, and day.
- [OracleTimeStampLTZ\(int, int, int, int, int, int\)](#)  
This constructor creates a new instance of the `OracleTimeStampLTZ` structure and sets its value for date and time using year, month, day, hour, minute, and second.
- [OracleTimeStampLTZ\(int, int, int, int, int, int, double\)](#)  
This constructor creates a new instance of the `OracleTimeStampLTZ` structure and sets its value for date and time using year, month, day, hour, minute, second, and millisecond.
- [OracleTimeStampLTZ\(int, int, int, int, int, int, int\)](#)  
This constructor creates a new instance of the `OracleTimeStampLTZ` structure and sets its value for date and time using year, month, day, hour, minute, second, and nanosecond.
- [OracleTimeStampLTZ\(byte \[ \]\)](#)  
This constructor creates a new instance of the `OracleTimeStampLTZ` structure and sets its value to the provided byte array, which is in the internal Oracle `TIMESTAMP WITH LOCAL TIME ZONE` format.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## OracleTimeStampLTZ(DateTime)

This constructor creates a new instance of the `OracleTimeStampLTZ` structure and sets its value for date and time using the supplied `DateTime` value.

**Declaration**

```
// C#  
public OracleTimeStampLTZ (DateTime dt);
```

### Parameters

- *dt*  
The supplied `DateTime` value.

### Exceptions

`ArgumentException` - The *dt* parameter cannot be used to construct a valid `OracleTimeStampLTZ`.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## OracleTimeStampLTZ(string)

This constructor creates a new instance of the `OracleTimeStampLTZ` structure and sets its value for date and time using the supplied string.

### Declaration

```
// C#  
public OracleTimeStampLTZ(string tsStr);
```

### Parameters

- *tsStr*  
A string that represents an Oracle `TIMESTAMP WITH LOCAL TIME ZONE`.

### Exceptions

`ArgumentException` - The *tsStr* is an invalid string representation of an Oracle `TIMESTAMP WITH LOCAL TIME ZONE` or the supplied *tsStr* is not in the timestamp format specified by the `OracleGlobalization.TimeStampFormat` property of the thread, which represents the Oracle `NLS_TIMESTAMP_FORMAT` parameter.

`ArgumentNullException` - The *tsStr* value is null.

### Remarks

The names and abbreviations used for months and days are in the language specified by the `DateLanguage` and `Calendar` properties of the thread's `OracleGlobalization` object. If any of the thread's globalization properties are set to null or an empty string, the client computer's settings are used.

### Example

```
// C#

using System;
using Oracle.DataAccess.Client;
using Oracle.DataAccess.Types;

class OracleTimeStampLTZSample
{
    static void Main()
    {
        // Set the nls_timestamp_format for the OracleTimeStampLTZ(string)
        // constructor
        OracleGlobalization info = OracleGlobalization.GetClientInfo();
        info.TimestampFormat = "DD-MON-YYYY HH:MI:SS.FF AM";
        OracleGlobalization.SetThreadInfo(info);

        // construct OracleTimeStampLTZ from a string using the format
        // specified.
        OracleTimeStampLTZ ts =
            new OracleTimeStampLTZ("11-NOV-1999 11:02:33.444 AM");

        // Set the nls_timestamp_format for the ToString() method
        info.TimestampFormat = "YYYY-MON-DD HH:MI:SS.FF AM";
        OracleGlobalization.SetThreadInfo(info);

        // Prints "1999-NOV-11 11:02:33.444000000 AM"
        Console.WriteLine(ts.ToString());
    }
}
```

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)
- ["OracleGlobalization Class"](#)
- ["Globalization Support "](#)
- *Oracle Database SQL Language Reference* for further information on date format elements

## OracleTimeStampLTZ(int, int, int)

This constructor creates a new instance of the `OracleTimeStampLTZ` structure and sets its value for date using year, month, and day.

### Declaration

```
// C#
public OracleTimeStampLTZ(int year, int month, int day);
```

### Parameters

- *year*  
The year provided. Range of *year* is (-4712 to 9999).
- *month*  
The month provided. Range of *month* is (1 to 12).
- *day*  
The day provided. Range of *day* is (1 to 31).

### Exceptions

`ArgumentOutOfRangeException` - The argument value for one or more of the parameters is out of the specified range.

`ArgumentException` - The argument values of the parameters cannot be used to construct a valid `OracleTimeStampLTZ` (that is, the day is out of range for the month).



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## OracleTimeStampLTZ(int, int, int, int, int)

This constructor creates a new instance of the `OracleTimeStampLTZ` structure and sets its value for date and time using year, month, day, hour, minute, and second.

### Declaration

```
// C#  
public OracleTimeStampLTZ (int year, int month, int day, int hour,  
    int minute, int second);
```

### Parameters

- *year*  
The year provided. Range of *year* is (-4712 to 9999).
- *month*  
The month provided. Range of *month* is (1 to 12).
- *day*  
The day provided. Range of *day* is (1 to 31).
- *hour*  
The hour provided. Range of *hour* is (0 to 23).

- *minute*  
The minute provided. Range of *minute* is (0 to 59).
- *second*  
The second provided. Range of *second* is (0 to 59).

### Exceptions

`ArgumentOutOfRangeException` - The argument value for one or more of the parameters is out of the specified range.

`ArgumentException` - The argument values of the parameters cannot be used to construct a valid `OracleTimeStampLTZ` (that is, the day is out of range for the month).

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## OracleTimeStampLTZ(int, int, int, int, int, double)

This constructor creates a new instance of the `OracleTimeStampLTZ` structure and sets its value for date and time using year, month, day, hour, minute, second, and millisecond.

### Declaration

```
// C#  
public OracleTimeStampLTZ(int year, int month, int day, int hour, int minute, int  
second, double millisecond);
```

### Parameters

- *year*  
The year provided. Range of *year* is (-4712 to 9999).
- *month*  
The month provided. Range of *month* is (1 to 12).
- *day*  
The day provided. Range of *day* is (1 to 31).
- *hour*  
The hour provided. Range of *hour* is (0 to 23).
- *minute*  
The minute provided. Range of *minute* is (0 to 59).
- *second*

The second provided. Range of *second* is (0 to 59).

- *milliseconds*

The milliseconds provided. Range of *millisecond* is (0 to 999.999999).

### Exceptions

`ArgumentOutOfRangeException` - The argument value for one or more of the parameters is out of the specified range.

`ArgumentException` - The argument values of the parameters cannot be used to construct a valid `OracleTimeStampLTZ` (that is, the day is out of range for the month).



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## OracleTimeStampLTZ(int, int, int, int, int, int)

This constructor creates a new instance of the `OracleTimeStampLTZ` structure and sets its value for date and time using year, month, day, hour, minute, second, and nanosecond.

### Declaration

```
// C#
public OracleTimeStampLTZ (int year, int month, int day, int hour,
    int minute, int second, int nanosecond);
```

### Parameters

- *year*  
The year provided. Range of *year* is (-4712 to 9999).
- *month*  
The month provided. Range of *month* is (1 to 12).
- *day*  
The day provided. Range of *day* is (1 to 31).
- *hour*  
The hour provided. Range of *hour* is (0 to 23).
- *minute*  
The minute provided. Range of *minute* is (0 to 59).
- *second*  
The second provided. Range of *second* is (0 to 59).

- *nanosecond*

The nanosecond provided. Range of *nanosecond* is (0 to 999999999).

### Exceptions

`ArgumentOutOfRangeException` - The argument value for one or more of the parameters is out of the specified range.

`ArgumentException` - The argument values of the parameters cannot be used to construct a valid `OracleTimeStampLTZ` (that is, the day is out of range for the month).



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## OracleTimeStampLTZ(byte [ ])

This constructor creates a new instance of the `OracleTimeStampLTZ` structure and sets its value to the provided byte array, which is in the internal Oracle `TIMESTAMP WITH LOCAL TIME ZONE` format.

### Declaration

```
// C#  
public OracleTimeStampLTZ (byte[] bytes);
```

### Parameters

- *bytes*

A byte array that represents an Oracle `TIMESTAMP WITH LOCAL TIME ZONE` in Oracle internal format.

### Exceptions

`ArgumentException` - *bytes* is not in an internal Oracle `TIMESTAMP WITH LOCAL TIME ZONE` format or *bytes* is not a valid Oracle `TIMESTAMP WITH LOCAL TIME ZONE`.

`ArgumentNullException` - *bytes* is null.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## OracleTimeStampLTZ Static Fields

The `OracleTimeStampLTZ` static fields are listed in [Table 15-120](#).

**Table 15-120 OracleTimeStampLTZ Static Fields**

Field	Description
<a href="#">MaxValue</a>	Represents the maximum valid date for an <code>OracleTimeStampLTZ</code> structure, which is December 31, 9999 23:59:59.999999999
<a href="#">MinValue</a>	Represents the minimum valid date for an <code>OracleTimeStampLTZ</code> structure, which is January 1, -4712 0:0:0
<a href="#">Null</a>	Represents a null value that can be assigned to an instance of the <code>OracleTimeStampLTZ</code> structure

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

### MaxValue

This static field represents the maximum valid date for an `OracleTimeStampLTZ` structure, which is December 31, 9999 23:59:59.999999999.

#### Declaration

```
// C#  
public static readonly OracleTimeStampLTZ MaxValue;
```

#### Remarks

This value is the maximum date and time in the client time zone.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## MinValue

This static field represents the minimum valid date for an `OracleTimeStampLTZ` structure, which is January 1, -4712 0:0:0.

### Declaration

```
// C#  
public static readonly OracleTimeStampLTZ MinValue;
```

### Remarks

This value is the minimum date and time in the client time zone.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## Null

This static field represents a null value that can be assigned to an instance of the `OracleTimeStampLTZ` structure.

### Declaration

```
// C#  
public static readonly OracleTimeStampLTZ Null;
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## OracleTimeStampLTZ Static Methods

The `OracleTimeStampLTZ` static methods are listed in [Table 15-121](#).

**Table 15-121 OracleTimeStampLTZ Static Methods**

Methods	Description
<a href="#">Equals</a>	Determines if two <code>OracleTimeStampLTZ</code> values are equal (Overloaded)
<a href="#">GetLocalTimeZoneName</a>	Gets the client's local time zone name
<a href="#">GetLocalTimeZoneOffset</a>	Gets the client's local time zone offset relative to UTC
<a href="#">GetSysDate</a>	Gets an <code>OracleTimeStampLTZ</code> structure that represents the current date and time
<a href="#">GreaterThan</a>	Determines if the first of two <code>OracleTimeStampLTZ</code> values is greater than the second
<a href="#">GreaterThanOrEqual</a>	Determines if the first of two <code>OracleTimeStampLTZ</code> values is greater than or equal to the second
<a href="#">LessThan</a>	Determines if the first of two <code>OracleTimeStampLTZ</code> values is less than the second
<a href="#">LessThanOrEqual</a>	Determines if the first of two <code>OracleTimeStampLTZ</code> values is less than or equal to the second
<a href="#">NotEquals</a>	Determines if two <code>OracleTimeStampLTZ</code> values are not equal
<a href="#">Parse</a>	Gets an <code>OracleTimeStampLTZ</code> structure and sets its value for date and time using the supplied string
<a href="#">SetPrecision</a>	Returns a new instance of an <code>OracleTimeStampLTZ</code> with the specified fractional second precision



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## Equals

This static method determines if two `OracleTimeStampLTZ` values are equal.

### Declaration

```
// C#
public static bool Equals(OracleTimeStampLTZ value1,
    OracleTimeStampLTZ value2);
```

### Parameters

- *value1*  
The first OracleTimeStampLTZ.
- *value2*  
The second OracleTimeStampLTZ.

### Return Value

Returns `true` if two OracleTimeStampLTZ values are equal. Returns `false` otherwise.

### Remarks

The following rules apply to the behavior of this method.

- Any OracleTimeStampLTZ that has a value is greater than an OracleTimeStampLTZ that has a null value.
- Two OracleTimeStampLTZs that contain a null value are equal.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## GetLocalTimeZoneName

This static method gets the client's local time zone name.

### Declaration

```
// C#  
public static string GetLocalTimeZoneName();
```

### Return Value

A string containing the local time zone.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## GetLocalTimeZoneOffset

This static method gets the client's local time zone offset relative to Coordinated Universal Time (UTC).

### Declaration

```
// C#  
public static TimeSpan GetLocalTimeZoneOffset( );
```

### Return Value

A `TimeSpan` structure containing the local time zone hours and time zone minutes.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## GetSysDate

This static method gets an `OracleTimeStampLTZ` structure that represents the current date and time.

### Declaration

```
// C#  
public static OracleTimeStampLTZ GetSysDate();
```

### Return Value

An `OracleTimeStampLTZ` structure that represents the current date and time.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## GreaterThan

This static method determines if the first of two `OracleTimeStampLTZ` values is greater than the second.

### Declaration

```
// C#  
public static bool GreaterThan(OracleTimeStampLTZ value1,  
    OracleTimeStampLTZ value2);
```

### Parameters

- *value1*  
The first OracleTimeStampLTZ.
- *value2*  
The second OracleTimeStampLTZ.

### Return Value

Returns `true` if the first of two OracleTimeStampLTZ values is greater than the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any OracleTimeStampLTZ that has a value is greater than an OracleTimeStampLTZ that has a null value.
- Two OracleTimeStampLTZs that contain a null value are equal.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## GreaterThanOrEqual

This static method determines if the first of two OracleTimeStampLTZ values is greater than or equal to the second.

### Declaration

```
// C#  
public static bool GreaterThanOrEqual(OracleTimeStampLTZ value1,  
    OracleTimeStampLTZ value2);
```

### Parameters

- *value1*  
The first OracleTimeStampLTZ.
- *value2*

The second `OracleTimeStampLTZ`.

### Return Value

Returns `true` if the first of two `OracleTimeStampLTZ` values is greater than or equal to the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleTimeStampLTZ` that has a value is greater than an `OracleTimeStampLTZ` that has a null value.
- Two `OracleTimeStampLTZ`s that contain a null value are equal.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## LessThan

This static method determines if the first of two `OracleTimeStampLTZ` values is less than the second.

### Declaration

```
// C#  
public static bool LessThan(OracleTimeStampLTZ value1,  
    OracleTimeStampLTZ value2);
```

### Parameters

- `value1`  
The first `OracleTimeStampLTZ`.
- `value2`  
The second `OracleTimeStampLTZ`.

### Return Value

Returns `true` if the first of two `OracleTimeStampLTZ` values is less than the second. Returns `false` otherwise.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleTimeStampLTZ` that has a value is greater than an `OracleTimeStampLTZ` that has a null value.

- Two OracleTimeStampLTZs that contain a null value are equal.

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## LessThanOrEqual

This static method determines if the first of two OracleTimeStampLTZ values is less than or equal to the second.

**Declaration**

```
// C#  
public static bool LessThanOrEqual(OracleTimeStampLTZ value1,  
    OracleTimeStampLTZ value2);
```

**Parameters**

- *value1*  
The first OracleTimeStampLTZ.
- *value2*  
The second OracleTimeStampLTZ.

**Return Value**

Returns `true` if the first of two OracleTimeStampLTZ values is less than or equal to the second. Returns `false` otherwise.

**Remarks**

The following rules apply to the behavior of this method.

- Any OracleTimeStampLTZ that has a value is greater than an OracleTimeStampLTZ that has a null value.
- Two OracleTimeStampLTZs that contain a null value are equal.

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## NotEquals

This static method determines if two `OracleTimeStampLTZ` values are not equal.

### Declaration

```
// C#  
public static bool NotEquals(OracleTimeStampLTZ value1,  
    OracleTimeStampLTZ value2);
```

### Parameters

- *value1*  
The first `OracleTimeStampLTZ`.
- *value2*  
The second `OracleTimeStampLTZ`.

### Return Value

Returns `true` if two `OracleTimeStampLTZ` values are not equal. Returns `false` otherwise.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleTimeStampLTZ` that has a value is greater than an `OracleTimeStampLTZ` that has a null value.
- Two `OracleTimeStampLTZ`s that contain a null value are equal.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## Parse

This static method creates an `OracleTimeStampLTZ` structure and sets its value using the supplied string.

### Declaration

```
// C#  
public static OracleTimeStampLTZ Parse(string tsStr);
```

### Parameters

- *tsStr*

A string that represents an Oracle `TIMESTAMP WITH LOCAL TIME ZONE`.

### Return Value

An `OracleTimeStampLTZ` structure.

### Exceptions

`ArgumentException` - The `tsStr` parameter is an invalid string representation of an Oracle `TIMESTAMP WITH LOCAL TIME ZONE` or the `tsStr` is not in the timestamp format specified by the `OracleGlobalization.TimeStampFormat` property of the thread, which represents the Oracle `NLS_TIMESTAMP_FORMAT` parameter.

`ArgumentNullException` - The `tsStr` value is null.

### Remarks

The names and abbreviations used for months and days are in the language specified by the `DateLanguage` and `Calendar` properties of the thread's `OracleGlobalization` object. If any of the thread's globalization properties are set to null or an empty string, the client computer's settings are used.

### Example

```
// C#

using System;
using Oracle.DataAccess.Types;
using Oracle.DataAccess.Client;

class ParseSample
{
    static void Main()
    {
        // Set the nls_timestamp_format for the Parse() method
        OracleGlobalization info = OracleGlobalization.GetClientInfo();
        info.TimeStampFormat = "DD-MON-YYYY HH:MI:SS.FF AM";
        OracleGlobalization.SetThreadInfo(info);

        // construct OracleTimeStampLTZ from a string using the format specified.
        OracleTimeStampLTZ ts =
            OracleTimeStampLTZ.Parse("11-NOV-1999 11:02:33.444 AM");

        // Set the nls_timestamp_format for the ToString() method
        info.TimeStampFormat = "YYYY-MON-DD HH:MI:SS.FF AM";
        OracleGlobalization.SetThreadInfo(info);

        // Prints "1999-NOV-11 11:02:33.444000000 AM"
        Console.WriteLine(ts.ToString());
    }
}
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)
- ["OracleGlobalization Class"](#)
- ["Globalization Support "](#)

## SetPrecision

This static method returns a new instance of an `OracleTimeStampLTZ` with the specified fractional second precision.

### Declaration

```
// C#
public static OracleTimeStampLTZ SetPrecision(OracleTimeStampLTZ value1,
      int fracSecPrecision);
```

### Parameters

- *value1*  
The provided `OracleTimeStampLTZ` object.
- *fracSecPrecision*  
The fractional second precision provided. Range of fractional second precision is (0 to 9).

### Return Value

An `OracleTimeStampLTZ` structure with the specified fractional second precision

### Exceptions

`ArgumentOutOfRangeException` - *fracSecPrecision* is out of the specified range.

### Remarks

The value specified in the supplied *fracSecPrecision* parameter is used to perform a rounding off operation on the supplied `OracleTimeStampLTZ` value. Depending on this value, 0 or more trailing zeros are displayed in the string returned by `ToString()`.

### Example

The `OracleTimeStampLTZ` with a value of "December 31, 9999 23:59:59.99" results in the string "December 31, 9999 23:59:59.99000" when `SetPrecision()` is called with the fractional second precision set to 5.

 See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## OracleTimeStampLTZ Static Operators

The `OracleTimeStampLTZ` static operators are listed in [Table 15-122](#).

**Table 15-122 OracleTimeStampLTZ Static Operators**

Operator	Description
<code>operator +</code>	Adds the supplied instance value to the supplied <code>OracleTimeStampLTZ</code> and returns a new <code>OracleTimeStampLTZ</code> structure (Overloaded)
<code>operator ==</code>	Determines if two <code>OracleTimeStampLTZ</code> values are equal
<code>operator &gt;</code>	Determines if the first of two <code>OracleTimeStampLTZ</code> values is greater than the second
<code>operator &gt;=</code>	Determines if the first of two <code>OracleTimeStampLTZ</code> values is greater than or equal to the second
<code>operator !=</code>	Determines if two <code>OracleTimeStampLTZ</code> values are not equal
<code>operator &lt;</code>	Determines if the first of two <code>OracleTimeStampLTZ</code> values is less than the second
<code>operator &lt;=</code>	Determines if the first of two <code>OracleTimeStampLTZ</code> values is less than or equal to the second
<code>operator -</code>	Subtracts the supplied instance value from the supplied <code>OracleTimeStampLTZ</code> and returns a new <code>OracleTimeStampLTZ</code> structure (Overloaded)

 See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

### operator +

`operator +` adds the supplied value to the supplied `OracleTimeStampLTZ` and returns a new `OracleTimeStampLTZ` structure.

**Overload List:**

- [operator + \(OracleTimeStampLTZ, OracleIntervalDS\)](#)  
This static operator adds the supplied `OracleIntervalDS` to the supplied `OracleTimeStampLTZ` and returns a new `OracleTimeStampLTZ` structure.
- [operator + \(OracleTimeStampLTZ, OracleIntervalYM\)](#)  
This static operator adds the supplied `OracleIntervalYM` to the supplied `OracleTimeStampLTZ` and returns a new `OracleTimeStampLTZ` structure.
- [operator + \(OracleTimeStampLTZ, TimeSpan\)](#)  
This static operator adds the supplied `TimeSpan` to the supplied `OracleTimeStampLTZ` and returns a new `OracleTimeStampLTZ` structure.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## operator + (OracleTimeStampLTZ, OracleIntervalDS)

This static operator adds the supplied `OracleIntervalDS` to the supplied `OracleTimeStampLTZ` and returns a new `OracleTimeStampLTZ` structure.

**Declaration**

```
// C#  
public static operator +(OracleTimeStampLTZ value1,  
    OracleIntervalDS value2);
```

**Parameters**

- *value1*  
An `OracleTimeStampLTZ`.
- *value2*  
An `OracleIntervalDS`.

**Return Value**

An `OracleTimeStampLTZ`.

**Remarks**

If either parameter has a null value, the returned `OracleTimeStampLTZ` has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## operator + (OracleTimeStampLTZ, OracleIntervalYM)

This static operator adds the supplied `OracleIntervalYM` to the supplied `OracleTimeStampLTZ` and returns a new `OracleTimeStampLTZ` structure.

### Declaration

```
// C#  
public static operator +(OracleTimeStampLTZ value1,  
    OracleIntervalYM value2);
```

### Parameters

- *value1*  
An `OracleTimeStampLTZ`.
- *value2*  
An `OracleIntervalYM`.

### Return Value

An `OracleTimeStampLTZ`.

### Remarks

If either parameter has a null value, the returned `OracleTimeStampLTZ` has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## operator + (OracleTimeStampLTZ, TimeSpan)

This static operator adds the supplied `TimeSpan` to the supplied `OracleTimeStampLTZ` and returns a new `OracleTimeStampLTZ` structure.

### Declaration

```
// C#  
public static operator +(OracleTimeStampLTZ value1, TimeSpan value2);
```

### Parameters

- *value1*  
An OracleTimeStampLTZ.
- *value2*  
A TimeSpan.

### Return Value

An OracleTimeStampLTZ.

### Remarks

If the OracleTimeStampLTZ instance has a null value, the returned OracleTimeStampLTZ has a null value.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## operator ==

This static operator determines if two OracleTimeStampLTZ values are equal.

### Declaration

```
// C#  
public static bool operator ==(OracleTimeStampLTZ value1,  
    OracleTimeStampLTZ value2);
```

### Parameters

- *value1*  
The first OracleTimeStampLTZ.
- *value2*  
The second OracleTimeStampLTZ.

### Return Value

Returns true if they are the same; otherwise, returns false.

## Remarks

The following rules apply to the behavior of this method.

- Any `OracleTimeStampLTZ` that has a value is greater than an `OracleTimeStampLTZ` that has a null value.
- Two `OracleTimeStampLTZ`s that contain a null value are equal.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## operator >

This static operator determines if the first of two `OracleTimeStampLTZ` values is greater than the second.

### Declaration

```
// C#  
public static bool operator > (OracleTimeStampLTZ value1,  
    OracleTimeStampLTZ value2);
```

### Parameters

- *value1*  
The first `OracleTimeStampLTZ`.
- *value2*  
The second `OracleTimeStampLTZ`.

### Return Value

Returns `true` if the first `OracleTimeStampLTZ` value is greater than the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleTimeStampLTZ` that has a value is greater than an `OracleTimeStampLTZ` that has a null value.
- Two `OracleTimeStampLTZ`s that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## operator >=

This static operator determines if the first of two `OracleTimeStampLTZ` values is greater than or equal to the second.

### Declaration

```
// C#  
public static bool operator >= (OracleTimeStampLTZ value1,  
    OracleTimeStampLTZ value2);
```

### Parameters

- *value1*  
An `OracleTimeStampLTZ`.
- *value2*  
The second `OracleTimeStampLTZ`.

### Return Value

Returns `true` if the first `OracleTimeStampLTZ` is greater than or equal to the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleTimeStampLTZ` that has a value is greater than an `OracleTimeStampLTZ` that has a null value.
- Two `OracleTimeStampLTZ`s that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## operator !=

This static operator determines if two `OracleTimeStampLTZ` values are not equal.

### Declaration

```
// C#  
public static bool operator != (OracleTimeStampLTZ value1,  
    OracleTimeStampLTZ value2);
```

### Parameters

- `value1`  
The first `OracleTimeStampLTZ`.
- `value2`  
The second `OracleTimeStampLTZ`.

### Return Value

Returns `true` if two `OracleTimeStampLTZ` values are not equal; otherwise returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleTimeStampLTZ` that has a value is greater than an `OracleTimeStampLTZ` that has a null value.
- Two `OracleTimeStampLTZ`s that contain a null value are equal.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## operator <

This static operator determines if the first of two `OracleTimeStampLTZ` values is less than the second.

### Declaration

```
// C#  
public static bool operator < (OracleTimeStampLTZ value1,  
    OracleTimeStampLTZ value2);
```

### Parameters

- `value1`

The first `OracleTimeStampLTZ`.

- `value2`

The second `OracleTimeStampLTZ`.

### Return Value

Returns `true` if the first `OracleTimeStampLTZ` is less than the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleTimeStampLTZ` that has a value is greater than an `OracleTimeStampLTZ` that has a null value.
- Two `OracleTimeStampLTZs` that contain a null value are equal.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## operator <=

This static operator determines if the first of two `OracleTimeStampLTZ` values is less than or equal to the second.

### Declaration

```
// C#  
public static bool operator <= (OracleTimeStampLTZ value1,  
    OracleTimeStampLTZ value2);
```

### Parameters

- `value1`

The first `OracleTimeStampLTZ`.

- `value2`

The second `OracleTimeStampLTZ`.

### Return Value

Returns `true` if the first `OracleTimeStampLTZ` is less than or equal to the second; otherwise, returns `false`.

## Remarks

The following rules apply to the behavior of this method.

- Any `OracleTimeStampLTZ` that has a value is greater than an `OracleTimeStampLTZ` that has a null value.
- Two `OracleTimeStampLTZ`s that contain a null value are equal.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## operator -

`operator-` subtracts the supplied value, from the supplied `OracleTimeStampLTZ` value, and returns a new `OracleTimeStampLTZ` structure.

### Overload List:

- [operator - \(OracleTimeStampLTZ, OracleIntervalDS\)](#)  
This static operator subtracts the supplied `OracleIntervalDS` value, from the supplied `OracleTimeStampLTZ` value, and return a new `OracleTimeStampLTZ` structure.
- [operator - \(OracleTimeStampLTZ, OracleIntervalYM\)](#)  
This static operator subtracts the supplied `OracleIntervalYM` value, from the supplied `OracleTimeStampLTZ` value, and returns a new `OracleTimeStampLTZ` structure.
- [operator - \(OracleTimeStampLTZ, TimeSpan\)](#)  
This static operator subtracts the supplied `TimeSpan` value, from the supplied `OracleTimeStampLTZ` value, and returns a new `OracleTimeStampLTZ` structure.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## operator - (OracleTimeStampLTZ, OracleIntervalDS)

This static operator subtracts the supplied `OracleIntervalDS` value, from the supplied `OracleTimeStampLTZ` value, and return a new `OracleTimeStampLTZ` structure.

### Declaration

```
// C#  
public static operator - (OracleTimeStampLTZ value1,  
    OracleIntervalDS value2);
```

### Parameters

- *value1*  
An `OracleTimeStampLTZ`.
- *value2*  
An `OracleIntervalDS` instance.

### Return Value

An `OracleTimeStampLTZ` structure.

### Remarks

If either parameter has a null value, the returned `OracleTimeStampLTZ` has a null value.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## operator - (OracleTimeStampLTZ, OracleIntervalYM)

This static operator subtracts the supplied `OracleIntervalYM` value, from the supplied `OracleTimeStampLTZ` value, and returns a new `OracleTimeStampLTZ` structure.

### Declaration

```
// C#  
public static operator - (OracleTimeStampLTZ value1,  
    OracleIntervalYM value2);
```

### Parameters

- *value1*  
An `OracleTimeStampLTZ`.

- *value2*  
An OracleIntervalYM.

### Return Value

An OracleTimeStampLTZ structure.

### Remarks

If either parameter has a null value, the returned OracleTimeStampLTZ has a null value.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## operator - (OracleTimeStampLTZ, TimeSpan)

This static operator subtracts the supplied `TimeSpan` value, from the supplied `OracleTimeStampLTZ` value, and returns a new `OracleTimeStampLTZ` structure.

### Declaration

```
// C#  
public static operator -(OracleTimeStampLTZ value1, TimeSpan value2);
```

### Parameters

- *value1*  
An OracleTimeStampLTZ.
- *value2*  
A TimeSpan.

### Return Value

An OracleTimeStampLTZ structure.

### Remarks

If the OracleTimeStampLTZ instance has a null value, the returned OracleTimeStampLTZ structure has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## OracleTimeStampLTZ Static Type Conversions

The `OracleTimeStampLTZ` static type conversions are listed in [Table 15-123](#).

**Table 15-123 OracleTimeStampLTZ Static Type Conversions**

Operator	Description
<a href="#">explicit operator OracleTimeStampLTZ</a>	Converts an instance value to an <code>OracleTimeStampLTZ</code> structure (Overloaded)
<a href="#">implicit operator OracleTimeStampLTZ</a>	Converts an instance value to an <code>OracleTimeStampLTZ</code> structure (Overloaded)
<a href="#">explicit operator DateTime</a>	Converts an <code>OracleTimeStampLTZ</code> value to a <code>DateTime</code> structure

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

### explicit operator OracleTimeStampLTZ

`explicit operator OracleTimeStampLTZ` converts the supplied value to an `OracleTimeStampLTZ` structure.

**Overload List:**

- [explicit operator OracleTimeStampLTZ\(OracleTimeStamp\)](#)  
This static type conversion operator converts an `OracleTimeStamp` value to an `OracleTimeStampLTZ` structure.
- [explicit operator OracleTimeStampLTZ\(OracleTimeStampTZ\)](#)  
This static type conversion operator converts an `OracleTimeStampTZ` value to an `OracleTimeStampLTZ` structure.
- [explicit operator OracleTimeStampLTZ\(string\)](#)

This static type conversion operator converts the supplied string to an `OracleTimeStampLTZ` structure.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## explicit operator OracleTimeStampLTZ(OracleTimeStamp)

This static type conversion operator converts an `OracleTimeStamp` value to an `OracleTimeStampLTZ` structure.

### Declaration

```
// C#  
public static explicit operator OracleTimeStampLTZ (OracleTimeStamp value1);
```

### Parameters

- `value1`  
An `OracleTimeStamp`.

### Return Value

The `OracleTimeStampLTZ` structure contains the date and time of the `OracleTimeStampTZ` structure.

### Remarks

If the `OracleTimeStamp` structure has a null value, the returned `OracleTimeStampLTZ` structure also has a null value.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## explicit operator OracleTimeStampLTZ(OracleTimeStampTZ)

This static type conversion operator converts an `OracleTimeStampTZ` value to an `OracleTimeStampLTZ` structure.

### Declaration

```
// C#  
public static explicit operator OracleTimeStampLTZ  
    (OracleTimeStampTZ value1);
```

### Parameters

- *value1*  
An OracleTimeStampTZ instance.

### Return Value

The OracleTimeStampLTZ structure contains the date and time in the OracleTimeStampTZ structure (which is normalized to the client local time zone).

### Remarks

If the OracleTimeStampTZ structure has a null value, the returned OracleTimeStampLTZ structure also has a null value.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## explicit operator OracleTimeStampLTZ(string)

This static type conversion operator converts the supplied string to an OracleTimeStampLTZ structure.

### Declaration

```
// C#  
public static explicit operator OracleTimeStampLTZ (string tsStr);
```

### Parameters

- *tsStr*  
A string representation of an Oracle TIMESTAMP WITH LOCAL TIME ZONE.

### Return Value

A OracleTimeStampLTZ.

### Exceptions

ArgumentException - The *tsStr* parameter is an invalid string representation of an Oracle TIMESTAMP WITH LOCAL TIME ZONE or the *tsStr* is not in the timestamp format

specified by the thread's `OracleGlobalization.TimeStampFormat` property, which represents the Oracle `NLS_TIMESTAMP_FORMAT` parameter.

### Remarks

The names and abbreviations used for months and days are in the language specified by the `DateLanguage` and `Calendar` properties of the thread's `OracleGlobalization` object. If any of the thread's globalization properties are set to null or an empty string, the client computer's settings are used.

### Example

```
// C#

using System;
using Oracle.DataAccess.Types;
using Oracle.DataAccess.Client;

class OracleTimeStampLTZSample
{
    static void Main()
    {
        // Set the nls_timestamp_format for the OracleTimeStampLTZ(string)
        // constructor
        OracleGlobalization info = OracleGlobalization.GetClientInfo();
        info.TimeStampFormat = "DD-MON-YYYY HH:MI:SS.FF AM";
        OracleGlobalization.SetThreadInfo(info);

        // construct OracleTimeStampLTZ from a string using the format specified.
        OracleTimeStampLTZ ts =
            new OracleTimeStampLTZ("11-NOV-1999 11:02:33.444 AM");

        // Set the nls_timestamp_format for the ToString() method
        info.TimeStampFormat = "YYYY-MON-DD HH:MI:SS.FF AM";
        OracleGlobalization.SetThreadInfo(info);

        // Prints "1999-NOV-11 11:02:33.444000000 AM"
        Console.WriteLine(ts.ToString());
    }
}
```

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)
- ["OracleGlobalization Class"](#)
- ["Globalization Support "](#)
- *Oracle Database SQL Language Reference* for further information on datetime format elements

## implicit operator OracleTimeStampLTZ

implicit operator OracleTimeStampLTZ converts the supplied structure to an OracleTimeStampLTZ structure.

### Overload List:

- [implicit operator OracleTimeStampLTZ\(OracleDate\)](#)  
This static type conversion operator converts an OracleDate value to an OracleTimeStampLTZ structure.
- [implicit operator OracleTimeStampLTZ\(DateTime\)](#)  
This static type conversion operator converts a DateTime structure to an OracleTimeStampLTZ structure.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## implicit operator OracleTimeStampLTZ(OracleDate)

This static type conversion operator converts an OracleDate value to an OracleTimeStampLTZ structure.

### Declaration

```
// C#  
public static implicit operator OracleTimeStampLTZ(OracleDate value1);
```

### Parameters

- *value1*  
An OracleDate.

### Return Value

The returned OracleTimeStampLTZ structure contains the date and time in the OracleDate structure.

### Remarks

If the OracleDate structure has a null value, the returned OracleTimeStampLTZ structure also has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## implicit operator OracleTimeStampLTZ(DateTime)

This static type conversion operator converts a `DateTime` structure to an `OracleTimeStampLTZ` structure.

### Declaration

```
// C#  
public static implicit operator OracleTimeStampLTZ(DateTime value1);
```

### Parameters

- `value1`  
A `DateTime` structure.

### Return Value

An `OracleTimeStampLTZ` structure.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## explicit operator DateTime

This static type conversion operator converts an `OracleTimeStampLTZ` value to a `DateTime` structure.

### Declaration

```
// C#  
public static explicit operator DateTime(OracleTimeStampLTZ value1);
```

### Parameters

- `value1`  
An `OracleTimeStampLTZ` instance.

**Return Value**

A `DateTime` that contains the date and time in the current instance.

**Exceptions**

`OracleNullValueException` - The `OracleTimeStampLTZ` structure has a null value.

**Remarks**

The precision of the `OracleTimeStampLTZ` value can be lost during the conversion.

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## OracleTimeStampLTZ Properties

The `OracleTimeStampLTZ` properties are listed in [Table 15-124](#).

**Table 15-124 OracleTimeStampLTZ Properties**

Properties	Description
<a href="#">BinData</a>	Returns an array of bytes that represents an Oracle <code>TIMESTAMP WITH LOCAL TIME ZONE</code> in Oracle internal format
<a href="#">Day</a>	Specifies the day component of an <code>OracleTimeStampLTZ</code>
<a href="#">IsNull</a>	Indicates whether or not the <code>OracleTimeStampLTZ</code> instance has a null value
<a href="#">Hour</a>	Specifies the hour component of an <code>OracleTimeStampLTZ</code>
<a href="#">Millisecond</a>	Specifies the millisecond component of an <code>OracleTimeStampLTZ</code>
<a href="#">Minute</a>	Specifies the minute component of an <code>OracleTimeStampLTZ</code>
<a href="#">Month</a>	Specifies the month component of an <code>OracleTimeStampLTZ</code>
<a href="#">Nanosecond</a>	Specifies the nanosecond component of an <code>OracleTimeStampLTZ</code>
<a href="#">Second</a>	Specifies the second component of an <code>OracleTimeStampLTZ</code>
<a href="#">Value</a>	Specifies the date and time that is stored in the <code>OracleTimeStampLTZ</code> structure
<a href="#">Year</a>	Specifies the year component of an <code>OracleTimeStampLTZ</code>

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## BinData

This property returns an array of bytes that represents an Oracle `TIMESTAMP WITH LOCAL TIME ZONE` in Oracle internal format.

### Declaration

```
// C#  
public byte[] BinData {get;}
```

### Property Value

A byte array that represents an Oracle `TIMESTAMP WITH LOCAL TIME ZONE` internal format.

### Exceptions

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## Day

This property specifies the day component of an `OracleTimeStampLTZ`.

### Declaration

```
// C#  
public int Day{get;}
```

### Property Value

A number that represents the day. Range of `Day` is (1 to 31).

### Exceptions

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## IsNull

This property indicates whether or not the current instance has a null value.

### Declaration

```
// C#  
public bool IsNull{get;}
```

### Property Value

Returns `true` if the current instance contains a null value; otherwise, returns `false`.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## Hour

This property specifies the hour component of an `OracleTimeStampLTZ`.

### Declaration

```
// C#  
public int Hour{get;}
```

### Property Value

A number that represents the hour. Range of `Hour` is (0 to 23).

### Exceptions

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## Millisecond

This property gets the millisecond component of an `OracleTimeStampLTZ`.

### Declaration

```
// C#  
public double Millisecond{get;}
```

### Property Value

A number that represents a millisecond. Range of `Millisecond` is (0 to 999.999999)

### Exceptions

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## Minute

This property gets the minute component of an `OracleTimeStampLTZ`.

### Declaration

```
// C#  
public int Minute{get;}
```

### Property Value

A number that represent a minute. Range of `Minute` is (0 to 59).

### Exceptions

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## Month

This property gets the month component of an `OracleTimeStampLTZ`.

### Declaration

```
// C#  
public int Month{get;}
```

### Property Value

A number that represents a month. Range of `Month` is (1 to 12).

### Exceptions

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## Nanosecond

This property gets the nanosecond component of an `OracleTimeStampLTZ`.

### Declaration

```
// C#  
public int Nanosecond{get;}
```

### Property Value

A number that represents a nanosecond. Range of `Nanosecond` is (0 to 999999999).

### Exceptions

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## Second

This property gets the second component of an `OracleTimeStampLTZ`.

### Declaration

```
// C#  
public int Second{get;}
```

### Property Value

A number that represents a second. Range of `Second` is (0 to 59).

### Exceptions

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## Value

This property specifies the date and time that is stored in the `OracleTimeStampLTZ` structure.

### Declaration

```
// C#  
public DateTime Value{get;}
```

### Property Value

A `DateTime`.

### Exceptions

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## Year

This property gets the year component of an `OracleTimeStampLTZ`.

### Declaration

```
// C#
public int Year{get;}
```

### Property Value

A number that represents a year. The range of `Year` is (-4712 to 9999).

### Exceptions

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## OracleTimeStampLTZ Methods

The `OracleTimeStampLTZ` methods are listed in [Table 15-125](#).

**Table 15-125 OracleTimeStampLTZ Methods**

Methods	Description
<a href="#">AddDays</a>	Adds the supplied number of days to the current instance
<a href="#">AddHours</a>	Adds the supplied number of hours to the current instance
<a href="#">AddMilliseconds</a>	Adds the supplied number of milliseconds to the current instance
<a href="#">AddMinutes</a>	Adds the supplied number of minutes to the current instance
<a href="#">AddMonths</a>	Adds the supplied number of months to the current instance

Table 15-125 (Cont.) OracleTimeStampLTZ Methods

Methods	Description
<a href="#">AddNanoseconds</a>	Adds the supplied number of nanoseconds to the current instance
<a href="#">AddSeconds</a>	Adds the supplied number of seconds to the current instance
<a href="#">AddYears</a>	Adds the supplied number of years to the current instance
<a href="#">CompareTo</a>	Compares the current <code>OracleTimeStampLTZ</code> instance to an object and returns an integer that represents their relative values
<a href="#">Equals</a>	Determines whether or not an object has the same date and time as the current <code>OracleTimeStampLTZ</code> instance (Overloaded)
<a href="#">GetHashCode</a>	Returns a hash code for the <code>OracleTimeStampLTZ</code> instance
<a href="#">GetDaysBetween</a>	Subtracts an <code>OracleTimeStampLTZ</code> from the current instance and returns an <code>OracleIntervalDS</code> that represents the difference
<a href="#">GetYearsBetween</a>	Subtracts an <code>OracleTimeStampLTZ</code> from the current instance and returns an <code>OracleIntervalYM</code> that represents the difference
<a href="#">GetType</a>	Inherited from <code>System.Object</code>
<a href="#">ToOracleDate</a>	Converts the current <code>OracleTimeStampLTZ</code> structure to an <code>OracleDate</code> structure
<a href="#">ToOracleTimeStamp</a>	Converts the current <code>OracleTimeStampLTZ</code> structure to an <code>OracleTimeStamp</code> structure
<a href="#">ToOracleTimeStampTZ</a>	Converts the current <code>OracleTimeStampLTZ</code> structure to an <code>OracleTimeStampTZ</code> structure
<a href="#">ToString</a>	Converts the current <code>OracleTimeStampLTZ</code> structure to a string
<a href="#">ToUniversalTime</a>	Converts the current local time to Coordinated Universal Time (UTC)

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## AddDays

This method adds the supplied number of days to the current instance.

### Declaration

```
// C#  
public OracleTimeStampLTZ AddDays(double days);
```

### Parameters

- *days*

The supplied number of days. Range is  $(-1,000,000,000 < days < 1,000,000,000)$

### Return Value

An OracleTimeStampLTZ.

### Exceptions

OracleNullValueException - The current instance has a null value.

ArgumentOutOfRangeException - The argument value is out of the specified range.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## AddHours

This method adds the supplied number of hours to the current instance.

### Declaration

```
// C#  
public OracleTimeStampLTZ AddHours(double hours);
```

### Parameters

- *hours*

The supplied number of hours. Range is  $(-24,000,000,000 < hours < 24,000,000,000)$ .

### Return Value

An OracleTimeStampLTZ.

### Exceptions

OracleNullValueException - The current instance has a null value.

ArgumentOutOfRangeException - The argument value is out of the specified range.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## AddMilliseconds

This method adds the supplied number of milliseconds to the current instance.

### Declaration

```
// C#  
public OracleTimeStampLTZ AddMilliseconds(double milliseconds);
```

### Parameters

- *milliseconds*

The supplied number of milliseconds. Range is  $(-8.64 * 1016 < milliseconds < 8.64 * 1016)$ .

### Return Value

An OracleTimeStampLTZ.

### Exceptions

OracleNullValueException - The current instance has a null value.

ArgumentOutOfRangeException - The argument value is out of the specified range.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## AddMinutes

This method adds the supplied number of minutes to the current instance.

### Declaration

```
// C#  
public OracleTimeStampLTZ AddMinutes(double minutes);
```

### Parameters

- *minutes*  
The supplied number of minutes. Range is  $(-1,440,000,000,000 < minutes < 1,440,000,000,000)$ .

### Return Value

An OracleTimeStampLTZ.

### Exceptions

OracleNullValueException - The current instance has a null value.

ArgumentOutOfRangeException - The argument value is out of the specified range.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## AddMonths

This method adds the supplied number of months to the current instance.

### Declaration

```
// C#  
public OracleTimeStampLTZ AddMonths(long months);
```

### Parameters

- *months*  
The supplied number of months. Range is  $(-12,000,000,000 < months < 12,000,000,000)$ .

### Return Value

An OracleTimeStampLTZ.

### Exceptions

OracleNullValueException - The current instance has a null value.

ArgumentOutOfRangeException - The argument value is out of the specified range.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## AddNanoseconds

This method adds the supplied number of nanoseconds to the current instance.

### Declaration

```
// C#  
public OracleTimeStampLTZ AddNanoseconds(long nanoseconds);
```

### Parameters

- *nanoseconds*  
The supplied number of nanoseconds.

### Return Value

An OracleTimeStampLTZ.

### Exceptions

OracleNullValueException - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## AddSeconds

This method adds the supplied number of seconds to the current instance.

### Declaration

```
// C#  
public OracleTimeStampLTZ AddSeconds(double seconds);
```

### Parameters

- *seconds*

The supplied number of seconds. Range is  $(-8.64 * 10^{13} < \text{seconds} < 8.64 * 10^{13})$ .

### Return Value

An `OracleTimeStampLTZ`.

### Exceptions

`OracleNullValueException` - The current instance has a null value.

`ArgumentOutOfRangeException` - The argument value is out of the specified range.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## AddYears

This method adds the supplied number of years to the current instance

### Declaration

```
// C#  
public OracleTimeStampLTZ AddYears(int years);
```

### Parameters

- *years*  
The supplied number of years. Range is  $(-999,999,999 \leq \text{years} \leq 999,999,999)$

### Return Value

An `OracleTimeStampLTZ`.

### Exceptions

`OracleNullValueException` - The current instance has a null value.

`ArgumentOutOfRangeException` - The argument value is out of the specified range.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## CompareTo

This method compares the current `OracleTimeStampLTZ` instance to an object, and returns an integer that represents their relative values.

### Declaration

```
// C#  
public int CompareTo(object obj);
```

### Parameters

- *obj*  
The object being compared to the current `OracleTimeStampLTZ` instance.

### Return Value

The method returns a number that is:

- Less than zero: if the current `OracleTimeStampLTZ` instance value is less than that of *obj*.
- Zero: if the current `OracleTimeStampLTZ` instance and *obj* values are equal.
- Greater than zero: if the current `OracleTimeStampLTZ` instance value is greater than that of *obj*.

### Implements

`IComparable`

### Exceptions

`ArgumentException` - The *obj* parameter is not of type `OracleTimeStampLTZ`.

### Remarks

The following rules apply to the behavior of this method.

- The comparison must be between `OracleTimeStampLTZ`s. For example, comparing an `OracleTimeStampLTZ` instance with an `OracleBinary` instance is not allowed. When an `OracleTimeStampLTZ` is compared with a different type, an `ArgumentException` is thrown.
- Any `OracleTimeStampLTZ` that has a value is greater than an `OracleTimeStampLTZ` that has a null value.
- Two `OracleTimeStampLTZ`s that contain a null value are equal.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## Equals

Overrides `Object`

This method determines whether or not an object has the same date and time as the current `OracleTimeStampLTZ` instance.

### Declaration

```
// C#  
public override bool Equals(object obj);
```

### Parameters

- *obj*

The object being compared to the current `OracleTimeStampLTZ` instance.

### Return Value

Returns `true` if the *obj* is of type `OracleTimeStampLTZ` and represents the same date and time; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleTimeStampLTZ` that has a value is greater than an `OracleTimeStampLTZ` that has a null value.
- Two `OracleTimeStampLTZ`s that contain a null value are equal.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## GetHashCode

Overrides `Object`

This method returns a hash code for the `OracleTimeStampLTZ` instance.

### Declaration

```
// C#  
public override int GetHashCode();
```

### Return Value

A number that represents the hash code.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## GetDaysBetween

This method subtracts an `OracleTimeStampLTZ` value from the current instance and returns an `OracleIntervalDS` that represents the difference.

### Declaration

```
// C#  
public OracleIntervalDS GetDaysBetween(OracleTimeStampLTZ value1);
```

### Parameters

- *value1*  
The `OracleTimeStampLTZ` value being subtracted.

### Return Value

An `OracleIntervalDS` that represents the interval between two `OracleTimeStampLTZ` values.

### Remarks

If either the current instance or the parameter has a null value, the returned `OracleIntervalDS` has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## GetYearsBetween

This method subtracts an `OracleTimeStampLTZ` value from the current instance and returns an `OracleIntervalYM` that represents the time interval.

### Declaration

```
// C#  
public OracleIntervalYM GetYearsBetween(OracleTimeStampLTZ value1);
```

### Parameters

- `value1`  
The `OracleTimeStampLTZ` value being subtracted.

### Return Value

An `OracleIntervalYM` that represents the interval between two `OracleTimeStampLTZ` values.

### Remarks

If either the current instance or the parameter has a null value, the returned `OracleIntervalYM` has a null value.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## ToOracleDate

This method converts the current `OracleTimeStampLTZ` structure to an `OracleDate` structure.

### Declaration

```
// C#  
public OracleDate ToOracleDate();
```

### Return Value

The returned `OracleDate` structure contains the date and time in the current instance.

### Remarks

The precision of the `OracleTimeStampLTZ` value can be lost during the conversion.

If the current instance has a null value, the value of the returned `OracleDate` structure has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## ToOracleTimeStamp

This method converts the current `OracleTimeStampLTZ` structure to an `OracleTimeStamp` structure.

### Declaration

```
// C#  
public OracleTimeStamp ToOracleTimeStamp();
```

### Return Value

The returned `OracleTimeStamp` contains the date and time in the current instance.

### Remarks

If the current instance has a null value, the value of the returned `OracleTimeStamp` structure has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## ToOracleTimeStampTZ

This method converts the current `OracleTimeStampLTZ` structure to an `OracleTimeStampTZ` structure.

### Declaration

```
// C#  
public OracleTimeStampTZ ToOracleTimeStampTZ();
```

### Return Value

The returned `OracleTimeStampTZ` contains the date and time of the current instance, with the time zone set to the `OracleGlobalization.TimeZone` from the thread.

## Remarks

If the current instance has a null value, the value of the returned `OracleTimeStampTZ` structure has a null value.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)
- ["OracleGlobalization Class"](#)
- ["Globalization Support "](#)

## ToString

Overrides `Object`

This method converts the current `OracleTimeStampLTZ` structure to a string.

### Declaration

```
// C#  
public override string ToString();
```

### Return Value

A string that represents the same date and time as the current `OracleTimeStampLTZ` structure.

### Remarks

The returned value is a string representation of the `OracleTimeStampLTZ` in the format specified by the `OracleGlobalization.TimeStampFormat` property of the thread.

The names and abbreviations used for months and days are in the language specified by the `DateLanguage` and `Calendar` properties of the thread's `OracleGlobalization` object. If any of the thread's globalization properties are set to null or an empty string, the client computer's settings are used.

### Example

```
// C#  
  
using System;  
using Oracle.DataAccess.Types;  
using Oracle.DataAccess.Client;  
  
class ToStringSample  
{  
    static void Main()  
    {
```

```
// Set the nls_timestamp_format for the OracleTimeStampLTZ(string)
// constructor
OracleGlobalization info = OracleGlobalization.GetClientInfo();
info.TimestampFormat = "DD-MON-YYYY HH:MI:SS.FF AM";
OracleGlobalization.SetThreadInfo(info);

// construct OracleTimeStampLTZ from a string using the format
// specified.
OracleTimeStampLTZ ts =
    new OracleTimeStampLTZ("11-NOV-1999 11:02:33.444 AM");

// Set the nls_timestamp_format for the ToString() method
info.TimestampFormat = "YYYY-MON-DD HH:MI:SS.FF AM";
OracleGlobalization.SetThreadInfo(info);

// Prints "1999-NOV-11 11:02:33.444000000 AM"
Console.WriteLine(ts.ToString());
}
}
```



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)
- ["OracleGlobalization Class"](#)
- ["Globalization Support "](#)

## ToUniversalTime

This method converts the current local time to Coordinated Universal Time (UTC).

### Declaration

```
// C#
public OracleTimeStampTZ ToUniversalTime();
```

### Return Value

An `OracleTimeStampTZ` structure.

### Remarks

If the current instance has a null value, the value of the returned `OracleTimeStampTZ` structure has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampLTZ Structure](#)
- [OracleTimeStampLTZ Members](#)

## OracleTimeStampTZ Structure

The `OracleTimeStampTZ` structure represents the Oracle `TIMESTAMP WITH TIME ZONE` data type to be stored in or retrieved from a database. Each `OracleTimeStampTZ` stores the following information: year, month, day, hour, minute, second, nanosecond, and time zone.

### Class Inheritance

```
System.Object
```

```
System.ValueType
```

```
Oracle.DataAccess.Types.OracleTimeStampTZ
```

### Declaration

```
// C#
public struct OracleTimeStampTZ : IComparable, INullable, IXmlSerializable
```

### Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

### Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

### Example

```
// C#

using System;
using Oracle.DataAccess.Client;
using Oracle.DataAccess.Types;
```

```
class OracleTimeStampTZSample
{
    static void Main()
    {
        // Set the nls parameters for the current thread
        OracleGlobalization info = OracleGlobalization.GetClientInfo();
        info.TimeZone = "US/Eastern";
        info.TimeStampFormat = "DD-MON-YYYY HH:MI:SS.FF AM";
        info.TimeStampTZFormat = "DD-MON-YYYY HH:MI:SS.FF AM TZR";
        OracleGlobalization.SetThreadInfo(info);

        // Create an OracleTimeStampTZ in US/Pacific time zone
        OracleTimeStampTZ tstz1=new OracleTimeStampTZ("11-NOV-1999 "+
            "11:02:33.444 AM US/Pacific");

        // Note that ToOracleTimeStampTZ uses the thread's time zone region,
        // "US/Eastern"
        OracleTimeStamp ts = new OracleTimeStamp("11-NOV-1999 11:02:33.444 AM");
        OracleTimeStampTZ tstz2 = ts.ToOracleTimeStampTZ();

        // Calculate the difference between tstz1 and tstz2
        OracleIntervalDS idsDiff = tstz1.GetDaysBetween(tstz2);

        // Display information
        Console.WriteLine("tstz1.TimeZone = " + tstz1.TimeZone);

        // Prints "US/Pacific"
        Console.WriteLine("tstz2.TimeZone = " + tstz2.TimeZone);

        // Prints "US/Eastern"
        Console.WriteLine("idsDiff.Hours = " + idsDiff.Hours); // Prints 3
        Console.WriteLine("idsDiff.Minutes = " + idsDiff.Minutes); // Prints 0
    }
}
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Members](#)
- [OracleTimeStampTZ Constructors](#)
- [OracleTimeStampTZ Static Fields](#)
- [OracleTimeStampTZ Static Methods](#)
- [OracleTimeStampTZ Static Operators](#)
- [OracleTimeStampTZ Static Type Conversions](#)
- [OracleTimeStampTZ Properties](#)
- [OracleTimeStampTZ Methods](#)

## OracleTimeStampTZ Members

OracleTimeStampTZ members are listed in the following tables:

### OracleTimeStampTZ Constructors

OracleTimeStampTZ constructors are listed in [Table 15-126](#)

**Table 15-126 OracleTimeStampTZ Constructors**

Constructor	Description
<a href="#">OracleTimeStampTZ Constructors</a>	Instantiates a new instance of OracleTimeStampTZ structure (Overloaded)

### OracleTimeStampTZ Static Fields

The OracleTimeStampTZ static fields are listed in [Table 15-127](#).

**Table 15-127 OracleTimeStampTZ Static Fields**

Field	Description
<a href="#">MaxValue</a>	Represents the maximum valid date for an OracleTimeStampTZ structure in UTC, which is December 31, 999923:59:59.999999999
<a href="#">MinValue</a>	Represents the minimum valid date for an OracleTimeStampTZ structure in UTC, which is January 1, -4712 0:0:0
<a href="#">Null</a>	Represents a null value that can be assigned to an instance of the OracleTimeStampTZ structure

### OracleTimeStampTZ Static Methods

The OracleTimeStampTZ static methods are listed in [Table 15-128](#).

**Table 15-128 OracleTimeStampTZ Static Methods**

Methods	Description
<a href="#">Equals</a>	Determines if two OracleTimeStampTZ values are equal (Overloaded)
<a href="#">GetSysDate</a>	Gets an OracleTimeStampTZ structure that represents the current date and time
<a href="#">GreaterThan</a>	Determines if the first of two OracleTimeStampTZ values is greater than the second
<a href="#">GreaterThanOrEqual</a>	Determines if the first of two OracleTimeStampTZ values is greater than or equal to the second
<a href="#">LessThan</a>	Determines if the first of two OracleTimeStampTZ values is less than the second

**Table 15-128 (Cont.) OracleTimeStampTZ Static Methods**

Methods	Description
<a href="#">LessThanOrEqualTo</a>	Determines if the first of two OracleTimeStampTZ values is less than or equal to the second
<a href="#">NotEquals</a>	Determines if two OracleTimeStampTZ values are not equal
<a href="#">Parse</a>	Gets an OracleTimeStampTZ structure and sets its value for date and time using the supplied string
<a href="#">SetPrecision</a>	Returns a new instance of an OracleTimeStampTZ with the specified fractional second precision

**OracleTimeStampTZ Static Operators**

The OracleTimeStampTZ static operators are listed in [Table 15-129](#).

**Table 15-129 OracleTimeStampTZ Static Operators**

Operator	Description
<a href="#">operator +</a>	Adds the supplied instance value to the supplied OracleTimeStampTZ and returns a new OracleTimeStampTZ structure (Overloaded)
<a href="#">operator ==</a>	Determines if two OracleTimeStampTZ values are equal
<a href="#">operator &gt;</a>	Determines if the first of two OracleTimeStampTZ values is greater than the second
<a href="#">operator &gt;=</a>	Determines if the first of two OracleTimeStampTZ values is greater than or equal to the second
<a href="#">operator !=</a>	Determines if two OracleTimeStampTZ values are not equal
<a href="#">operator &lt;</a>	Determines if the first of two OracleTimeStampTZ values is less than the second
<a href="#">operator &lt;=</a>	Determines if the first of two OracleTimeStampTZ values is less than or equal to the second
<a href="#">operator -</a>	Subtracts the supplied instance value from the supplied OracleTimeStampTZ and returns a new OracleTimeStampTZ structure (Overloaded)

**OracleTimeStampTZ Static Type Conversions**

The OracleTimeStampTZ static type conversions are listed in [Table 15-130](#).

**Table 15-130 OracleTimeStampTZ Static Type Conversions**

Operator	Description
<a href="#">explicit operator OracleTimeStampTZ</a>	Converts an instance value to an OracleTimeStampTZ structure (Overloaded)

**Table 15-130 (Cont.) OracleTimeStampTZ Static Type Conversions**

Operator	Description
<a href="#">implicit operator OracleTimeStampTZ</a>	Converts an instance value to an OracleTimeStampTZ structure (Overloaded)
<a href="#">explicit operator DateTime</a>	Converts an OracleTimeStampTZ value to a DateTime structure

**OracleTimeStampTZ Properties**

The OracleTimeStampTZ properties are listed in [Table 15-131](#).

**Table 15-131 OracleTimeStampTZ Properties**

Properties	Description
<a href="#">BinData</a>	Returns an array of bytes that represents an Oracle TIMESTAMP WITH TIME ZONE in Oracle internal format
<a href="#">Day</a>	Specifies the day component of an OracleTimeStampTZ in the current time zone
<a href="#">IsNull</a>	Indicates whether or not the current instance has a null value
<a href="#">Hour</a>	Specifies the hour component of an OracleTimeStampTZ in the current time zone
<a href="#">Millisecond</a>	Specifies the millisecond component of an OracleTimeStampTZ in the current time zone
<a href="#">Minute</a>	Specifies the minute component of an OracleTimeStampTZ in the current time zone
<a href="#">Month</a>	Specifies the month component of an OracleTimeStampTZ in the current time zone
<a href="#">Nanosecond</a>	Specifies the nanosecond component of an OracleTimeStampTZ in the current time zone
<a href="#">Second</a>	Specifies the second component of an OracleTimeStampTZ in the current time zone
<a href="#">TimeZone</a>	Returns the time zone of the OracleTimeStampTZ instance
<a href="#">Value</a>	Returns the date and time that is stored in the OracleTimeStampTZ structure in the current time zone
<a href="#">Year</a>	Specifies the year component of an OracleTimeStampTZ

**OracleTimeStampTZ Methods**

The OracleTimeStampTZ methods are listed in [Table 15-132](#).

Table 15-132 OracleTimeStampTZ Methods

Methods	Description
<a href="#">AddDays</a>	Adds the supplied number of days to the current instance
<a href="#">AddHours</a>	Adds the supplied number of hours to the current instance
<a href="#">AddMilliseconds</a>	Adds the supplied number of milliseconds to the current instance
<a href="#">AddMinutes</a>	Adds the supplied number of minutes to the current instance
<a href="#">AddMonths</a>	Adds the supplied number of months to the current instance
<a href="#">AddNanoseconds</a>	Adds the supplied number of nanoseconds to the current instance
<a href="#">AddSeconds</a>	Adds the supplied number of seconds to the current instance
<a href="#">AddYears</a>	Adds the supplied number of years to the current instance
<a href="#">CompareTo</a>	Compares the current <code>OracleTimeStampTZ</code> instance to an object, and returns an integer that represents their relative values
<a href="#">Equals</a>	Determines whether or not an object has the same date and time as the current <code>OracleTimeStampTZ</code> instance
<a href="#">GetDaysBetween</a>	Subtracts an <code>OracleTimeStampTZ</code> from the current instance and returns an <code>OracleIntervalDS</code> that represents the time interval
<a href="#">GetHashCode</a>	Returns a hash code for the <code>OracleTimeStampTZ</code> instance
<a href="#">GetTimeZoneOffset</a>	Gets the time zone information in hours and minutes of the current <code>OracleTimeStampTZ</code>
<a href="#">GetYearsBetween</a>	Subtracts an <code>OracleTimeStampTZ</code> from the current instance and returns an <code>OracleIntervalYM</code> that represents the time interval
<a href="#">GetType</a>	Inherited from <code>System.Object</code>
<a href="#">ToLocalTime</a>	Converts the current <code>OracleTimeStampTZ</code> instance to local time
<a href="#">ToOracleDate</a>	Converts the current <code>OracleTimeStampTZ</code> structure to an <code>OracleDate</code> structure
<a href="#">ToOracleTimeStampLTZ</a>	Converts the current <code>OracleTimeStampTZ</code> structure to an <code>OracleTimeStampLTZ</code> structure
<a href="#">ToOracleTimeStamp</a>	Converts the current <code>OracleTimeStampTZ</code> structure to an <code>OracleTimeStamp</code> structure
<a href="#">ToString</a>	Converts the current <code>OracleTimeStampTZ</code> structure to a string

Table 15-132 (Cont.) OracleTimeStampTZ Methods

Methods	Description
<a href="#">ToUniversalTime</a>	Converts the current datetime to Coordinated Universal Time (UTC)

 **See Also:**

- "Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"
- [OracleTimeStampTZ Structure](#)

## OracleTimeStampTZ Constructors

The `OracleTimeStampTZ` constructors create new instances of the `OracleTimeStampTZ` structure.

### Overload List:

- [OracleTimeStampTZ\(DateTime\)](#)

This constructor creates a new instance of the `OracleTimeStampTZ` structure and sets its value for date and time using the supplied `DateTime` value.
- [OracleTimeStampTZ\(DateTime, string\)](#)

This constructor creates a new instance of the `OracleTimeStampTZ` structure and sets its value for date and time using the supplied `DateTime` value and the supplied time zone data.
- [OracleTimeStampTZ\(string\)](#)

This constructor creates a new instance of the `OracleTimeStampTZ` structure and sets its value for date and time using the supplied string.
- [OracleTimeStampTZ\(int, int, int\)](#)

This constructor creates a new instance of the `OracleTimeStampTZ` structure and sets its value for date and time using year, month, and day.
- [OracleTimeStampTZ\(int, int, int, string\)](#)

This constructor creates a new instance of the `OracleTimeStampTZ` structure and sets its value for date and time using year, month, day, and time zone data.
- [OracleTimeStampTZ\(int, int, int, int, int, int\)](#)

This constructor creates a new instance of the `OracleTimeStampTZ` structure and sets its value for date and time using year, month, day, hour, minute, and second.
- [OracleTimeStampTZ\(int, int, int, int, int, int, string\)](#)

This constructor creates a new instance of the `OracleTimeStampTZ` structure and sets its value for date and time using year, month, day, hour, minute, second, and time zone data.

- [OracleTimeStampTZ\(int, int, int, int, int, int, double\)](#)

This constructor creates a new instance of the `OracleTimeStampTZ` structure and sets its value for date and time using year, month, day, hour, minute, second, and millisecond.
- [OracleTimeStampTZ\(int, int, int, int, int, int, double, string\)](#)

This constructor creates a new instance of the `OracleTimeStampTZ` structure and sets its value for date and time using year, month, day, hour, minute, second, millisecond, and time zone data.
- [OracleTimeStampTZ\(int, int, int, int, int, int, int\)](#)

This constructor creates a new instance of the `OracleTimeStampTZ` structure and sets its value for date and time using year, month, day, hour, minute, second, and nanosecond.
- [OracleTimeStampTZ\(int, int, int, int, int, int, int, string\)](#)

This constructor creates a new instance of the `OracleTimeStampTZ` structure and sets its value for date and time using year, month, day, hour, minute, second, nanosecond, and time zone data.
- [OracleTimeStampTZ\(byte \[\]\)](#)

This constructor creates a new instance of the `OracleTimeStampTZ` structure and sets its value to the provided byte array, that represents the internal Oracle `TIMESTAMP WITH TIME ZONE` format.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## OracleTimeStampTZ(DateTime)

This constructor creates a new instance of the `OracleTimeStampTZ` structure and sets its value for date and time using the supplied `DateTime` value.

### Declaration

```
// C#  
public OracleTimeStampTZ (DateTime dt);
```

### Parameters

- *dt*

The supplied `DateTime` value.

### Remarks

The time zone is set to the `OracleGlobalization.TimeZone` of the thread.

## Exceptions

`ArgumentException` - The `dt` parameter cannot be used to construct a valid `OracleTimeStampTZ`.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## OracleTimeStampTZ(DateTime, string)

This constructor creates a new instance of the `OracleTimeStampTZ` structure with the supplied `DateTime` value and the time zone data.

### Declaration

```
// C#  
public OracleTimeStampTZ (DateTime value1, string timeZone);
```

### Parameters

- `value1`  
The supplied `DateTime` value.
- `timeZone`  
The time zone data provided.

### Exceptions

`ArgumentException` - The argument values of the parameters cannot be used to construct a valid `OracleTimeStampTZ`.

### Remarks

`timeZone` can be either an hour offset, for example, 7:00, or a valid time zone region name that is provided in `V$TIMEZONE_NAMES`, such as US/Pacific. Time zone abbreviations are not supported.

If time zone is null, the `OracleGlobalization.TimeZone` of the thread is used.

### Note:

PST is a time zone region name as well as a time zone abbreviation; therefore it is accepted by `OracleTimeStampTZ`.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## OracleTimeStampTZ(string)

This constructor creates a new instance of the `OracleTimeStampTZ` structure and sets its value for date and time using the supplied string.

### Declaration

```
// C#  
public OracleTimeStampTZ (string tsStr);
```

### Parameters

- *tsStr*

A string that represents an Oracle `TIMESTAMP WITH TIME ZONE`.

### Exceptions

`ArgumentException` - The *tsStr* is an invalid string representation of an Oracle `TIMESTAMP WITH TIME ZONE` or the *tsStr* is not in the timestamp format specified by the `OracleGlobalization.TimeStampTZFormat` property of the thread.

`ArgumentNullException` - The *tsStr* value is null.

### Remarks

The names and abbreviations used for months and days are in the language specified by the `DateLanguage` and `Calendar` properties of the thread's `OracleGlobalization` object. If any of the thread's globalization properties are set to null or an empty string, the client computer's settings are used.

### Example

```
// C#  
  
using System;  
using Oracle.DataAccess.Client;  
using Oracle.DataAccess.Types;  
  
class OracleTimeStampTZSample  
{  
    static void Main()  
    {  
        OracleGlobalization info = OracleGlobalization.GetClientInfo();  
        info.TimeStampTZFormat = "DD-MON-YYYY HH:MI:SS.FF AM TZR";  
        OracleGlobalization.SetThreadInfo(info);  
  
        // construct OracleTimeStampTZ from a string using the format specified.
```

```
OracleTimeStampTZ tstz = new OracleTimeStampTZ("11-NOV-1999" +
    "11:02:33.444 AM US/Pacific");

// Set the nls_timestamp_tz_format for the ToString() method
info.TimestampTZFormat = "YYYY-MON-DD HH:MI:SS.FF AM TZR";
OracleGlobalization.SetThreadInfo(info);

// Prints "1999-NOV-11 11:02:33.444000000 AM US/Pacific"
Console.WriteLine(tstz.ToString());
}
}
```

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)
- ["OracleGlobalization Class"](#)
- ["Globalization Support "](#)
- *Oracle Database SQL Language Reference* for further information on date format elements

## OracleTimeStampTZ(int, int, int)

This constructor creates a new instance of the `OracleTimeStampTZ` structure and sets its value for date and time using year, month, and day.

### Declaration

```
// C#
public OracleTimeStampTZ(int year, int month, int day);
```

### Parameters

- *year*  
The year provided. Range of *year* is (-4712 to 9999).
- *month*  
The month provided. Range of *month* is (1 to 12).
- *day*  
The day provided. Range of *day* is (1 to 31).

### Exceptions

`ArgumentOutOfRangeException` - The argument value for one or more of the parameters is out of the specified range.

`ArgumentException` - The argument values of the parameters cannot be used to construct a valid `OracleTimeStampTZ` (that is, the day is out of range for the month).

### Remarks

The time zone is set to the `OracleGlobalization.TimeZone` of the thread.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## OracleTimeStampTZ(int, int, int, string)

This constructor creates a new instance of the `OracleTimeStampTZ` structure and sets its value for date and time using year, month, day, and time zone data.

### Declaration

```
// C#  
public OracleTimeStampTZ(int year, int month, int day,  
    string timeZone);
```

### Parameters

- *year*  
The year provided. Range of *year* is (-4712 to 9999).
- *month*  
The month provided. Range of *month* is (1 to 12).
- *day*  
The day provided. Range of *day* is (1 to 31).
- *timeZone*  
The time zone data provided.

### Exceptions

`ArgumentOutOfRangeException` - The argument value for one or more of the parameters is out of the specified range.

`ArgumentException` - The argument values of the parameters cannot be used to construct a valid `OracleTimeStampTZ` (that is, the day is out of range for the month or the time zone is invalid).

## Remarks

`timeZone` can be either an hour offset, for example, 7:00, or a valid time zone region name that is provided in `V$TIMEZONE_NAMES`, such as US/Pacific. Time zone abbreviations are not supported.

If time zone is null, the `OracleGlobalization.TimeZone` of the thread is used.

### Note:

PST is a time zone region name as well as a time zone abbreviation; therefore it is accepted by `OracleTimeStampTZ`.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## OracleTimeStampTZ(int, int, int, int, int, int)

This constructor creates a new instance of the `OracleTimeStampTZ` structure and sets its value for date and time using year, month, day, hour, minute, and second.

### Declaration

```
// C#  
public OracleTimeStampTZ(int year, int month, int day, int hour,  
    int minute, int second);
```

### Parameters

- *year*  
The year provided. Range of *year* is (-4712 to 9999).
- *month*  
The month provided. Range of *month* is (1 to 12).
- *day*  
The day provided. Range of *day* is (1 to 31).
- *hour*  
The hour provided. Range of *hour* is (0 to 23).
- *minute*  
The minute provided. Range of *minute* is (0 to 59).

- *second*

The second provided. Range of *second* is (0 to 59).

### Exceptions

`ArgumentOutOfRangeException` - The argument value for one or more of the parameters is out of the specified range.

`ArgumentException` - The argument values of the parameters cannot be used to construct a valid `OracleTimeStampTZ` (that is, the day is out of range for the month).

### Remarks

The time zone is set to the `OracleGlobalization.TimeZone` of the thread.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## OracleTimeStampTZ(int, int, int, int, int, string)

This constructor creates a new instance of the `OracleTimeStampTZ` structure and sets its value for date and time using year, month, day, hour, minute, second, and time zone data.

### Declaration

```
// C#
public OracleTimeStampTZ (int year, int month, int day, int hour,
    int minute, int second, string timeZone);
```

### Parameters

- *year*  
The year provided. Range of *year* is (-4712 to 9999).
- *month*  
The month provided. Range of *month* is (1 to 12).
- *day*  
The day provided. Range of *day* is (1 to 31).
- *hour*  
The hour provided. Range of *hour* is (0 to 23).
- *minute*  
The minute provided. Range of *minute* is (0 to 59).
- *second*

The second provided. Range of *second* is (0 to 59).

- *timeZone*

The time zone data provided.

### Exceptions

`ArgumentOutOfRangeException` - The argument value for one or more of the parameters is out of the specified range.

`ArgumentException` - The argument values of the parameters cannot be used to construct a valid `OracleTimeStampTZ` (that is, the day is out of range of the month or the time zone is invalid).

### Remarks

*timeZone* can be either an hour offset, for example, 7:00, or a valid time zone region name that is provided in `V$TIMEZONE_NAMES`, such as US/Pacific. Time zone abbreviations are not supported.

If time zone is null, the `OracleGlobalization.TimeZone` of the thread is used.



#### Note:

PST is a time zone region name as well as a time zone abbreviation; therefore it is accepted by `OracleTimeStampTZ`.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## OracleTimeStampTZ(int, int, int, int, int, double)

This constructor creates a new instance of the `OracleTimeStampTZ` structure and sets its value for date and time using year, month, day, hour, minute, second, and millisecond.

### Declaration

```
// C#
public OracleTimeStampTZ(int year, int month, int day, int hour,
    int minute, int second, double millisecond);
```

### Parameters

- *year*

The year provided. Range of *year* is (-4712 to 9999).

- *month*

The month provided. Range of *month* is (1 to 12).

- *day*

The day provided. Range of *day* is (1 to 31).

- *hour*

The hour provided. Range of *hour* is (0 to 23).

- *minute*

The minute provided. Range of *minute* is (0 to 59).

- *second*

The second provided. Range of *second* is (0 to 59).

- *millisecond*

The millisecond provided. Range of *millisecond* is (0 to 999.999999).

### Exceptions

`ArgumentOutOfRangeException` - The argument value for one or more of the parameters is out of the specified range.

`ArgumentException` - The argument values of the parameters cannot be used to construct a valid `OracleTimeStampTZ` (that is, the day is out of range for the month).

### Remarks

The time zone is set to the `OracleGlobalization.TimeZone` of the thread.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## OracleTimeStampTZ(int, int, int, int, int, int, double, string)

This constructor creates a new instance of the `OracleTimeStampTZ` structure and sets its value for date and time using year, month, day, hour, minute, second, millisecond, and time zone data.

### Declaration

```
// C#
public OracleTimeStampTZ(int year, int month, int day, int hour,
    int minute, int second, double millisecond, string timeZone);
```

## Parameters

- *year*  
The year provided. Range of *year* is (-4712 to 9999).
- *month*  
The month provided. Range of *month* is (1 to 12).
- *day*  
The day provided. Range of *day* is (1 to 31).
- *hour*  
The hour provided. Range of *hour* is (0 to 23).
- *minute*  
The minute provided. Range of *minute* is (0 to 59).
- *second*  
The second provided. Range of *second* is (0 to 59).
- *millisecond*  
The millisecond provided. Range of *millisecond* is (0 to 999.999999).
- *timeZone*  
The time zone data provided.

## Exceptions

`ArgumentOutOfRangeException` - The argument value for one or more of the parameters is out of the specified range.

`ArgumentException` - The argument values of the parameters cannot be used to construct a valid `OracleTimeStampTZ` (that is, the day is out of range for the month or the time zone is invalid).

## Remarks

`timeZone` can be either an hour offset, for example, 7:00, or a valid time zone region name that is provided in `V$TIMEZONE_NAMES`, such as US/Pacific. Time zone abbreviations are not supported.

If time zone is null, the `OracleGlobalization.TimeZone` of the thread is used.



### Note:

PST is a time zone region name as well as a time zone abbreviation; therefore it is accepted by `OracleTimeStampTZ`.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## OracleTimeStampTZ(int, int, int, int, int, int)

This constructor creates a new instance of the `OracleTimeStampTZ` structure and sets its value for date and time using year, month, day, hour, minute, second, and nanosecond.

### Declaration

```
// C#  
public OracleTimeStampTZ(int year, int month, int day, int hour,  
    int minute, int second, int nanosecond);
```

### Parameters

- *year*  
The year provided. Range of *year* is (-4712 to 9999).
- *month*  
The month provided. Range of *month* is (1 to 12).
- *day*  
The day provided. Range of *day* is (1 to 31).
- *hour*  
The hour provided. Range of *hour* is (0 to 23).
- *minute*  
The minute provided. Range of *minute* is (0 to 59).
- *second*  
The second provided. Range of *second* is (0 to 59).
- *nanosecond*  
The nanosecond provided. Range of *nanosecond* is (0 to 999999999).

### Exceptions

`ArgumentOutOfRangeException` - The argument value for one or more of the parameters is out of the specified range.

`ArgumentException` - The argument values of the parameters cannot be used to construct a valid `OracleTimeStampTZ` (that is, the day is out of range for the month).

## Remarks

The time zone is set to the `OracleGlobalization.TimeZone` of the thread.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## OracleTimeStampTZ(int, int, int, int, int, int, string)

This constructor creates a new instance of the `OracleTimeStampTZ` structure and sets its value for date and time using year, month, day, hour, minute, second, nanosecond, and time zone data.

### Declaration

```
// C#
public OracleTimeStampTZ(int year, int month, int day, int hour,
    int minute, int second, int nanosecond, string timeZone);
```

### Parameters

- *year*  
The year provided. Range of *year* is (-4712 to 9999).
- *month*  
The month provided. Range of *month* is (1 to 12).
- *day*  
The day provided. Range of *day* is (1 to 31).
- *hour*  
The hour provided. Range of *hour* is (0 to 23).
- *minute*  
The minute provided. Range of *minute* is (0 to 59).
- *second*  
The second provided. Range of *second* is (0 to 59).
- *nanosecond*  
The nanosecond provided. Range of *nanosecond* is (0 to 999999999).
- *timeZone*  
The time zone data provided.

## Exceptions

`ArgumentOutOfRangeException` - The argument value for one or more of the parameters is out of the specified range.

`ArgumentException` - The argument values of the parameters cannot be used to construct a valid `OracleTimeStampTZ` (that is, the day is out of range for the month or the time zone is invalid).

## Remarks

`timeZone` can be either an hour offset, for example, 7:00, or a valid time zone region name that is provided in `V$TIMEZONE_NAMES`, such as `US/Pacific`. Time zone abbreviations are not supported.

If time zone is null, the `OracleGlobalization.TimeZone` of the thread is used.

### Note:

PST is a time zone region name as well as a time zone abbreviation; therefore it is accepted by `OracleTimeStampTZ`.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## OracleTimeStampTZ(byte [ ])

This constructor creates a new instance of the `OracleTimeStampTZ` structure and sets its value to the provided byte array, that represents the internal Oracle `TIMESTAMP WITH TIME ZONE` format.

### Declaration

```
// C#  
public OracleTimeStampLTZ (byte[] bytes);
```

### Parameters

- `bytes`

The provided byte array that represents an Oracle `TIMESTAMP WITH TIME ZONE` in Oracle internal format.

## Exceptions

`ArgumentException` - *bytes* is not in internal Oracle `TIMESTAMP WITH TIME ZONE` format or *bytes* is not a valid Oracle `TIMESTAMP WITH TIME ZONE`.

`ArgumentNullException` - *bytes* is null.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## OracleTimeStampTZ Static Fields

The `OracleTimeStampTZ` static fields are listed in [Table 15-133](#).

**Table 15-133 OracleTimeStampTZ Static Fields**

Field	Description
<a href="#">MaxValue</a>	Represents the maximum valid date for an <code>OracleTimeStampTZ</code> structure in UTC, which is December 31, 999923:59:59.999999999
<a href="#">MinValue</a>	Represents the minimum valid date for an <code>OracleTimeStampTZ</code> structure in UTC, which is January 1, -4712 0:0:0
<a href="#">Null</a>	Represents a null value that can be assigned to an instance of the <code>OracleTimeStampTZ</code> structure

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## MaxValue

This static field represents the maximum valid datetime time for an `OracleTimeStampTZ` structure in UTC, which is December 31, 999923:59:59.999999999.

### Declaration

```
// C#
public static readonly OracleTimeStampTZ MaxValue;
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## MinValue

This static field represents the minimum valid datetime for an `OracleTimeStampTZ` structure in UTC, which is January 1, -4712 0:0:0.

### Declaration

```
// C#  
public static readonly OracleTimeStampTZ MinValue;
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## Null

This static field represents a null value that can be assigned to an instance of the `OracleTimeStampTZ` structure.

### Declaration

```
// C#  
public static readonly OracleTimeStampTZ Null;
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## OracleTimeStampTZ Static Methods

The `OracleTimeStampTZ` static methods are listed in [Table 15-134](#).

**Table 15-134 OracleTimeStampTZ Static Methods**

Methods	Description
<a href="#">Equals</a>	Determines if two <code>OracleTimeStampTZ</code> values are equal (Overloaded)
<a href="#">GetSysDate</a>	Gets an <code>OracleTimeStampTZ</code> structure that represents the current date and time
<a href="#">GreaterThan</a>	Determines if the first of two <code>OracleTimeStampTZ</code> values is greater than the second
<a href="#">GreaterThanOrEqual</a>	Determines if the first of two <code>OracleTimeStampTZ</code> values is greater than or equal to the second
<a href="#">LessThan</a>	Determines if the first of two <code>OracleTimeStampTZ</code> values is less than the second
<a href="#">LessThanOrEqual</a>	Determines if the first of two <code>OracleTimeStampTZ</code> values is less than or equal to the second
<a href="#">NotEquals</a>	Determines if two <code>OracleTimeStampTZ</code> values are not equal
<a href="#">Parse</a>	Gets an <code>OracleTimeStampTZ</code> structure and sets its value for date and time using the supplied string
<a href="#">SetPrecision</a>	Returns a new instance of an <code>OracleTimeStampTZ</code> with the specified fractional second precision

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## Equals

This static method determines if two `OracleTimeStampTZ` values are equal.

### Declaration

```
// C#
public static bool Equals(OracleTimeStampTZ value1,
    OracleTimeStampTZ value2);
```

### Parameters

- *value1*

The first `OracleTimeStampTZ`.

- `value2`

The second `OracleTimeStampTZ`.

### Return Value

Returns `true` if two `OracleTimeStampTZ` values are equal. Returns `false` otherwise.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleTimeStampTZ` that has a value is greater than an `OracleTimeStampTZ` that has a null value.
- Two `OracleTimeStampTZ`s that contain a null value are equal.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## GetSysDate

This static method gets an `OracleTimeStampTZ` structure that represents the current date and time.

### Declaration

```
// C#  
public static OracleTimeStampTZ GetSysDate();
```

### Return Value

An `OracleTimeStampTZ` structure that represents the current date and time.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## GreaterThan

This static method determines if the first of two `OracleTimeStampTZ` values is greater than the second.

### Declaration

```
// C#  
public static bool GreaterThan(OracleTimeStampTZ value1,  
    OracleTimeStampTZ value2);
```

### Parameters

- `value1`  
The first `OracleTimeStampTZ`.
- `value2`  
The second `OracleTimeStampTZ`.

### Return Value

Returns `true` if the first of two `OracleTimeStampTZ` values is greater than the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleTimeStampTZ` that has a value is greater than an `OracleTimeStampTZ` that has a null value.
- Two `OracleTimeStampTZ`s that contain a null value are equal.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## GreaterThanOrEqual

This static method determines if the first of two `OracleTimeStampTZ` values is greater than or equal to the second.

### Declaration

```
// C#  
public static bool GreaterThanOrEqual(OracleTimeStampTZ value1,  
    OracleTimeStampTZ value2);
```

### Parameters

- *value1*  
The first OracleTimeStampTZ.
- *value2*  
The second OracleTimeStampTZ.

### Return Value

Returns `true` if the first of two OracleTimeStampTZ values is greater than or equal to the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any OracleTimeStampTZ that has a value is greater than an OracleTimeStampTZ that has a null value.
- Two OracleTimeStampTZs that contain a null value are equal.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## LessThan

This static method determines if the first of two OracleTimeStampTZ values is less than the second.

### Declaration

```
// C#  
public static bool LessThan(OracleTimeStampTZ value1,  
    OracleTimeStampTZ value2);
```

### Parameters

- *value1*  
The first OracleTimeStampTZ.
- *value2*  
The second OracleTimeStampTZ.

### Return Value

Returns `true` if the first of two `OracleTimeStampTZ` values is less than the second. Returns `false` otherwise.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleTimeStampTZ` that has a value is greater than an `OracleTimeStampTZ` that has a null value.
- Two `OracleTimeStampTZ`s that contain a null value are equal.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## LessThanOrEqual

This static method determines if the first of two `OracleTimeStampTZ` values is less than or equal to the second.

### Declaration

```
// C#
public static bool LessThanOrEqual(OracleTimeStampTZ value1,
    OracleTimeStampTZ value2);
```

### Parameters

- *value1*  
The first `OracleTimeStampTZ`.
- *value2*  
The second `OracleTimeStampTZ`.

### Return Value

Returns `true` if the first of two `OracleTimeStampTZ` values is less than or equal to the second. Returns `false` otherwise.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleTimeStampTZ` that has a value is greater than an `OracleTimeStampTZ` that has a null value.

- Two OracleTimeStampTZs that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## NotEquals

This static method determines if two OracleTimeStampTZ values are not equal.

### Declaration

```
// C#  
public static bool NotEquals(OracleTimeStampTZ value1,  
    OracleTimeStampTZ value2);
```

### Parameters

- *value1*  
The first OracleTimeStampTZ.
- *value2*  
The second OracleTimeStampTZ.

### Return Value

Returns true if two OracleTimeStampTZ values are not equal. Returns false otherwise.

### Remarks

The following rules apply to the behavior of this method.

- Any OracleTimeStampTZ that has a value is greater than an OracleTimeStampTZ that has a null value.
- Two OracleTimeStampTZs that contain a null value are equal.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## Parse

This static method returns an `OracleTimeStampTZ` structure and sets its value for date and time using the supplied string.

### Declaration

```
// C#  
public static OracleTimeStampTZ Parse(string tsStr);
```

### Parameters

- `tsStr`

A string that represents an Oracle `TIMESTAMP WITH TIME ZONE`.

### Return Value

An `OracleTimeStampTZ` structure.

### Exceptions

`ArgumentException` - The `tsStr` is an invalid string representation of an Oracle `TIMESTAMP WITH TIME ZONE` or the `tsStr` is not in the timestamp format specified by the `OracleGlobalization.TimeStampTZFormat` property of the thread, which represents the Oracle `NLS_TIMESTAMP_TZ_FORMAT` parameter.

`ArgumentNullException` - The `tsStr` value is null.

### Remarks

The names and abbreviations used for months and days are in the language specified by the `DateLanguage` and `Calendar` properties of the thread's `OracleGlobalization` object. If any of the thread's globalization properties are set to null or an empty string, the client computer's settings are used.

### Example

```
// C#  
  
using System;  
using Oracle.DataAccess.Client;  
using Oracle.DataAccess.Types;  
  
class ParseSample  
{  
    static void Main()  
    {  
        // Set the nls_timestamp_tz_format for the Parse() method  
        OracleGlobalization info = OracleGlobalization.GetClientInfo();  
        info.TimeStampTZFormat = "DD-MON-YYYY HH:MI:SS.FF AM TZR";  
        OracleGlobalization.SetThreadInfo(info);  
  
        // construct OracleTimeStampTZ from a string using the format specified.  
        OracleTimeStampTZ tstz = OracleTimeStampTZ.Parse("11-NOV-1999 " +  
            "11:02:33.444 AM US/Pacific");  
  
        // Set the nls_timestamp_tz_format for the ToString() method
```

```
info.TimeStampTZFormat = "YYYY-MON-DD HH:MI:SS.FF AM TZR";
OracleGlobalization.SetThreadInfo(info);

// Prints "1999-NOV-11 11:02:33.444000000 AM US/Pacific"
Console.WriteLine(tstz.ToString());
}
}
```

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)
- ["OracleGlobalization Class"](#)
- ["Globalization Support "](#)

## SetPrecision

This static method returns a new instance of an `OracleTimeStampTZ` with the specified fractional second precision.

### Declaration

```
// C#
public static OracleTimeStampTZ SetPrecision(OracleTimeStampTZ value1,
    int fracSecPrecision);
```

### Parameters

- *value1*  
The provided `OracleTimeStampTZ` object.
- *fracSecPrecision*  
The fractional second precision provided. Range of fractional second precision is (0 to 9).

### Return Value

An `OracleTimeStampTZ` structure with the specified fractional second precision

### Exceptions

`ArgumentOutOfRangeException` - *fracSecPrecision* is out of the specified range.

### Remarks

The value specified in the supplied *fracSecPrecision* is used to perform a rounding off operation on the supplied `OracleTimeStampTZ` value. Depending on this value, 0 or more trailing zeros are displayed in the string returned by `ToString()`.

**Example**

The `OracleTimeStampTZ` with a value of "December 31, 9999 23:59:59.99 US/Pacific" results in the string "December 31, 9999 23:59:59.99000 US/Pacific" when `SetPrecision()` is called with the fractional second precision set to 5.

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## OracleTimeStampTZ Static Operators

The `OracleTimeStampTZ` static operators are listed in [Table 15-135](#).

**Table 15-135 OracleTimeStampTZ Static Operators**

Operator	Description
<code>operator +</code>	Adds the supplied instance value to the supplied <code>OracleTimeStampTZ</code> and returns a new <code>OracleTimeStampTZ</code> structure (Overloaded)
<code>operator ==</code>	Determines if two <code>OracleTimeStampTZ</code> values are equal
<code>operator &gt;</code>	Determines if the first of two <code>OracleTimeStampTZ</code> values is greater than the second
<code>operator &gt;=</code>	Determines if the first of two <code>OracleTimeStampTZ</code> values is greater than or equal to the second
<code>operator !=</code>	Determines if two <code>OracleTimeStampTZ</code> values are not equal
<code>operator &lt;</code>	Determines if the first of two <code>OracleTimeStampTZ</code> values is less than the second
<code>operator &lt;=</code>	Determines if the first of two <code>OracleTimeStampTZ</code> values is less than or equal to the second
<code>operator -</code>	Subtracts the supplied instance value from the supplied <code>OracleTimeStampTZ</code> and returns a new <code>OracleTimeStampTZ</code> structure (Overloaded)

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## operator +

`operator+` adds the supplied structure to the supplied `OracleTimeStampTZ` and returns a new `OracleTimeStampTZ` structure.

### Overload List:

- [operator +\(OracleTimeStampTZ, OracleIntervalDS\)](#)  
This static operator adds the supplied `OracleIntervalDS` to the supplied `OracleTimeStampTZ` and returns a new `OracleTimeStampTZ` structure.
- [operator +\(OracleTimeStampTZ, OracleIntervalYM\)](#)  
This static operator adds the supplied `OracleIntervalYM` to the supplied `OracleTimeStampTZ` and returns a new `OracleTimeStampTZ` structure.
- [operator +\(OracleTimeStampTZ, TimeSpan\)](#)  
This static operator adds the supplied `TimeSpan` to the supplied `OracleTimeStampTZ` and returns a new `OracleTimeStampTZ` structure.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## operator +(OracleTimeStampTZ, OracleIntervalDS)

This static operator adds the supplied `OracleIntervalDS` to the supplied `OracleTimeStampTZ` and returns a new `OracleTimeStampTZ` structure.

### Declaration

```
// C#
public static operator +(OracleTimeStampTZ value1,
    OracleIntervalDS value2);
```

### Parameters

- `value1`

An OracleTimeStampTZ.

- *value2*

An OracleIntervalDS.

### Return Value

An OracleTimeStampTZ.

### Remarks

If either parameter has a null value, the returned OracleTimeStampTZ has a null value.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## operator +(OracleTimeStampTZ, OracleIntervalYM)

This static operator adds the supplied OracleIntervalYM to the supplied OracleTimeStampTZ and returns a new OracleTimeStampTZ structure.

### Declaration

```
// C#  
public static operator +(OracleTimeStampTZ value1,  
    OracleIntervalYM value2);
```

### Parameters

- *value1*  
An OracleTimeStampTZ.
- *value2*  
An OracleIntervalYM.

### Return Value

An OracleTimeStampTZ.

### Remarks

If either parameter has a null value, the returned OracleTimeStampTZ has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## operator +(OracleTimeStampTZ, TimeSpan)

This static operator adds the supplied `TimeSpan` to the supplied `OracleTimeStampTZ` and returns a new `OracleTimeStampTZ` structure.

### Declaration

```
// C#  
public static operator +(OracleTimeStampTZ value1, TimeSpan value2);
```

### Parameters

- *value1*  
An `OracleTimeStampTZ`.
- *value2*  
A `TimeSpan`.

### Return Value

An `OracleTimeStampTZ`.

### Remarks

If the `OracleTimeStampTZ` instance has a null value, the returned `OracleTimeStampTZ` has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## operator ==

This static operator determines if two `OracleTimeStampTZ` values are equal.

### Declaration

```
// C#  
public static bool operator == (OracleTimeStampTZ value1,  
    OracleTimeStampTZ value2);
```

### Parameters

- *value1*  
The first OracleTimeStampTZ.
- *value2*  
The second OracleTimeStampTZ.

### Return Value

Returns `true` if they are equal; otherwise returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any OracleTimeStampTZ that has a value is greater than an OracleTimeStampTZ that has a null value.
- Two OracleTimeStampTZs that contain a null value are equal.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## operator >

This static operator determines if the first of two OracleTimeStampTZ values is greater than the second.

### Declaration

```
// C#  
public static bool operator > (OracleTimeStampTZ value1,  
    OracleTimeStampTZ value2);
```

### Parameters

- *value1*  
The first OracleTimeStampTZ.
- *value2*

The second `OracleTimeStampTZ`.

### Return Value

Returns `true` if the first `OracleTimeStampTZ` value is greater than the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleTimeStampTZ` that has a value is greater than an `OracleTimeStampTZ` that has a null value.
- Two `OracleTimeStampTZ`s that contain a null value are equal.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## operator >=

This static operator determines if the first of two `OracleTimeStampTZ` values is greater than or equal to the second.

### Declaration

```
// C#  
public static bool operator >= (OracleTimeStampTZ value1,  
    OracleTimeStampTZ value2);
```

### Parameters

- `value1`  
The first `OracleTimeStampTZ`.
- `value2`  
The second `OracleTimeStampTZ`.

### Return Value

Returns `true` if the first `OracleTimeStampTZ` is greater than or equal to the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleTimeStampTZ` that has a value is greater than an `OracleTimeStampTZ` that has a null value.

- Two OracleTimeStampTZs that contain a null value are equal.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## operator !=

This static operator determines if two OracleTimeStampTZ values are not equal.

### Declaration

```
// C#  
public static bool operator != (OracleTimeStampTZ value1,  
    OracleTimeStampTZ value2);
```

### Parameters

- *value1*  
The first OracleTimeStampTZ.
- *value2*  
The second OracleTimeStampTZ.

### Return Value

Returns true if two OracleTimeStampTZ values are not equal; otherwise, returns false.

### Remarks

The following rules apply to the behavior of this method.

- Any OracleTimeStampTZ that has a value is greater than an OracleTimeStampTZ that has a null value.
- Two OracleTimeStampTZs that contain a null value are equal.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## operator <

This static operator determines if the first of two `OracleTimeStampTZ` values is less than the second.

### Declaration

```
// C#  
public static bool operator < (OracleTimeStampTZ value1,  
    OracleTimeStampTZ value2);
```

### Parameters

- `value1`  
The first `OracleTimeStampTZ`.
- `value2`  
The second `OracleTimeStampTZ`.

### Return Value

Returns `true` if the first `OracleTimeStampTZ` is less than the second; otherwise returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleTimeStampTZ` that has a value is greater than an `OracleTimeStampTZ` that has a null value.
- Two `OracleTimeStampTZ`s that contain a null value are equal.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## operator <=

This static operator determines if the first of two `OracleTimeStampTZ` values is less than or equal to the second.

### Declaration

```
// C#  
public static bool operator <= (OracleTimeStampTZ value1,  
    OracleTimeStampTZ value2);
```

### Parameters

- *value1*  
The first OracleTimeStampTZ.
- *value2*  
The second OracleTimeStampTZ.

### Return Value

Returns `true` if the first OracleTimeStampTZ is less than or equal to the second; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any OracleTimeStampTZ that has a value is greater than an OracleTimeStampTZ that has a null value.
- Two OracleTimeStampTZs that contain a null value are equal.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## operator -

`operator-` subtracts the supplied value, from the supplied OracleTimeStampTZ value, and returns a new OracleTimeStampTZ structure.

### Overload List:

- [operator - \(OracleTimeStampTZ, OracleIntervalDS\)](#)  
This static operator subtracts the supplied OracleIntervalDS value, from the supplied OracleTimeStampTZ value, and return a new OracleTimeStampTZ structure.
- [operator - \(OracleTimeStampTZ, OracleIntervalYM\)](#)  
This static operator subtracts the supplied OracleIntervalYM value, from the supplied OracleTimeStampTZ value, and returns a new OracleTimeStampTZ structure.
- [operator - \(OracleTimeStampTZ value1, TimeSpan value2\)](#)  
This static operator subtracts the supplied TimeSpan value, from the supplied OracleTimeStampTZ value, and returns a new OracleTimeStampTZ structure.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## operator - (OracleTimeStampTZ, OracleIntervalDS)

This static operator subtracts the supplied `OracleIntervalDS` value, from the supplied `OracleTimeStampTZ` value, and return a new `OracleTimeStampTZ` structure.

### Declaration

```
// C#  
public static operator - (OracleTimeStampTZ value1,  
    OracleIntervalDS value2);
```

### Parameters

- *value1*  
An `OracleTimeStampTZ`.
- *value2*  
An `OracleIntervalDS`.

### Return Value

An `OracleTimeStampTZ` structure.

### Remarks

If either parameter has a null value, the returned `OracleTimeStampTZ` has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## operator - (OracleTimeStampTZ, OracleIntervalYM)

This static operator subtracts the supplied `OracleIntervalYM` value, from the supplied `OracleTimeStampTZ` value, and returns a new `OracleTimeStampTZ` structure.

**Declaration**

```
// C#  
public static operator - (OracleTimeStampTZ value1,  
    OracleIntervalYM value2);
```

**Parameters**

- *value1*  
An OracleTimeStampTZ.
- *value2*  
An OracleIntervalYM.

**Return Value**

An OracleTimeStampTZ structure.

**Remarks**

If either parameter has a null value, the returned OracleTimeStampTZ has a null value.

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

**operator - (OracleTimeStampTZ value1, TimeSpan value2)**

This static operator subtracts the supplied `TimeSpan` value, from the supplied `OracleTimeStampTZ` value, and returns a new `OracleTimeStampTZ` structure.

**Declaration**

```
// C#  
public static operator - (OracleTimeStampTZ value1, TimeSpan value2);
```

**Parameters**

- *value1*  
An OracleTimeStampTZ.
- *value2*  
A TimeSpan.

**Return Value**

An OracleTimeStampTZ structure.

**Remarks**

If the `OracleTimeStampTZ` instance has a null value, the returned `OracleTimeStampTZ` structure has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## OracleTimeStampTZ Static Type Conversions

The `OracleTimeStampTZ` static type conversions are listed in [Table 15-136](#).

**Table 15-136 OracleTimeStampTZ Static Type Conversions**

Operator	Description
<a href="#">explicit operator OracleTimeStampTZ</a>	Converts an instance value to an <code>OracleTimeStampTZ</code> structure (Overloaded)
<a href="#">implicit operator OracleTimeStampTZ</a>	Converts an instance value to an <code>OracleTimeStampTZ</code> structure (Overloaded)
<a href="#">explicit operator DateTime</a>	Converts an <code>OracleTimeStampTZ</code> value to a <code>DateTime</code> structure in the current time zone

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

### explicit operator OracleTimeStampTZ

`explicit operator OracleTimeStampTZ` converts an instance value to an `OracleTimeStampTZ` structure.

**Overload List:**

- [explicit operator OracleTimeStampTZ\(OracleTimeStamp\)](#)  
This static type conversion operator converts an `OracleTimeStamp` value to an `OracleTimeStampTZ` structure.

- [explicit operator OracleTimeStampTZ\(OracleTimeStampLTZ\)](#)  
This static type conversion operator converts an `OracleTimeStampLTZ` value to an `OracleTimeStampTZ` structure.
- [explicit operator OracleTimeStampTZ\(string\)](#)  
This static type conversion operator converts the supplied string value to an `OracleTimeStampTZ` structure.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)
- ["OracleGlobalization Class"](#)
- ["Globalization Support "](#)

## explicit operator OracleTimeStampTZ(OracleTimeStamp)

This static type conversion operator converts an `OracleTimeStamp` value to an `OracleTimeStampTZ` structure.

### Declaration

```
// C#  
public static explicit operator OracleTimeStampTZ(OracleTimeStamp value1);
```

### Parameters

- *value1*  
An `OracleTimeStamp`.

### Return Value

The returned `OracleTimeStampTZ` contains the date and time from the `OracleTimeStamp` and the time zone from the `OracleGlobalization.TimeZone` of the thread.

### Remarks

The `OracleGlobalization.TimeZone` of the thread is used to convert from an `OracleTimeStamp` structure to an `OracleTimeStampTZ` structure.

If the `OracleTimeStamp` structure has a null value, the returned `OracleTimeStampTZ` structure also has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)
- ["OracleGlobalization Class"](#)
- ["Globalization Support "](#)

## explicit operator OracleTimeStampTZ(OracleTimeStampLTZ)

This static type conversion operator converts an `OracleTimeStampLTZ` value to an `OracleTimeStampTZ` structure.

### Declaration

```
// C#  
public static explicit operator OracleTimeStampTZ(OracleTimeStampLTZ value1);
```

### Parameters

- `value1`  
An `OracleTimeStampLTZ`.

### Return Value

The returned `OracleTimeStampTZ` contains the date and time from the `OracleTimeStampLTZ` and the time zone from the `OracleGlobalization.TimeZone` of the thread.

### Remarks

If the `OracleTimeStampLTZ` structure has a null value, the returned `OracleTimeStampTZ` structure also has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)
- ["OracleGlobalization Class"](#)
- ["Globalization Support "](#)

## explicit operator OracleTimeStampTZ(string)

This static type conversion operator converts the supplied string value to an OracleTimeStampTZ structure.

### Declaration

```
// C#  
public static explicit operator OracleTimeStampTZ(string tsStr);
```

### Parameters

- *tsStr*  
A string representation of an Oracle `TIMESTAMP WITH TIME ZONE`.

### Return Value

An OracleTimeStampTZ value.

### Exceptions

ArgumentException - The *tsStr* is an invalid string representation of an Oracle `TIMESTAMP WITH TIME ZONE`, or the *tsStr* is not in the timestamp format specified by the thread's `OracleGlobalization.TimeStampTZFormat` property, which represents the Oracle `NLS_TIMESTAMP_TZ_FORMAT` parameter.

### Remarks

The names and abbreviations used for months and days are in the language specified by the `DateLanguage` and `Calendar` properties of the thread's `OracleGlobalization` object. If any of the thread's globalization properties are set to null or an empty string, the client computer's settings are used.

### Example

```
// C#  
  
using System;  
using Oracle.DataAccess.Client;  
using Oracle.DataAccess.Types;  
  
class OracleTimeStampTZSample  
{  
    static void Main()  
    {  
        // Set the nls_timestamp_tz_format for the explicit operator  
        // OracleTimeStampTZ(string)  
        OracleGlobalization info = OracleGlobalization.GetClientInfo();  
        info.TimeStampTZFormat = "DD-MON-YYYY HH:MI:SS.FF AM TZR";  
        OracleGlobalization.SetThreadInfo(info);  
  
        // construct OracleTimeStampTZ from a string using the format specified.  
        OracleTimeStampTZ tstz = new OracleTimeStampTZ("11-NOV-1999" +  
            "11:02:33.444 AM US/Pacific");  
  
        // Set the nls_timestamp_tz_format for the ToString() method  
        info.TimeStampTZFormat = "YYYY-MON-DD HH:MI:SS.FF AM TZR";
```

```
OracleGlobalization.SetThreadInfo(info);  
Console.WriteLine(tstz.ToString());  
}  
}
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)
- ["OracleGlobalization Class"](#)
- ["Globalization Support "](#)

## implicit operator OracleTimeStampTZ

implicit operator OracleTimeStampTZ converts a DateTime structure to an OracleTimeStampTZ structure.

**Overload List:**

- [implicit operator OracleTimeStampTZ\(OracleDate\)](#)  
This static type conversion operator converts an OracleDate value to an OracleTimeStampTZ structure.
- [implicit operator OracleTimeStampTZ\(DateTime\)](#)  
This static type conversion operator converts a DateTime structure to an OracleTimeStampTZ structure.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)
- ["OracleGlobalization Class"](#)
- ["Globalization Support "](#)

## implicit operator OracleTimeStampTZ(OracleDate)

This static type conversion operator converts an OracleDate value to an OracleTimeStampTZ structure.

## Declaration

```
// C#  
public static implicit operator OracleTimeStampTZ(OracleDate value1);
```

## Parameters

- *value1*  
An OracleDate.

## Return Value

The returned OracleTimeStampTZ contains the date and time from the OracleDate and the time zone from the OracleGlobalization.TimeZone of the thread.

## Remarks

The OracleGlobalization.TimeZone of the thread is used to convert from an OracleDate to an OracleTimeStampTZ structure. If the OracleDate structure has a null value, the returned OracleTimeStampTZ structure also has a null value.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)
- ["OracleGlobalization Class"](#)
- ["Globalization Support "](#)

## implicit operator OracleTimeStampTZ(DateTime)

This static type conversion operator converts a DateTime structure to an OracleTimeStampTZ structure.

## Declaration

```
// C#  
public static implicit operator OracleTimeStampTZ (DateTime value1);
```

## Parameters

- *value1*  
A DateTime structure.

## Return Value

The returned OracleTimeStampTZ contains the date and time from the DateTime and the time zone from the OracleGlobalization.TimeZone of the thread.

## Remarks

The `OracleGlobalization.TimeZone` of the thread is used to convert from a `DateTime` to an `OracleTimeStampTZ` structure.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)
- ["OracleGlobalization Class"](#)
- ["Globalization Support "](#)

## explicit operator DateTime

This static type conversion operator converts an `OracleTimeStampTZ` value to a `DateTime` structure and truncates the time zone information.

### Declaration

```
// C#  
public static explicit operator DateTime(OracleTimeStampTZ value1);
```

### Parameters

- *value1*  
An `OracleTimeStampTZ`.

### Return Value

A `DateTime` containing the date and time in the current instance, but with the time zone information in the current instance truncated.

### Exceptions

`OracleNullValueException` - The `OracleTimeStampTZ` structure has a null value.

### Remarks

The precision of the `OracleTimeStampTZ` value can be lost during the conversion, and the time zone information in the current instance is truncated

 See Also:

- "Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"
- OracleTimeStampTZ Structure
- OracleTimeStampTZ Members

## OracleTimeStampTZ Properties

The OracleTimeStampTZ properties are listed in [Table 15-137](#).

**Table 15-137 OracleTimeStampTZ Properties**

Properties	Description
<a href="#">BinData</a>	Returns an array of bytes that represents an Oracle <code>TIMESTAMP WITH TIME ZONE</code> in Oracle internal format
<a href="#">Day</a>	Specifies the day component of an OracleTimeStampTZ in the current time zone
<a href="#">IsNull</a>	Indicates whether or not the current instance has a null value
<a href="#">Hour</a>	Specifies the hour component of an OracleTimeStampTZ in the current time zone
<a href="#">Millisecond</a>	Specifies the millisecond component of an OracleTimeStampTZ in the current time zone
<a href="#">Minute</a>	Specifies the minute component of an OracleTimeStampTZ in the current time zone
<a href="#">Month</a>	Specifies the month component of an OracleTimeStampTZ in the current time zone
<a href="#">Nanosecond</a>	Specifies the nanosecond component of an OracleTimeStampTZ in the current time zone
<a href="#">Second</a>	Specifies the second component of an OracleTimeStampTZ in the current time zone
<a href="#">TimeZone</a>	Returns the time zone of the OracleTimeStampTZ instance
<a href="#">Value</a>	Returns the date and time that is stored in the OracleTimeStampTZ structure in the current time zone
<a href="#">Year</a>	Specifies the year component of an OracleTimeStampTZ

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## BinData

This property returns an array of bytes that represents an Oracle `TIMESTAMP WITH TIME ZONE` in Oracle internal format.

### Declaration

```
// C#  
public byte[] BinData {get;}
```

### Property Value

The provided byte array that represents an Oracle `TIMESTAMP WITH TIME ZONE` in Oracle internal format.

### Exceptions

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## Day

This property specifies the day component of an `OracleTimeStampTZ` in the current time zone.

### Declaration

```
// C#  
public int Day{get;}
```

### Property Value

A number that represents the day. Range of `Day` is (1 to 31).

### Exceptions

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## IsNull

This property indicates whether or not the current instance has a null value.

### Declaration

```
// C#  
public bool IsNull{get;}
```

### Property Value

Returns `true` if the current instance has a null value. Otherwise, returns `false`.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## Hour

This property specifies the hour component of an `OracleTimeStampTZ` in the current time zone.

### Declaration

```
// C#  
public int Hour{get;}
```

### Property Value

A number that represents the hour. Range of `Hour` is (0 to 23).

### Exceptions

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## Millisecond

This property gets the millisecond component of an `OracleTimeStampTZ` in the current time zone.

### Declaration

```
// C#  
public double Millisecond{get;}
```

### Property Value

A number that represents a millisecond. Range of `Millisecond` is (0 to 999.999999)

### Exceptions

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## Minute

This property gets the minute component of an `OracleTimeStampTZ` in the current time zone.

### Declaration

```
// C#  
public int Minute{get;}
```

### Property Value

A number that represent a minute. Range of `Minute` is (0 to 59).

### Exceptions

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## Month

This property gets the month component of an `OracleTimeStampTZ` in the current time zone

### Declaration

```
// C#  
public int Month{get;}
```

### Property Value

A number that represents a month. Range of `Month` is (1 to 12).

### Exceptions

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## Nanosecond

This property gets the nanosecond component of an `OracleTimeStampTZ` in the current time zone.

### Declaration

```
// C#  
public int Nanosecond{get;}
```

### Property Value

A number that represents a nanosecond. Range of `Nanosecond` is (0 to 999999999).

### Exceptions

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## Second

This property gets the second component of an `OracleTimeStampTZ` in the current time zone.

### Declaration

```
// C#  
public int Second{get;}
```

### Property Value

A number that represents a second. Range of `Second` is (0 to 59).

### Exceptions

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## TimeZone

This property returns the time zone of the `OracleTimeStampTZ` instance.

### Declaration

```
// C#  
public string TimeZone{get;}
```

### Property Value

A string that represents the time zone.

### Remarks

If no time zone is specified in the constructor, this property is set to the thread's `OracleGlobalization.TimeZone` by default

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)
- ["OracleGlobalization Class"](#)
- ["Globalization Support "](#)

## Value

This property returns the date and time that is stored in the `OracleTimeStampTZ` structure in the current time zone.

### Declaration

```
// C#  
public DateTime Value{get;}
```

### Property Value

A `DateTime` in the current time zone.

### Exceptions

`OracleNullValueException` - The current instance has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## Year

This property sets the year component of an `OracleTimeStampTZ` in the current time zone.

### Declaration

```
// C#  
public int Year{get;}
```

### Property Value

A number that represents a year. The range of `Year` is (-4712 to 9999).

## Exceptions

`OracleNullValueException` - The current instance has a null value.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## OracleTimeStampTZ Methods

The `OracleTimeStampTZ` methods are listed in [Table 15-138](#).

**Table 15-138 OracleTimeStampTZ Methods**

Methods	Description
<a href="#">AddDays</a>	Adds the supplied number of days to the current instance
<a href="#">AddHours</a>	Adds the supplied number of hours to the current instance
<a href="#">AddMilliseconds</a>	Adds the supplied number of milliseconds to the current instance
<a href="#">AddMinutes</a>	Adds the supplied number of minutes to the current instance
<a href="#">AddMonths</a>	Adds the supplied number of months to the current instance
<a href="#">AddNanoseconds</a>	Adds the supplied number of nanoseconds to the current instance
<a href="#">AddSeconds</a>	Adds the supplied number of seconds to the current instance
<a href="#">AddYears</a>	Adds the supplied number of years to the current instance
<a href="#">CompareTo</a>	Compares the current <code>OracleTimeStampTZ</code> instance to an object, and returns an integer that represents their relative values
<a href="#">Equals</a>	Determines whether or not an object has the same date and time as the current <code>OracleTimeStampTZ</code> instance (Overloaded)
<a href="#">GetDaysBetween</a>	Subtracts an <code>OracleTimeStampTZ</code> from the current instance and returns an <code>OracleIntervalDS</code> that represents the time interval
<a href="#">GetHashCode</a>	Returns a hash code for the <code>OracleTimeStampTZ</code> instance
<a href="#">GetTimeZoneOffset</a>	Gets the time zone information in hours and minutes of the current <code>OracleTimeStampTZ</code>
<a href="#">GetYearsBetween</a>	Subtracts an <code>OracleTimeStampTZ</code> from the current instance and returns an <code>OracleIntervalYM</code> that represents the time interval
<a href="#">GetType</a>	Inherited from <code>System.Object</code>
<a href="#">ToLocalTime</a>	Converts the current <code>OracleTimeStampTZ</code> instance to local time
<a href="#">ToOracleDate</a>	Converts the current <code>OracleTimeStampTZ</code> structure to an <code>OracleDate</code> structure

**Table 15-138 (Cont.) OracleTimeStampTZ Methods**

Methods	Description
<a href="#">ToOracleTimeStampLTZ</a>	Converts the current OracleTimeStampTZ structure to an OracleTimeStampLTZ structure
<a href="#">ToOracleTimeStamp</a>	Converts the current OracleTimeStampTZ structure to an OracleTimeStamp structure
<a href="#">ToString</a>	Converts the current OracleTimeStampTZ structure to a string
<a href="#">ToUniversalTime</a>	Converts the current datetime to Coordinated Universal Time (UTC)

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## AddDays

This method adds the supplied number of days to the current instance.

### Declaration

```
// C#  
public OracleTimeStampTZ AddDays(double days);
```

### Parameters

- *days*  
The supplied number of days. Range is  $(-1,000,000,000 < days < 1,000,000,000)$

### Return Value

An OracleTimeStampTZ.

### Exceptions

OracleNullValueException - The current instance has a null value.

ArgumentOutOfRangeException - The argument value is out of the specified range.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## AddHours

This method adds the supplied number of hours to the current instance.

### Declaration

```
// C#  
public OracleTimeStampTZ AddHours(double hours);
```

### Parameters

- *hours*  
The supplied number of hours. Range is  $(-24,000,000,000 < hours < 24,000,000,000)$ .

### Return Value

An OracleTimeStampTZ.

### Exceptions

OracleNullValueException - The current instance has a null value.

ArgumentOutOfRangeException - The argument value is out of the specified range.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## AddMilliseconds

This method adds the supplied number of milliseconds to the current instance.

### Declaration

```
// C#  
public OracleTimeStampTZ AddMilliseconds(double milliseconds);
```

### Parameters

- *milliseconds*

The supplied number of milliseconds. Range is  $(-8.64 * 1016 < milliseconds < 8.64 * 1016)$ .

### Return Value

An OracleTimeStampTZ.

### Exceptions

OracleNullValueException - The current instance has a null value.

ArgumentOutOfRangeException - The argument value is out of the specified range.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## AddMinutes

This method adds the supplied number of minutes to the current instance.

### Declaration

```
// C#  
public OracleTimeStampTZ AddMinutes(double minutes);
```

### Parameters

- *minutes*

The supplied number of minutes. Range is  $(-1,440,000,000,000 < minutes < 1,440,000,000,000)$ .

### Return Value

An OracleTimeStampTZ.

### Exceptions

OracleNullValueException - The current instance has a null value.

ArgumentOutOfRangeException - The argument value is out of the specified range.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## AddMonths

This method adds the supplied number of months to the current instance.

### Declaration

```
// C#  
public OracleTimeStampTZ AddMonths(long months);
```

### Parameters

- *months*

The supplied number of months. Range is  $(-12,000,000,000 < months < 12,000,000,000)$ .

### Return Value

An OracleTimeStampTZ.

### Exceptions

OracleNullValueException - The current instance has a null value.

ArgumentOutOfRangeException - The argument value is out of the specified range.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## AddNanoseconds

This method adds the supplied number of nanoseconds to the current instance.

### Declaration

```
// C#  
public OracleTimeStampTZ AddNanoseconds(long nanoseconds);
```

### Parameters

- *nanoseconds*  
The supplied number of nanoseconds.

### Return Value

An OracleTimeStampTZ.

### Exceptions

OracleNullValueException - The current instance has a null value.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## AddSeconds

This method adds the supplied number of seconds to the current instance.

### Declaration

```
// C#  
public OracleTimeStampTZ AddSeconds(double seconds);
```

### Parameters

- *seconds*  
The supplied number of seconds. Range is  $(-8.64 * 1013 < seconds < 8.64 * 1013)$ .

### Return Value

An OracleTimeStampTZ.

### Exceptions

OracleNullValueException - The current instance has a null value.

ArgumentOutOfRangeException - The argument value is out of the specified range.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## AddYears

This method adds the supplied number of years to the current instance

### Declaration

```
// C#  
public OracleTimeStampTZ AddYears(int years);
```

### Parameters

- *years*  
The supplied number of years. Range is (-999,999,999 <= *years* <= 999,999,999).

### Return Value

An OracleTimeStampTZ.

### Exceptions

OracleNullValueException - The current instance has a null value.

ArgumentOutOfRangeException - The argument value is out of the specified range.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## CompareTo

This method compares the current OracleTimeStampTZ instance to an object, and returns an integer that represents their relative values.

### Declaration

```
// C#  
public int CompareTo(object obj);
```

### Parameters

- *obj*  
The object being compared to the current `OracleTimeStampTZ` instance.

### Return Value

The method returns a number that is:

Less than zero: if the current `OracleTimeStampTZ` instance value is less than that of *obj*.

Zero: if the current `OracleTimeStampTZ` instance and *obj* values are equal.

Greater than zero: if the current `OracleTimeStampTZ` instance value is greater than that of *obj*.

### Implements

`Comparable`

### Exceptions

`ArgumentException` - The *obj* is not of type `OracleTimeStampTZ`.

### Remarks

The following rules apply to the behavior of this method.

- The comparison must be between `OracleTimeStampTZ`s. For example, comparing an `OracleTimeStampTZ` instance with an `OracleBinary` instance is not allowed. When an `OracleTimeStampTZ` is compared with a different type, an `ArgumentException` is thrown.
- Any `OracleTimeStampTZ` that has a value is greater than an `OracleTimeStampTZ` that has a null value.
- Two `OracleTimeStampTZ`s that contain a null value are equal.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## Equals

Overrides `Object`

This method determines whether or not an object has the same date and time as the current `OracleTimeStampTZ` instance.

### Declaration

```
// C#  
public override bool Equals(object obj);
```

### Parameters

- *obj*

The object being compared to the current `OracleTimeStampTZ` instance.

### Return Value

Returns `true` if the *obj* is of type `OracleTimeStampTZ` and represents the same date and time; otherwise, returns `false`.

### Remarks

The following rules apply to the behavior of this method.

- Any `OracleTimeStampTZ` that has a value is greater than an `OracleTimeStampTZ` that has a null value.
- Two `OracleTimeStampTZ`s that contain a null value are equal.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## GetDaysBetween

This method subtracts an `OracleTimeStampTZ` value from the current instance and returns an `OracleIntervalDS` that represents the time interval.

### Declaration

```
// C#  
public OracleIntervalDS GetDaysBetween(OracleTimeStampTZ value1);
```

### Parameters

- *value1*

The `OracleTimeStampTZ` value being subtracted.

### Return Value

An `OracleIntervalDS` that represents the interval between two `OracleTimeStampTZ` values.

### Remarks

If either the current instance or the parameter has a null value, the returned `OracleIntervalDS` has a null value.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## GetHashCode

Overrides `Object`

This method returns a hash code for the `OracleTimeStampTZ` instance.

### Declaration

```
// C#  
public override int GetHashCode();
```

### Return Value

A number that represents the hash code.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## GetTimeZoneOffset

This method gets the time zone portion in hours and minutes of the current `OracleTimeStampTZ`.

### Declaration

```
// C#  
public TimeSpan GetTimeZoneOffset();
```

### Return Value

A `TimeSpan`.

## Exceptions

`OracleNullValueException` - The current instance has a null value.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## GetYearsBetween

This method subtracts an `OracleTimeStampTZ` value from the current instance and returns an `OracleIntervalYM` that represents the time interval.

### Declaration

```
// C#  
public OracleIntervalYM GetYearsBetween(OracleTimeStampTZ val);
```

### Parameters

- *val*  
The `OracleTimeStampTZ` value being subtracted.

### Return Value

An `OracleIntervalYM` that represents the interval between two `OracleTimeStampTZ` values.

### Remarks

If either the current instance or the parameter has a null value, the returned `OracleIntervalYM` has a null value.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## ToLocalTime

This method converts the current `OracleTimeStampTZ` instance to local time.

**Declaration**

```
// C#  
public OracleTimeStampLTZ ToLocalTime();
```

**Return Value**

An `OracleTimeStampLTZ` that contains the date and time, which is normalized to the client local time zone, in the current instance.

**Remarks**

If the current instance has a null value, the returned `OracleTimeStampLTZ` has a null value.

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## ToOracleDate

This method converts the current `OracleTimeStampTZ` structure to an `OracleDate` structure.

**Declaration**

```
// C#  
public OracleDate ToOracleDate();
```

**Return Value**

The returned `OracleDate` contains the date and time in the current instance, but the time zone information in the current instance is truncated.

**Remarks**

The precision of the `OracleTimeStampTZ` value can be lost during the conversion, and the time zone information in the current instance is truncated.

If the current instance has a null value, the value of the returned `OracleDate` structure has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## ToOracleTimeStampLTZ

This method converts the current `OracleTimeStampTZ` structure to an `OracleTimeStampLTZ` structure.

### Declaration

```
// C#  
public OracleTimeStampLTZ ToOracleTimeStampLTZ();
```

### Return Value

The returned `OracleTimeStampLTZ` structure contains the date and time, which is normalized to the client local time zone, in the current instance.

### Remarks

If the value of the current instance has a null value, the value of the returned `OracleTimeStampLTZ` structure has a null value.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## ToOracleTimeStamp

This method converts the current `OracleTimeStampTZ` structure to an `OracleTimeStamp` structure.

### Declaration

```
// C#  
public OracleTimeStamp ToOracleTimeStamp();
```

### Return Value

The returned `OracleTimeStamp` contains the date and time in the current instance, but the time zone information is truncated.

## Remarks

If the value of the current instance has a null value, the value of the returned `OracleTimeStamp` structure has a null value.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## ToString

Overrides `Object`

This method converts the current `OracleTimeStampTZ` structure to a string.

### Declaration

```
// C#  
public override string ToString();
```

### Return Value

A string that represents the same date and time as the current `OracleTimeStampTZ` structure.

### Remarks

The returned value is a string representation of an `OracleTimeStampTZ` in the format specified by the `OracleGlobalization.TimeStampTZFormat` property of the thread. The names and abbreviations used for months and days are in the language specified by the `OracleGlobalization.DateLanguage` and the `OracleGlobalization.Calendar` properties of the thread. If any of the thread's globalization properties are set to null or an empty string, the client computer's settings are used.

### Example

```
// C#  
  
using System;  
using Oracle.DataAccess.Client;  
using Oracle.DataAccess.Types;  
  
class ToStringSample  
{  
    static void Main()  
    {  
        // Set the nls parameters for the current thread  
        OracleGlobalization info = OracleGlobalization.GetClientInfo();  
        info.TimeZone = "US/Eastern";  
        info.TimeStampFormat = "DD-MON-YYYY HH:MI:SS.FF AM";  
    }  
}
```

```
info.TimeStampTZFormat = "DD-MON-YYYY HH:MI:SS.FF AM TZR";
OracleGlobalization.SetThreadInfo(info);

// Create an OracleTimeStampTZ in US/Pacific time zone
OracleTimeStampTZ tstz1=new OracleTimeStampTZ("11-NOV-1999 "+
    "11:02:33.444 AM US/Pacific");

// Note that ToOracleTimeStampTZ uses the thread's time zone region,
// "US/Eastern"
OracleTimeStamp ts = new OracleTimeStamp("11-NOV-1999 11:02:33.444 AM");
OracleTimeStampTZ tstz2 = ts.ToOracleTimeStampTZ();

// Calculate the difference between tstz1 and tstz2
OracleIntervalDS idsDiff = tstz1.GetDaysBetween(tstz2);

// Prints "US/Pacific"
Console.WriteLine("tstz1.TimeZone = " + tstz1.TimeZone);

// Prints "US/Eastern"
Console.WriteLine("tstz2.TimeZone = " + tstz2.TimeZone);

// Prints 3
Console.WriteLine("idsDiff.Hours = " + idsDiff.Hours);

// Prints 0
Console.WriteLine("idsDiff.Minutes = " + idsDiff.Minutes);
}
}
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)
- ["OracleGlobalization Class"](#)
- ["Globalization Support "](#)

## ToUniversalTime

This method converts the current datetime to Coordinated Universal Time (UTC).

### Declaration

```
// C#
public OracleTimeStampTZ ToUniversalTime();
```

### Return Value

An `OracleTimeStampTZ` structure.

**Remarks**

If the current instance has a null value, the value of the returned `OracleTimeStampTZ` structure has a null value.

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTimeStampTZ Structure](#)
- [OracleTimeStampTZ Members](#)

## INullable Interface

The `INullable` interface is used to determine whether or not an ODP.NET type has a NULL value.

**Declaration**

```
// C#
public interface INullable
```

**Requirements**

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

**Thread Safety**

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [INullable Interface Members](#)
- [INullable Interface Properties](#)

## INullable Interface Members

INullable members are listed in the following tables.

### INullable Interface Properties

INullable interface properties are listed in [Table 15-139](#).

**Table 15-139** INullable Interface Properties

Public Property	Description
<a href="#">IsNull</a>	Indicates whether or not the ODP.NET type has a NULL value

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [INullable Interface](#)

## INullable Interface Properties

INullable interface properties are listed in [Table 15-139](#).

**Table 15-140** INullable Interface Properties

Public Property	Description
<a href="#">IsNull</a>	Indicates whether or not the ODP.NET type has a NULL value

## IsNull

This property indicates whether or not the ODP.NET type has a NULL value.

### Declaration

```
// C#
bool IsNull {get;}
```

### Property Value

Returns true if the ODP.NET type has a `NULL` value; otherwise, returns false.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [INullable Interface](#)
- [INullable Interface Members](#)

# 16

## Oracle Data Provider for .NET Types Exceptions

This section covers the ODP.NET Types exceptions.

This chapter contains these topics:

- [OracleTypeException Class](#)
- [OracleNullValueException Class](#)
- [OracleTruncateException Class](#)

### OracleTypeException Class

The `OracleTypeException` is the base exception class for handling exceptions that occur in the ODP.NET Types classes.

#### Class Inheritance

```
System.Object
    System.Exception
        System.SystemException
            Oracle.DataAccess.Types.OracleTypeException
```

#### Declaration

```
// C#
public class OracleTypeException : SystemException
```

#### Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

#### Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTypeException Members](#)
- [OracleTypeException Constructors](#)
- [OracleTypeException Static Methods](#)
- [OracleTypeException Properties](#)
- [OracleTypeException Methods](#)

## OracleTypeException Members

OracleTypeException members are listed in the following tables.

### OracleTypeException Constructors

The OracleTypeException constructors are listed in [Table 16-1](#).

**Table 16-1 OracleTypeException Constructor**

Constructor	Description
<a href="#">OracleTypeException Constructors</a>	Creates a new instance of the OracleTypeException class (Overloaded)

### OracleTypeException Static Methods

The OracleTypeException static methods are listed in [Table 16-2](#).

**Table 16-2 OracleTypeException Static Methods**

Methods	Description
Equals	Inherited from System.Object (Overloaded)

### OracleTypeException Properties

The OracleTypeException properties are listed in [Table 16-3](#).

**Table 16-3 OracleTypeException Properties**

Properties	Description
HelpLink	Inherited from System.SystemException.Exception
InnerException	Inherited from System.SystemException.Exception

**Table 16-3 (Cont.) OracleTypeException Properties**

Properties	Description
<a href="#">Message</a>	Specifies the error messages that occur in the exception
<a href="#">Number</a>	Specifies the error number that occurs in the exception
<a href="#">Source</a>	Specifies the name of the data provider that generates the error
StackTrace	Inherited from <code>System.SystemException.Exception</code>
TargetSite	Inherited from <code>System.SystemException.Exception</code>

### OracleTypeException Methods

The `OracleTypeException` methods are listed in [Table 16-4](#).

**Table 16-4 OracleTypeException Methods**

Methods	Description
<code>Equals</code>	Inherited from <code>System.Object (Overloaded)</code>
<code>GetBaseException</code>	Inherited from <code>System.SystemException.Exception</code>
<code>GetHashCode</code>	Inherited from <code>System.Object</code>
<code>GetObjectData</code>	Inherited from <code>System.SystemException.Exception</code>
<code>GetType</code>	Inherited from <code>System.Object</code>
<a href="#">ToString</a>	Returns the fully qualified name of this exception



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTypeException Class](#)

## OracleTypeException Constructors

The `OracleTypeException` constructors create new instances of the `OracleTypeException` class.

### Overload List:

- [OracleTypeException\(string\)](#)

This constructor creates a new instance of the `OracleTypeException` class with the specified error message, `errMessage`.

- [OracleTypeException\(SerializationInfo, StreamingContext\)](#)

This constructor creates a new instance of the `OracleTypeException` class with the specified serialization information, `si`, and the specified streaming context, `sc`.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTypeException Class](#)
- [OracleTypeException Members](#)

## OracleTypeException(string)

This constructor creates a new instance of the `OracleTypeException` class with the specified error message, `errorMessage`.

#### Declaration

```
// C#  
public OracleTypeException (string errorMessage);
```

#### Parameters

- `errorMessage`  
The specified error message.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTypeException Class](#)
- [OracleTypeException Members](#)

## OracleTypeException(SerializationInfo, StreamingContext)

This constructor creates a new instance of the `OracleTypeException` class with the specified serialization information, `si`, and the specified streaming context, `sc`.

#### Declaration

```
// C#  
protected OracleTypeException (SerializationInfo si, StreamingContext sc);
```

#### Parameters

- `si`

The specified serialization information.

- `sc`

The specified streaming context.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTypeException Class](#)
- [OracleTypeException Members](#)

## OracleTypeException Static Methods

The `OracleTypeException` static methods are listed in [Table 16-5](#).

**Table 16-5 OracleTypeException Static Methods**

Methods	Description
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTypeException Class](#)
- [OracleTypeException Members](#)

## OracleTypeException Properties

The `OracleTypeException` properties are listed in [Table 16-6](#).

**Table 16-6 OracleTypeException Properties**

Properties	Description
<code>HelpLink</code>	Inherited from <code>System.SystemException.Exception</code>
<code>InnerException</code>	Inherited from <code>System.SystemException.Exception</code>
<code>Message</code>	Specifies the error messages that occur in the exception
<code>Number</code>	Specifies the error number that occurs in the exception
<code>Source</code>	Specifies the name of the data provider that generates the error
<code>StackTrace</code>	Inherited from <code>System.SystemException.Exception</code>

**Table 16-6 (Cont.) OracleTypeException Properties**

Properties	Description
TargetSite	Inherited from <code>System.SystemException.Exception</code>

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTypeException Class](#)
- [OracleTypeException Members](#)

## Message

Overrides `Exception`

This property specifies the error messages that occur in the exception.

### Declaration

```
// C#  
public override string Message {get;}
```

### Property Value

An error message.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTypeException Class](#)
- [OracleTypeException Members](#)

## Number

Overrides `Exception`

This property specifies the error number that occurs in the exception

### Declaration

```
// C#  
public override int Number {get;}
```

**Property Value**

An error number

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTypeException Class](#)
- [OracleTypeException Members](#)

## Source

Overrides `Exception`

This property specifies the name of the data provider that generates the error.

**Declaration**

```
// C#
public override string Source {get;}
```

**Property Value**

Oracle Data Provider for .NET.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTypeException Class](#)
- [OracleTypeException Members](#)

## OracleTypeException Methods

The `OracleTypeException` methods are listed in [Table 16-7](#).**Table 16-7 OracleTypeException Methods**

Methods	Description
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)
<code>GetBaseException</code>	Inherited from <code>System.SystemException.Exception</code>
<code>GetHashCode</code>	Inherited from <code>System.Object</code>
<code>GetObjectData</code>	Inherited from <code>System.SystemException.Exception</code>

Table 16-7 (Cont.) OracleTypeException Methods

Methods	Description
GetType	Inherited from <code>System.Object</code>
<a href="#">ToString</a>	Returns the fully qualified name of this exception

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTypeException Class](#)
- [OracleTypeException Members](#)

## ToString

Overrides `Exception`

This method returns the fully qualified name of this exception, the error message in the `Message` property, the `InnerException.ToString()` message, and the stack trace.

### Declaration

```
// C#
public override string ToString();
```

### Return Value

The fully qualified name of this exception.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTypeException Class](#)
- [OracleTypeException Members](#)

## OracleNullValueException Class

The `OracleNullValueException` represents an exception that is thrown when trying to access an ODP.NET Types structure that has a null value.

### Class Inheritance

`System.Object`

```

System.Exception
    System.SystemException
        System.OracleTypeException
            Oracle.DataAccess.Types.OracleNullValueException

```

### Declaration

```

// C#
public sealed class OracleNullValueException : OracleTypeException

```

### Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

### Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleNullValueException Members](#)
- [OracleNullValueException Constructors](#)
- [OracleNullValueException Static Methods](#)
- [OracleNullValueException Properties](#)
- [OracleNullValueException Methods](#)

## OracleNullValueException Members

OracleNullValueException members are listed in the following tables.

### OracleNullValueException Constructors

The OracleNullValueException constructors are listed in [Table 16-8](#).

**Table 16-8 OracleNullValueException Constructors**

Constructor	Description
<a href="#">OracleNullValueException Constructors</a>	Creates a new instance of the OracleNullValueException class (Overloaded)

**OracleNullValueException Static Methods**

The OracleNullValueException static methods are listed in [Table 16-9](#).

**Table 16-9 OracleNullValueException Static Methods**

Methods	Description
Equals	Inherited from System.Object (Overloaded)

**OracleNullValueException Properties**

The OracleNullValueException properties are listed in [Table 16-10](#).

**Table 16-10 OracleNullValueException Properties**

Properties	Description
HelpLink	Inherited from System.SystemException.Exception
InnerException	Inherited from System.SystemException.Exception
Message	Inherited from OracleTypeException
Source	Inherited from OracleTypeException
StackTrace	Inherited from System.SystemException.Exception
TargetSite	Inherited from System.SystemException.Exception

**OracleNullValueException Methods**

The OracleNullValueException methods are listed in [Table 16-11](#).

**Table 16-11 OracleNullValueException Methods**

Methods	Description
Equals	Inherited from System.Object (Overloaded)
GetBaseException	Inherited from System.SystemException.Exception
GetHashCode	Inherited from System.Object
GetObjectData	Inherited from System.SystemException.Exception

**Table 16-11 (Cont.) OracleNullValueException Methods**

Methods	Description
GetType	Inherited from <code>System.Object</code>
ToString	Inherited from <code>OracleTypeException</code>

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleNullValueException Class](#)

## OracleNullValueException Constructors

The `OracleNullValueException` constructors create new instances of the `OracleNullValueException` class.

**Overload List:**

- [OracleNullValueException\(\)](#)

This constructor creates a new instance of the `OracleNullValueException` class with its default properties.

- [OracleNullValueException\(string\)](#)

This constructor creates a new instance of the `OracleNullValueException` class with the specified error message, `errorMessage`.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleNullValueException Class](#)
- [OracleNullValueException Members](#)

## OracleNullValueException()

This constructor creates a new instance of the `OracleNullValueException` class with its default properties.

**Declaration**

```
// C#  
public OracleNullValueException();
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleNullValueException Class](#)
- [OracleNullValueException Members](#)

## OracleNullValueException(string)

This constructor creates a new instance of the `OracleNullValueException` class with the specified error message, `errorMessage`.

### Declaration

```
// C#  
public OracleNullValueException (string errorMessage);
```

### Parameters

- `errorMessage`  
The specified error message.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleNullValueException Class](#)
- [OracleNullValueException Members](#)

## OracleNullValueException Static Methods

The `OracleNullValueException` static methods are listed in [Table 16-12](#).

**Table 16-12 OracleNullValueException Static Methods**

Methods	Description
Equals	Inherited from <code>System.Object</code> (Overloaded)

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleNullValueException Class](#)
- [OracleNullValueException Members](#)

## OracleNullValueException Properties

The `OracleNullValueException` properties are listed in [Table 16-13](#).

**Table 16-13 OracleNullValueException Properties**

Properties	Description
HelpLink	Inherited from <code>System.SystemException.Exception</code>
InnerException	Inherited from <code>System.SystemException.Exception</code>
Message	Inherited from <code>OracleTypeException</code>
Source	Inherited from <code>OracleTypeException</code>
StackTrace	Inherited from <code>System.SystemException.Exception</code>
TargetSite	Inherited from <code>System.SystemException.Exception</code>

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleNullValueException Class](#)
- [OracleNullValueException Members](#)

## OracleNullValueException Methods

The `OracleNullValueException` methods are listed in [Table 16-14](#).

**Table 16-14 OracleNullValueException Methods**

Methods	Description
Equals	Inherited from <code>System.Object (Overloaded)</code>
GetBaseException	Inherited from <code>System.SystemException.Exception</code>
GetHashCode	Inherited from <code>System.Object</code>
GetObjectData	Inherited from <code>System.SystemException.Exception</code>

**Table 16-14 (Cont.) OracleNullValueException Methods**

Methods	Description
GetType	Inherited from System.Object
ToString	Inherited from OracleTypeException

## OracleTruncateException Class

The `OracleTruncateException` class represents an exception that is thrown when truncation in a ODP.NET Types class occurs.

### Class Inheritance

System.Object

System.Exception

System.SystemException

System.OracleTypeException

Oracle.DataAccess.Types.OracleTruncateException

### Declaration

```
// C#
public sealed class OracleTruncateException : OracleTypeException
```

### Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

### Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTruncateException Members](#)
- [OracleTruncateException Constructors](#)
- [OracleTruncateException Static Methods](#)
- [OracleTruncateException Properties](#)
- [OracleTruncateException Methods](#)

## OracleTruncateException Members

OracleTruncateException members are listed in the following tables.

### OracleTruncateException Constructors

The OracleTruncateException constructors are listed in [Table 16-15](#).

**Table 16-15 OracleTruncateException Constructors**

Constructor	Description
<a href="#">OracleTruncateException Constructors</a>	Creates a new instance of the OracleTruncateException class (Overloaded)

### OracleTruncateException Static Methods

The OracleTruncateException static methods are listed in [Table 16-16](#).

**Table 16-16 OracleTruncateException Static Methods**

Methods	Description
Equals	Inherited from System.Object (Overloaded)

### OracleTruncateException Properties

The OracleTruncateException properties are listed in [Table 16-17](#).

**Table 16-17 OracleTruncateException Properties**

Properties	Description
HelpLink	Inherited from System.SystemException.Exception
InnerException	Inherited from System.SystemException.Exception
Message	Inherited from OracleTypeException
Source	Inherited from OracleTypeException

**Table 16-17 (Cont.) OracleTruncateException Properties**

Properties	Description
StackTrace	Inherited from <code>System.SystemException.Exception</code>
TargetSite	Inherited from <code>System.SystemException.Exception</code>

**OracleTruncateException Methods**

The `OracleTruncateException` methods are listed in [Table 16-18](#).

**Table 16-18 OracleTruncateException Methods**

Methods	Description
Equals	Inherited from <code>System.Object (Overloaded)</code>
GetBaseException	Inherited from <code>System.SystemException.Exception</code>
GetHashCode	Inherited from <code>System.Object</code>
GetObjectData	Inherited from <code>System.SystemException.Exception</code>
GetType	Inherited from <code>System.Object</code>
ToString	Inherited from <code>OracleTypeException</code>

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTruncateException Class](#)

## OracleTruncateException Constructors

The `OracleTruncateException` constructors create new instances of the `OracleTruncateException` class

**Overload List:**

- [OracleTruncateException\(\)](#)  
This constructor creates a new instance of the `OracleTruncateException` class with its default properties.
- [OracleTruncateException\(string\)](#)  
This constructor creates a new instance of the `OracleTruncateException` class with the specified error message, `errorMessage`.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTruncateException Class](#)
- [OracleTruncateException Members](#)

## OracleTruncateException()

This constructor creates a new instance of the `OracleTruncateException` class with its default properties.

### Declaration

```
// C#  
public OracleTruncateException();
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTruncateException Class](#)
- [OracleTruncateException Members](#)

## OracleTruncateException(string)

This constructor creates a new instance of the `OracleTruncateException` class with the specified error message, `errorMessage`.

### Declaration

```
// C#  
public OracleTruncateException (string errorMessage);
```

### Parameters

- *errorMessage*  
The specified error message.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTruncateException Class](#)
- [OracleTruncateException Members](#)

## OracleTruncateException Static Methods

The `OracleTruncateException` static methods are listed in [Table 16-19](#).

**Table 16-19 OracleTruncateException Static Methods**

Methods	Description
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTruncateException Class](#)
- [OracleTruncateException Members](#)

## OracleTruncateException Properties

The `OracleTruncateException` properties are listed in [Table 16-20](#).

**Table 16-20 OracleTruncateException Properties**

Properties	Description
<code>HelpLink</code>	Inherited from <code>System.SystemException.Exception</code>
<code>InnerException</code>	Inherited from <code>System.SystemException.Exception</code>
<code>Message</code>	Inherited from <code>OracleTypeException</code>
<code>Source</code>	Inherited from <code>OracleTypeException</code>
<code>StackTrace</code>	Inherited from <code>System.SystemException.Exception</code>
<code>TargetSite</code>	Inherited from <code>System.SystemException.Exception</code>

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTruncateException Class](#)
- [OracleTruncateException Members](#)

## OracleTruncateException Methods

The `OracleTruncateException` methods are listed in [Table 16-21](#).

**Table 16-21 OracleTruncateException Methods**

Methods	Description
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)
<code>GetBaseException</code>	Inherited from <code>System.SystemException.Exception</code>
<code>GetHashCode</code>	Inherited from <code>System.Object</code>
<code>GetObjectData</code>	Inherited from <code>System.SystemException.Exception</code>
<code>GetType</code>	Inherited from <code>System.Object</code>
<code>ToString</code>	Inherited from <code>OracleTypeException</code>

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleTruncateException Class](#)
- [OracleTruncateException Members](#)

# 17

## Oracle Data Provider for .NET UDT-Related Classes

This chapter describes the object-related classes and interfaces in the Oracle Data Provider for .NET that provide support for Oracle user-defined data types (UDT).

In ODAC Oracle Universal Installer, samples are provided in the `ORACLE_BASE\ORACLE_HOME\ODP.NET\Samples\UDT` directory.



### See Also:

["Oracle User-Defined Types \(UDTs\) and .NET Custom Types"](#)

- [OracleCustomTypeMappingAttribute Class](#)
- [OracleObjectMappingAttribute Class](#)
- [OracleArrayMappingAttribute Class](#)
- [IOracleCustomType Interface](#)
- [IOracleCustomTypeFactory Interface](#)
- [IOracleArrayTypeFactory Interface](#)
- [OracleUdt Class](#)
- [OracleRef Class](#)
- [OracleUdtFetchOption Enumeration](#)
- [OracleUdtStatus Enumeration](#)

## OracleCustomTypeMappingAttribute Class

The `OracleCustomTypeMappingAttribute` class is used to mark a custom type factory class or struct with information that is used by ODP.NET when a custom type is used to represent an Oracle UDT.

### Class Inheritance

```
System.Object
System.Attribute
System.OracleCustomTypeMappingAttribute
```

### Declaration

```
// C#
[AttributeUsageAttribute(AttributeTargets.Class|AttributeTargets.Struct,
```

```

    AllowMultiple=false, Inherited=true)]
public sealed class OracleCustomTypeMappingAttribute : Attribute

```

## Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

## Remarks

The `OracleCustomTypeMapping` attribute must be specified on the custom type factory class to indicate the Oracle UDT that the corresponding custom type represents. The Oracle UDT may be specified in the form `schema_name.type_name`.

For each Oracle UDT that the application uses, there must be a unique custom type factory, as follows:

- **Oracle Object Types**  
The custom type factory must return a custom type that cannot be used to represent any other Oracle Object Type.
- **Oracle Collection Types**  
The custom type factory may return a custom type that can be used by other Oracle Collection Types. This is common when an array type is used to represent an Oracle Collection, that is, when an `int[]` is used to represent a collection of NUMBERS.

If the `OracleCustomTypeMappingAttribute` is not specified, then custom type mappings must be specified through an XML configuration file, for example, `app.config` for Windows applications or the `web.config` for web applications, and the `machine.config`

## Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

 **See Also:**

- "Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"
- OracleCustomTypeMappingAttribute Members
- OracleCustomTypeMappingAttribute Constructors
- OracleCustomTypeMappingAttribute Static Methods
- OracleCustomTypeMappingAttribute Methods

## OracleCustomTypeMappingAttribute Members

OracleCustomTypeMappingAttribute members are listed in the following tables.

### OracleCustomTypeMappingAttribute Constructors

OracleCustomTypeMappingAttribute constructors are listed in [Table 17-1](#).

**Table 17-1 OracleCustomTypeMappingAttribute Constructors**

Constructor	Description
<a href="#">OracleCustomTypeMappingAttribute Constructors</a>	Instantiates a new instance of OracleCustomTypeMappingAttribute class

### OracleCustomTypeMappingAttribute Static Methods

OracleCustomTypeMappingAttribute static methods are listed in [Table 17-2](#).

**Table 17-2 OracleCustomTypeMappingAttribute Static Methods**

Method	Description
Equals	Inherited from System.Attribute
GetCustomAttribute	Inherited from System.Attribute
GetCustomAttributes	Inherited from System.Attribute
IsDefined	Inherited from System.Attribute
ReferenceEquals	Inherited from System.Attribute

### OracleCustomTypeMappingAttribute Properties

OracleCustomTypeMappingAttribute properties are listed in [Table 17-3](#).

**Table 17-3 OracleCustomTypeMappingAttribute Properties**

Property	Description
<a href="#">UdtTypeName</a>	Specifies the Oracle user-defined type name that the custom class maps to

**Table 17-3 (Cont.) OracleCustomTypeMappingAttribute Properties**

Property	Description
TypeId	Inherited from System.Attribute

**OracleCustomTypeMappingAttribute Methods**

OracleCustomTypeMappingAttribute methods are listed in [Table 17-4](#).

**Table 17-4 OracleCustomTypeMappingAttribute Methods**

Method	Description
Equals	Inherited from System.Attribute
GetHashCode	Inherited from System.Attribute
GetType	Inherited from System.Attribute
IsDefaultAttribute	Inherited from System.Attribute
Match	Inherited from System.Attribute
ToString	Inherited from System.Attribute

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleCustomTypeMappingAttribute Class](#)

## OracleCustomTypeMappingAttribute Constructors

OracleCustomTypeMappingAttribute constructors create new instances of the OracleCustomTypeMappingAttribute class.

**Overload List:**

- [OracleCustomTypeMappingAttribute\(string\)](#)

This constructor creates and initializes an OracleCustomTypeMappingAttribute using the specified Oracle user-defined type name.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleCustomTypeMappingAttribute Class](#)
- [OracleCustomTypeMappingAttribute Methods](#)

## OracleCustomTypeMappingAttribute(string)

This constructor creates and initializes an `OracleCustomTypeMappingAttribute` using the specified Oracle user-defined type name.

### Declaration

```
// C#
public OracleCustomTypeMappingAttribute(string udtTypeName)
```

### Parameters

- *udtTypeName*

The Oracle user-defined type name that the custom class maps to.

### Remarks

The *udtTypeName* parameter is case-sensitive. The *udtTypeName* is specified in the form of *schema\_name.type\_name*.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleCustomTypeMappingAttribute Class](#)
- [OracleCustomTypeMappingAttribute Members](#)

## OracleCustomTypeMappingAttribute Static Methods

`OracleCustomTypeMappingAttribute` static methods are listed in [Table 17-5](#).

**Table 17-5 OracleCustomTypeMappingAttribute Static Methods**

Method	Description
<code>Equals</code>	Inherited from <code>System.Attribute</code>
<code>GetCustomAttribute</code>	Inherited from <code>System.Attribute</code>
<code>GetCustomAttributes</code>	Inherited from <code>System.Attribute</code>

**Table 17-5 (Cont.) OracleCustomTypeMappingAttribute Static Methods**

Method	Description
IsDefined	Inherited from <code>System.Attribute</code>
ReferenceEquals	Inherited from <code>System.Attribute</code>

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleCustomTypeMappingAttribute Class](#)
- [OracleCustomTypeMappingAttribute Members](#)

## OracleCustomTypeMappingAttribute Properties

`OracleCustomTypeMappingAttribute` properties are listed in [Table 17-6](#).

**Table 17-6 OracleCustomTypeMappingAttribute Properties**

Property	Description
<a href="#">UdtTypeName</a>	Specifies the Oracle user-defined type name that the custom class maps to
TypeId	Inherited from <code>System.Attribute</code>

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleCustomTypeMappingAttribute Class](#)
- [OracleCustomTypeMappingAttribute Members](#)

## UdtTypeName

This property specifies the Oracle user-defined type name that the custom class maps to.

**Declaration**

```
// C#  
public string UdtTypeName {get; set;}
```

**Property Value**

A string that represents an Oracle user-defined type name.

**Remarks**

UdtTypeName is case-sensitive. It is specified in the form of *schema\_name.type\_name*.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleCustomTypeMappingAttribute Class](#)
- [OracleCustomTypeMappingAttribute Members](#)

## OracleCustomTypeMappingAttribute Methods

OracleCustomTypeMappingAttribute methods are listed in [Table 17-7](#).

**Table 17-7 OracleCustomTypeMappingAttribute Methods**

Method	Description
Equals	Inherited from System.Attribute
GetHashCode	Inherited from System.Attribute
GetType	Inherited from System.Attribute
IsDefaultAttribute	Inherited from System.Attribute
Match	Inherited from System.Attribute
ToString	Inherited from System.Attribute

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleCustomTypeMappingAttribute Class](#)
- [OracleCustomTypeMappingAttribute Members](#)

## OracleObjectMappingAttribute Class

The OracleObjectMappingAttribute class marks custom class fields or properties with information that ODP.NET uses when a custom type represents an Oracle Object type.

## Class Inheritance

```
System.Object
    System.Attribute
        System.OracleObjectMappingAttribute
```

## Declaration

```
// C#
[AttributeUsageAttribute(AttributeTargets.Field|AttributeTargets.Property,
AllowMultiple=false, Inherited=true)]

public sealed class OracleObjectMappingAttribute : Attribute
```

## Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

## Remarks

The `OracleObjectMappingAttribute` is specified on members of a custom type that represent an Oracle object type. This attribute must specify the name or zero-based index of the attribute in the Oracle object that the custom class field or property maps to. This also allows the custom type to declare field or property names which differ from the Oracle Object type.

## Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleObjectMappingAttribute Members](#)
- [OracleObjectMappingAttribute Constructors](#)
- [OracleObjectMappingAttribute Static Methods](#)
- [OracleObjectMappingAttribute Properties](#)
- [OracleObjectMappingAttribute Methods](#)

## OracleObjectMappingAttribute Members

OracleObjectMappingAttribute members are listed in the following tables.

### OracleObjectMappingAttribute Constructors

OracleObjectMappingAttribute constructors are listed in [Table 17-8](#).

**Table 17-8 OracleObjectMappingAttribute Constructors**

Constructor	Description
<a href="#">OracleObjectMappingAttribute Constructors</a>	Instantiates a new instance of OracleObjectMappingAttribute class (Overloaded)

### OracleObjectMappingAttribute Static Methods

OracleObjectMappingAttribute static methods are listed in [Table 17-9](#).

**Table 17-9 OracleObjectMappingAttribute Static Methods**

Method	Description
Equals	Inherited from System.Attribute
GetCustomAttribute	Inherited from System.Attribute
GetCustomAttributes	Inherited from System.Attribute
IsDefined	Inherited from System.Attribute
ReferenceEquals	Inherited from System.Attribute

### OracleObjectMappingAttribute Properties

OracleObjectMappingAttribute properties are listed in [Table 17-10](#).

**Table 17-10 OracleObjectMappingAttribute Properties**

Property	Description
<a href="#">AttributeIndex</a>	Specifies the index of the Oracle Object attribute that must be retrieved
<a href="#">AttributeName</a>	Specifies the name of Oracle Object attribute that must be retrieved
TypeId	Inherited from <code>System.Attribute</code>

**OracleObjectMappingAttribute Methods**

`OracleObjectMappingAttribute` methods are listed in [Table 17-11](#).

**Table 17-11 OracleObjectMappingAttribute Methods**

Method	Description
<code>Equals</code>	Inherited from <code>System.Attribute</code>
<code>GetHashCode</code>	Inherited from <code>System.Attribute</code>
<code>GetType</code>	Inherited from <code>System.Attribute</code>
<code>IsDefaultAttribute</code>	Inherited from <code>System.Attribute</code>
<code>Match</code>	Inherited from <code>System.Attribute</code>
<code>ToString</code>	Inherited from <code>System.Attribute</code>

**See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleObjectMappingAttribute Class](#)

## OracleObjectMappingAttribute Constructors

`OracleObjectMappingAttribute` constructors create new instances of the `OracleObjectMappingAttribute` class.

**Overload List:**

- [OracleObjectMappingAttribute\(string\)](#)  
This constructor creates and initializes an `OracleObjectMappingAttribute` object with the specified Oracle Object attribute name.
- [OracleObjectMappingAttribute\(int\)](#)  
This constructor creates and initializes an `OracleObjectMappingAttribute` with the specified Oracle Object attribute index.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleObjectMappingAttribute Class](#)
- [OracleObjectMappingAttribute Members](#)

## OracleObjectMappingAttribute(string)

This constructor creates and initializes an `OracleObjectMappingAttribute` object with the specified Oracle Object attribute name.

### Declaration

```
// C#  
public OracleObjectMappingAttribute(string attrName);
```

### Parameters

- *attrName*  
The name of the Oracle Object attribute to map to.

### Remarks

The *attrName* parameter is case-sensitive.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleObjectMappingAttribute Class](#)
- [OracleObjectMappingAttribute Members](#)

## OracleObjectMappingAttribute(int)

This constructor creates and initializes an `OracleObjectMappingAttribute` object with the specified Oracle Object attribute index.

### Declaration

```
// C#  
public OracleObjectMappingAttribute(int attrIndex);
```

### Parameters

- *attrIndex*  
The zero-based index of the Oracle Object attribute to map to.

 See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleObjectMappingAttribute Class](#)
- [OracleObjectMappingAttribute Members](#)

## OracleObjectMappingAttribute Static Methods

OracleObjectMappingAttribute static methods are listed in [Table 17-12](#).

**Table 17-12 OracleObjectMappingAttribute Static Method**

Method	Description
Equals	Inherited from System.Attribute
GetCustomAttribute	Inherited from System.Attribute
GetCustomAttributes	Inherited from System.Attribute
IsDefined	Inherited from System.Attribute
ReferenceEquals	Inherited from System.Attribute

 See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleObjectMappingAttribute Class](#)
- [OracleObjectMappingAttribute Members](#)

## OracleObjectMappingAttribute Properties

OracleObjectMappingAttribute properties are listed in [Table 17-13](#).

**Table 17-13 OracleObjectMappingAttribute Properties**

Property	Description
<a href="#">AttributeIndex</a>	Specifies the index of the Oracle Object attribute that must be retrieved
<a href="#">AttributeName</a>	Specifies the name of the Oracle Object attribute that must be retrieved
TypeId	Inherited from System.Attribute

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleObjectMappingAttribute Class](#)
- [OracleObjectMappingAttribute Members](#)

## AttributeIndex

This property specifies the index of the Oracle Object attribute that must be retrieved.

### Declaration

```
// C#  
public int AttributeIndex {get;}
```

### Property Value

The zero-based index of an Oracle Object type attribute.

### Remarks

The `AttributeIndex` property specifies the index of the Oracle Object type attribute that the custom class field or property maps to. This allows the custom class to declare fields or property names that differ from the Oracle object.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleObjectMappingAttribute Class](#)
- [OracleObjectMappingAttribute Members](#)

## AttributeName

This property specifies the name of the Oracle Object attribute that must be retrieved.

### Declaration

```
// C#  
public string AttributeName {get;}
```

### Property Value

The name of an attribute of an Oracle Object type.

## Remarks

The `AttributeName` property specifies name of the attribute in the Oracle Object type that the custom class field or property maps to. This allows the custom class to declare field or property names that differ from the Oracle object.

The specified attribute name is case-sensitive.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleObjectMappingAttribute Class](#)
- [OracleObjectMappingAttribute Members](#)

## OracleObjectMappingAttribute Methods

`OracleObjectMappingAttribute` methods are listed in [Table 17-14](#).

**Table 17-14 OracleObjectMappingAttribute Methods**

Method	Description
<code>Equals</code>	Inherited from <code>System.Attribute</code>
<code>GetHashCode</code>	Inherited from <code>System.Attribute</code>
<code>GetType</code>	Inherited from <code>System.Attribute</code>
<code>IsDefaultAttribute</code>	Inherited from <code>System.Attribute</code>
<code>Match</code>	Inherited from <code>System.Attribute</code>
<code>ToString</code>	Inherited from <code>System.Attribute</code>

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleObjectMappingAttribute Class](#)
- [OracleObjectMappingAttribute Members](#)

## OracleArrayMappingAttribute Class

The `OracleArrayMappingAttribute` class is required to mark a custom class field or property with information that ODP.NET uses when a custom type represents an Oracle Collection type.

## Class Inheritance

System.Object

System.Attribute

System.OracleArrayMappingAttribute

## Declaration

[AttributeUsageAttribute(AttributeTargets.Field|AttributeTargets.Property, AllowMultiple=false, Inherited=true)]

```
// C#
public sealed class OracleArrayMappingAttribute : Attribute
```

## Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

## Remarks

An `OracleArrayMappingAttribute` object must be specified when a custom type represents an Oracle Collection. This attribute is applied only to the custom class member that stores the collection elements.

## Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleArrayMappingAttribute Members](#)
- [OracleArrayMappingAttribute Constructors](#)
- [OracleArrayMappingAttribute Static Methods](#)
- [OracleArrayMappingAttribute Properties](#)
- [OracleArrayMappingAttribute Methods](#)

## OracleArrayMappingAttribute Members

OracleArrayMappingAttribute members are listed in the following tables.

### OracleArrayMappingAttribute Constructors

OracleArrayMappingAttribute constructors are listed in [Table 17-15](#).

**Table 17-15 OracleArrayMappingAttribute Constructors**

Constructor	Description
<a href="#">OracleArrayMappingAttribute Constructors</a>	Instantiates a new instance of OracleArrayMappingAttribute class (Overloaded)

### OracleArrayMappingAttribute Static Methods

OracleArrayMappingAttribute static methods are listed in [Table 17-16](#).

**Table 17-16 OracleArrayMappingAttribute Static Methods**

Method	Description
Equals	Inherited from System.Attribute
GetCustomAttribute	Inherited from System.Attribute
GetCustomAttributes	Inherited from System.Attribute
IsDefined	Inherited from System.Attribute
ReferenceEquals	Inherited from System.Attribute

### OracleArrayMappingAttribute Properties

OracleArrayMappingAttribute properties are listed in [Table 17-17](#).

**Table 17-17 OracleArrayMappingAttribute Properties**

Property	Description
TypeId	Inherited from System.Attribute

### OracleArrayMappingAttribute Methods

OracleArrayMappingAttribute methods are listed in [Table 17-18](#).

**Table 17-18 OracleArrayMappingAttribute Methods**

Method	Description
Equals	Inherited from System.Attribute
GetHashCode	Inherited from System.Attribute
GetType	Inherited from System.Attribute

**Table 17-18 (Cont.) OracleArrayMappingAttribute Methods**

Method	Description
IsDefaultAttribute	Inherited from <code>System.Attribute</code>
Match	Inherited from <code>System.Attribute</code>
ToString	Inherited from <code>System.Attribute</code>

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleArrayMappingAttribute Class](#)

## OracleArrayMappingAttribute Constructors

`OracleArrayMappingAttribute` constructors create new instances of the `OracleArrayMappingAttribute` class.

**Overload List:**

- [OracleArrayMappingAttribute\(\)](#)  
This constructor creates and initializes an `OracleArrayMappingAttribute` object.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleArrayMappingAttribute Class](#)
- [OracleArrayMappingAttribute Members](#)

## OracleArrayMappingAttribute()

This constructor creates and initializes an `OracleArrayMappingAttribute` object.

**Declaration**

```
// C#  
public OracleArrayMappingAttribute();
```

**Remarks**

An `OracleArrayMappingAttribute` object must be applied when a custom class represents an Oracle Collection type, to specify the custom class field or property that stores the collection elements.

The `OracleArrayMappingAttribute` can be applied to only one field or property in the custom class.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleArrayMappingAttribute Class](#)
- [OracleArrayMappingAttribute Members](#)

## OracleArrayMappingAttribute Static Methods

`OracleArrayMappingAttribute` static methods are listed in [Table 17-19](#).

**Table 17-19 OracleArrayMappingAttribute Static Methods**

Method	Description
<code>Equals</code>	Inherited from <code>System.Attribute</code>
<code>GetCustomAttribute</code>	Inherited from <code>System.Attribute</code>
<code>GetCustomAttributes</code>	Inherited from <code>System.Attribute</code>
<code>IsDefined</code>	Inherited from <code>System.Attribute</code>
<code>ReferenceEquals</code>	Inherited from <code>System.Attribute</code>



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleArrayMappingAttribute Class](#)
- [OracleArrayMappingAttribute Members](#)

## OracleArrayMappingAttribute Properties

`OracleArrayMappingAttribute` properties are listed in [Table 17-20](#).

**Table 17-20 OracleArrayMappingAttribute Properties**

Property	Description
<code>TypeId</code>	Inherited from <code>System.Attribute</code>

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleArrayMappingAttribute Class](#)
- [OracleArrayMappingAttribute Members](#)

## OracleArrayMappingAttribute Methods

OracleArrayMappingAttribute methods are listed in [Table 17-21](#).

**Table 17-21 OracleArrayMappingAttribute Methods**

Method	Description
Equals	Inherited from System.Attribute
GetHashCode	Inherited from System.Attribute
GetType	Inherited from System.Attribute
IsDefaultAttribute	Inherited from System.Attribute
Match	Inherited from System.Attribute
ToString	Inherited from System.Attribute

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleArrayMappingAttribute Class](#)
- [OracleArrayMappingAttribute Members](#)

## IOracleCustomType Interface

IOracleCustomType is an interface for converting between a Custom Type and an Oracle Object or Collection Type.

### Declaration

```
// C#
public interface IOracleCustomType
```

## Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

## Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [IOracleCustomType Members](#)
- [IOracleCustomType Interface Methods](#)

## IOracleCustomType Members

IOracleCustomType members are listed in the following tables.

### IOracleCustomType Interface Methods

IOracleCustomType interface methods are listed in [Table 17-22](#).

**Table 17-22 IOracleCustomType Interface Methods**

Interface Method	Description
<a href="#">FromCustomObject(OracleConnection, IntPtr)</a>	Returns the values that set the Oracle Object attributes <i>Available in ODP.NET, Unmanaged Driver only</i>
<a href="#">FromCustomObject(OracleConnection, object)</a>	Returns the values that set the Oracle Object attributes <i>Available in ODP.NET, Managed Driver and ODP.NET Core only</i>
<a href="#">ToCustomObject(OracleConnection, IntPtr)</a>	Provides the Oracle Object with the attribute values to set on the custom type <i>Available in ODP.NET, Unmanaged Driver only</i>
<a href="#">ToCustomObject(OracleConnection, object)</a>	Provides the Oracle Object with the attribute values to set on the custom type <i>Available in ODP.NET, Managed Driver and ODP.NET Core only</i>

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [IOracleCustomType Interface](#)

## IOracleCustomType Interface Methods

IOracleCustomType Interface methods are listed in [Table 17-23](#).

**Table 17-23 IOracleCustomType Interface Methods: Overload list**

Interface Method	Description
<a href="#">FromCustomObject(OracleConnection, IntPtr)</a>	Returns the values that set the Oracle Object attributes <i>Available in ODP.NET, Unmanaged Driver only</i>
<a href="#">FromCustomObject(OracleConnection, object)</a>	Returns the values that set the Oracle Object attributes <i>Available in ODP.NET, Managed Driver and ODP.NET Core only</i>
<a href="#">ToCustomObject(OracleConnection, IntPtr)</a>	Provides the Oracle Object with the attribute values to set on the custom type <i>Available in ODP.NET, Unmanaged Driver only</i>
<a href="#">ToCustomObject(OracleConnection, object)</a>	Provides the Oracle Object with the attribute values to set on the custom type <i>Available in ODP.NET, Managed Driver and ODP.NET Core only</i>

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [IOracleCustomType Interface](#)
- [IOracleCustomType Members](#)

### FromCustomObject(OracleConnection, IntPtr)

This interface method creates an Oracle Object or Collection by setting the attribute or element values respectively on the specified Oracle UDT.

**Declaration**

```
// C#
void FromCustomObject(OracleConnection con, IntPtr pUdt);
```

**Parameters**

- *con*

An `OracleConnection` instance.

- `pUdt`

An opaque pointer to the Oracle Object or Collection to be created.

### Remarks

The `FromCustomObject` method is used to build an Oracle Object or Collection from a custom object by setting attribute or element values respectively through the `OracleUdt.SetValue` method.

The `OracleUdt.SetValue` method is invoked as follows:

- **Oracle Object Type**  
For a custom type that represents an Oracle Object Type, the `OracleUdt.SetValue` method must be invoked for each non-NULL attribute value that needs to be set.
- **Oracle Collection Type**  
For a custom type that represents an Oracle Collection Type, a single call to `OracleUdt.SetValue` method specifies the collection element values.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [IOracleCustomType Interface](#)
- [IOracleCustomType Members](#)

## FromCustomObject(OracleConnection, object)

This interface method creates an Oracle Object or Collection by setting the attribute or element values respectively on the specified Oracle UDT.

### Declaration

```
// C#  
void FromCustomObject(OracleConnection con, object pUdt);
```

### Parameters

- `con`  
An `OracleConnection` instance.
- `pUdt`  
An object of Oracle Object or Collection to be created.

## Remarks

The `FromCustomObject` method is used to build an Oracle Object or Collection from a custom object by setting attribute or element values respectively through the `OracleUdt.SetValue` method.

The `OracleUdt.SetValue` method is invoked as follows:

- **Oracle Object Type**  
For a custom type that represents an Oracle Object Type, the `OracleUdt.SetValue` method must be invoked for each non-NULL attribute value that needs to be set.
- **Oracle Collection Type**  
For a custom type that represents an Oracle Collection Type, a single call to `OracleUdt.SetValue` method specifies the collection element values.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [IOracleCustomType Interface](#)
- [IOracleCustomType Members](#)

## ToCustomObject(OracleConnection, IntPtr)

This interface initializes a custom object using the specified Oracle UDT.

### Declaration

```
// C#  
void ToCustomObject (OracleConnection con, IntPtr pUdt);
```

### Parameters

- *con*  
An `OracleConnection` instance.
- *pUdt*  
An opaque pointer to the Oracle UDT.

### Remarks

The `ToCustomObject` method is used to initialize a custom object from the specified Oracle Object or Collection by retrieving attribute or element values respectively through the `OracleUdt.GetValue` method.

The `OracleUdt.GetValue` method is invoked as follows:

- **Oracle Object Type**

For a custom type that represents an Oracle Object Type, the `OracleUdt.GetValue` method must be invoked for each attribute value to be retrieved.

- For a custom type that represents an Oracle Collection Type, a single call to `OracleUdt.GetValue` method retrieves the collection element values.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [IOracleCustomType Interface](#)
- [IOracleCustomType Members](#)

## ToCustomObject(OracleConnection, object)

This interface initializes a custom object using the specified Oracle UDT.

### Declaration

```
// C#  
void ToCustomObject (OracleConnection con, object pUdt);
```

### Parameters

- *con*  
An `OracleConnection` instance.
- *pUdt*  
An object of the Oracle UDT.

### Remarks

The `ToCustomObject` method is used to initialize a custom object from the specified Oracle Object or Collection by retrieving attribute or element values respectively through the `OracleUdt.GetValue` method.

The `OracleUdt.GetValue` method is invoked as follows:

- Oracle Object Type  
For a custom type that represents an Oracle Object Type, the `OracleUdt.GetValue` method must be invoked for each attribute value to be retrieved.
- Oracle Collection Type  
For a custom type that represents an Oracle Collection Type, a single call to `OracleUdt.GetValue` method retrieves the collection element values.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [IOracleCustomType Interface](#)
- [IOracleCustomType Members](#)

## IOracleCustomTypeFactory Interface

The `IOracleCustomTypeFactory` interface is used by ODP.NET to create custom objects that represent Oracle Objects or Collections.

### Declaration

```
// C#
public interface IOracleCustomTypeFactory
```

### Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

### Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [IOracleCustomTypeFactory Members](#)
- [IOracleCustomTypeFactory Interface Methods](#)

## IOracleCustomTypeFactory Members

`IOracleCustomTypeFactory` members are listed in the following tables.

## IOracleCustomTypeFactory Interface Methods

IOracleCustomTypeFactory interface methods are listed in [Table 17-24](#).

**Table 17-24** IOracleCustomTypeFactory Interface Methods

Public Method	Description
<a href="#">CreateObject</a>	Returns a new custom object to represent an Oracle Object or Collection

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [IOracleCustomTypeFactory Interface](#)

## IOracleCustomTypeFactory Interface Methods

IOracleCustomTypeFactory Interface methods are listed in [Table 17-25](#).

**Table 17-25** IOracleCustomTypeFactory Interface Methods

Public Method	Description
<a href="#">CreateObject</a>	Returns a new custom object to represent an Oracle Object or Collection

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [IOracleCustomTypeFactory Interface](#)
- [IOracleCustomTypeFactory Members](#)

## CreateObject

This interface method returns a new custom object to represent an Oracle Object or Collection.

### Declaration

```
// C#
IOracleCustomType CreateObject();
```

**Return Value**

An `IOracleCustomType` object.

**Remarks**

The `CreateObject` method is used to create a new instance of a custom object to represent an Oracle Object or Collection.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [IOracleCustomTypeFactory Interface](#)
- [IOracleCustomTypeFactory Members](#)

## IOracleArrayTypeFactory Interface

The `IOracleArrayTypeFactory` interface is used by ODP.NET to create arrays that represent Oracle Collections.

**Declaration**

```
// C#
public interface IOracleArrayTypeFactory
```

**Requirements**

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

**Thread Safety**

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [IOracleArrayTypeFactory Members](#)
- [IOracleArrayTypeFactory Interface Methods](#)

## IOracleArrayTypeFactory Members

`IOracleArrayTypeFactory` members are listed in the following tables.

### IOracleArrayTypeFactory Interface Methods

`IOracleArrayTypeFactory` interface methods are listed in [Table 17-26](#).

**Table 17-26 IOracleArrayTypeFactory Interface Methods**

Public Method	Description
<a href="#">CreateArray</a>	Returns a new array of the specified length to store Oracle Collection elements
<a href="#">CreateStatusArray</a>	Returns a newly allocated <code>OracleUdtStatus</code> array of the specified length that will be used to store the null status of the collection elements

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [IOracleArrayTypeFactory Interface](#)

## IOracleArrayTypeFactory Interface Methods

`IOracleArrayTypeFactory` Interface methods are listed in [Table 17-27](#).

**Table 17-27 IOracleArrayTypeFactory Interface Methods**

Public Method	Description
<a href="#">CreateArray</a>	Returns a new array of the specified length to store Oracle Collection elements
<a href="#">CreateStatusArray</a>	Returns a newly allocated <code>OracleUdtStatus</code> array of the specified length that will be used to store the null status of the collection elements

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [IOracleArrayTypeFactory Interface](#)
- [IOracleArrayTypeFactory Members](#)

## CreateArray

This interface method returns a new array of the specified length to store Oracle Collection elements.

### Declaration

```
// C#  
Array CreateArray(int numElems);
```

### Parameters

- *numElems*  
The number of collection elements to be returned.

### Return Value

A `System.Array` object.

### Remarks

An Oracle Collection Type may be represented in either of the following ways:

- As an array of the appropriate type. The type must be able to represent a collection element.
- As a Custom Type that contains an array of the appropriate type.

In both cases, the `CreateArray` method creates an array of the specified length to store the collection elements.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [IOracleArrayTypeFactory Interface](#)
- [IOracleArrayTypeFactory Members](#)

## CreateStatusArray

This method returns a newly allocated `OracleUdtStatus` array of the specified length that will be used to store the null status of the collection elements.

### Declaration

```
// C#  
Array CreateStatusArray(int numElems);
```

### Parameters

- *numElems*

The number of collection elements to be returned.

### Return Value

A multi-dimensional `OracleUdtStatus` array as a `System.Array`.

### Remarks

An Oracle Collection Type can be represented in the following ways:

- As an array of the appropriate type. The type must be able to represent a collection element.
- As a Custom Type that contains an array of the appropriate type.

In both cases, the `CreateStatusArray` method creates an `OracleUdtStatus` array of the specified length that stores the null status of the collection elements.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [IOracleArrayTypeFactory Interface](#)
- [IOracleArrayTypeFactory Members](#)
- ["OracleUdtFetchOption Enumeration"](#)

## OracleUdt Class

The `OracleUdt` class defines static methods that are used when converting between Custom Types and Oracle UDTs and vice-versa.

### Class Inheritance

```
System.Object
```

```
    System.OracleUdt
```

### Declaration

```
public sealed class OracleUdt
```

## Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

## Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleUdt Members](#)
- [OracleUDT Static Methods](#)

## OracleUdt Members

OracleUdt static methods are listed in [Table 17-28](#).

**Table 17-28 OracleUdt Static Methods**

Static Method	Description
Equals	Inherited from <code>System.Object</code>
<a href="#">GetValue</a>	Gets the attributes or elements from the specified Oracle UDT (Overloaded)
<a href="#">IsDBNull</a>	Indicates whether or not the specified attribute being retrieved is NULL (Overloaded)
<a href="#">SetValue</a>	Sets the attributes or elements on the specified Oracle UDT (Overloaded)

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleUdt Class](#)

## OracleUDT Static Methods

OracleUDT methods are listed in [Table 17-29](#).

**Table 17-29 OracleUdt Static Methods**

Static Method	Description
Equals	Inherited from <code>System.Object</code>
<a href="#">GetValue</a>	Gets the attributes or elements from the specified Oracle UDT (Overloaded)
<a href="#">IsDBNull</a>	Indicates whether or not the specified attribute being retrieved is NULL (Overloaded)
<a href="#">SetValue</a>	Sets the attributes or elements on the specified Oracle UDT (Overloaded)

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleUdt Class](#)
- [OracleUdt Members](#)

## GetValue

GetValue methods get the attributes or elements from the specified Oracle UDT.

### Overload List for ODP.NET, Unmanaged Driver:

- [GetValue\(OracleConnection, IntPtr, string\)](#)  
This method gets the attributes or elements from the specified Oracle UDT, using the specified attribute name.
- [GetValue\(OracleConnection, IntPtr, int\)](#)  
This method gets the attribute or elements from the specified Oracle UDT, using the specified index.
- [GetValue\(OracleConnection, IntPtr, string, out object\)](#)

This method returns either the elements of the specified collection attribute of the specified Oracle Object or the elements of the specified Oracle Collection.

- [GetValue\(OracleConnection, IntPtr, int, out object\)](#)

This method returns either the elements of the specified collection attribute of the specified Oracle Object or the elements of the specified Oracle Collection.

#### Overload List for ODP.NET, Managed Driver and ODP.NET Core:

- [GetValue\(OracleConnection, object, string\)](#)

This method gets the attributes or elements from the specified Oracle UDT, using the specified attribute name.

- [GetValue\(OracleConnection, object, int\)](#)

This method gets the attribute or elements from the specified Oracle UDT, using the specified index.

- [GetValue\(OracleConnection, object, string, out object\)](#)

This method returns either the elements of the specified collection attribute of the specified Oracle Object or the elements of the specified Oracle Collection.

- [GetValue\(OracleConnection, object, int, out object\)](#)

This method returns either the elements of the specified collection attribute of the specified Oracle Object or the elements of the specified Oracle Collection.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleUdt Class](#)
- ["OracleUdt Members"](#)

## GetValue(OracleConnection, IntPtr, string)

This method gets the attributes or elements from the specified Oracle UDT, using the specified attribute name.

### Declaration

```
public static object GetValue(OracleConnection con, IntPtr pUdt, string attrName);
```

### Parameters

- *con*  
An `OracleConnection` instance.
- *pUdt*  
A pointer to an Oracle UDT.
- *attrName*

The case-sensitive name of the attribute to be retrieved. Null is specified for retrieving collection elements from a Custom Type that represents an Oracle Collection.

### Return Value

An object representing the returned attribute or collection elements.

### Exceptions

`ArgumentException` - The specified name is not a valid attribute name.

### Remarks

The `IOracleCustomType.ToCustomObject` method invokes `OracleUdt.GetValue` method passing it the `con` and `pUdt` parameters. The `OracleUdt.GetValue` method returns these types of object:

- **Oracle Object Type**  
For a Custom Type that represents an Oracle Object Type, the type returned for a specified attribute name is the type of the member in the custom class or struct that is mapped to the attribute using the `OracleObjectMappingAttribute` object.
- **Oracle Collection Type**  
For a Custom Type that represents an Oracle Collection Type, the type returned is the type of the member in the custom class or struct to which the `OracleArrayMappingAttribute` object is applied.

In the case of `NULL` attribute values, the appropriate null representation of the type is returned. For example, for attributes that are represented as Custom Types and Provider Specific Types, the static `Null` property of the type is returned. For attributes that are represented as Nullable types, for example, `System.String` and `System.Array` Types, null is returned, and for all other remaining built-in types such as `Int32` and `DateTime` `DBNull.Value` is returned.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleUdt Class](#)
- [OracleUdt Members](#)
- ["OracleUdtFetchOption Enumeration"](#)

## GetValue(OracleConnection, IntPtr, int)

This method gets the attribute or elements from the specified Oracle UDT, using the specified index.

## Declaration

```
// C#  
public static object GetValue(OracleConnection con, IntPtr pUdt, int attrIndex,);
```

## Parameters

- *con*  
An `OracleConnection` instance.
- *pUdt*  
A pointer to an Oracle UDT.
- *attrIndex*  
The zero-based index of the attribute to be retrieved. For retrieving collection elements from a Custom Type that represents an Oracle Collection, zero must be specified.

## Return Value

An object representing the returned attribute or collection elements.

## Exceptions

`ArgumentOutOfRangeException` - The specified index is not a valid attribute index.

## Remarks

The `IOracleCustomType.ToCustomObject` method invokes `OracleUdt.GetValue` method passing it the *con* and *pUdt* parameters. The `OracleUdt.GetValue` method returns these types of object:

- Oracle Object Type  
For a Custom Type that represents an Oracle Object Type, the type returned for a specified attribute index is the type of the member in the custom class or struct that is mapped to the attribute using the `OracleObjectMappingAttribute` object.
- Oracle Collection Type  
For a Custom Type that represents an Oracle Collection Type, the type returned is the type of the member in the custom class or struct to which the `OracleArrayMappingAttribute` object is applied.

In the case of `NULL` attribute values, the appropriate null representation of the type is returned. For example, for attributes that are represented as Custom Types and Provider Specific Types, the static `Null` property of the type is returned. For attributes that are represented as Nullable types, for example, `System.String` and `System.Array` Types, null is returned, and for all other remaining built-in types such as `Int32` and `DateTime` `DBNull.Value` is returned.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleUdt Class](#)
- [OracleUdt Members](#)
- ["OracleUdtFetchOption Enumeration"](#)

## GetValue(OracleConnection, IntPtr, string, out object)

This method returns either the elements of the specified collection attribute of the specified Oracle Object or the elements of the specified Oracle Collection.

### Declaration

```
// C#  
public static object GetValue(OracleConnection con, IntPtr pUdt, string attrName,  
    out object statusArray);
```

### Parameters

- *con*  
An `OracleConnection` instance.
- *pUdt*  
An opaque pointer to an Oracle UDT.
- *attrName*  
The case-sensitive name of the attribute to be retrieved. Null must be specified for retrieving collection elements from a Custom Type that represents an Oracle Collection.
- *statusArray*  
The `OracleUdtStatus` array which returns the null status for the retrieved collection elements.

### Return Value

An object representing the returned attribute or collection elements.

### Exceptions

`ArgumentException` - The specified name is not a valid attribute name.

### Remarks

The `IOracleCustomType.ToCustomObject` method invokes `OracleUdt.GetValue` method passing it the *con* and *pUdt* parameters. The `OracleUdt.GetValue` method returns these types of object:

- Oracle Object Type

For a Custom Type that represents an Oracle Object Type, the type returned for a specified attribute name is the type of the member in the custom class or struct that is mapped to the attribute using the `OracleObjectMappingAttribute` object.

- **Oracle Collection Type**

For a Custom Type that represents an Oracle Collection Type, the type returned is the type of the member in the custom class or struct to which the `OracleArrayMappingAttribute` object is applied.

In the case of `NULL` attribute values, the appropriate null representation of the type is returned. For example, for attributes that are represented as Custom Types and Provider Specific Types, the static `Null` property of the type is returned. For attributes that are represented as Nullable types, for example, `System.String` and `System.Array` Types, null is returned, and for all other remaining built-in types such as `Int32` and `DateTime` `DBNull.Value` is returned.

If the collection being returned is not `NULL`, the output `statusArray` parameter is populated with the null status for each of the collection elements.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleUdt Class](#)
- [OracleUdt Members](#)
- ["OracleUdtFetchOption Enumeration"](#)

## GetValue(OracleConnection, IntPtr, int, out object)

This method returns either the elements of the specified collection attribute of the specified Oracle Object or the elements of the specified Oracle Collection.

### Declaration

```
// C#
public static object GetValue(OracleConnection con, IntPtr pUdt, int attrIndex,
    out object statusArray);
```

### Parameters

- `con`  
An `OracleConnection` instance.
- `pUdt`  
An opaque pointer to an Oracle UDT.
- `attrIndex`  
The zero-based index of the attribute to be retrieved. For retrieving collection elements from a Custom Type that represents an Oracle Collection, 0 is specified.
- `statusArray`

The `OracleUdtStatus` array which returns the null status for the retrieved collection elements.

### Return Value

An object representing the returned attribute or collection elements.

### Exceptions

`ArgumentOutOfRangeException` - The specified index is not a valid attribute index.

### Remarks

The `IOracleCustomType.ToCustomObject` method invokes `OracleUdt.GetValue` method passing it the `con` and `pUdt` parameters. The `OracleUdt.GetValue` method returns these types of object:

- Oracle Object Type  
For a Custom Type that represents an Oracle Object Type, the type returned for a specified attribute index is the type of the member in the custom class or struct that is mapped to the attribute using the `OracleObjectMappingAttribute` object.
- Oracle Collection Type  
For a Custom Type that represents an Oracle Collection Type, the type returned is the type of the member in the custom class or struct to which the `OracleArrayMappingAttribute` object is applied.

In the case of `NULL` attribute values, the appropriate null representation of the type is returned. For example, for attributes that are represented as Custom Types and Provider Specific Types, the static `Null` property of the type is returned. For attributes that are represented as Nullable types, for example, `System.String` and `System.Array` Types, null is returned, and for all other remaining built-in types such as `Int32` and `DateTime` `DBNull.Value` is returned.

If the collection being returned is not `NULL`, the output `statusArray` parameter is populated with the null status for each of the collection elements.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleUdt Class](#)
- [OracleUdt Members](#)
- ["OracleUdtFetchOption Enumeration"](#)

## GetValue(OracleConnection, object, string)

This method gets the attributes or elements from the specified Oracle UDT, using the specified attribute name.

## Declaration

```
public static object GetValue(OracleConnection con, object Udt, string attrName);
```

## Parameters

- *con*  
An `OracleConnection` instance.
- *Udt*  
An object of an Oracle UDT.
- *attrName*  
The case-sensitive name of the attribute to be retrieved. Null is specified for retrieving collection elements from a Custom Type that represents an Oracle Collection.

## Return Value

An object representing the returned attribute or collection elements.

## Exceptions

`ArgumentException` - The specified name is not a valid attribute name.

## Remarks

The `IOracleCustomType.ToCustomObject` method invokes `OracleUdt.GetValue` method passing it the *con* and *Udt* parameters. The `OracleUdt.GetValue` method returns these types of object:

- Oracle Object Type  
For a Custom Type that represents an Oracle Object Type, the type returned for a specified attribute name is the type of the member in the custom class or struct that is mapped to the attribute using the `OracleObjectMappingAttribute` object.
- Oracle Collection Type  
For a Custom Type that represents an Oracle Collection Type, the type returned is the type of the member in the custom class or struct to which the `OracleArrayMappingAttribute` object is applied.

In the case of `NULL` attribute values, the appropriate null representation of the type is returned. For example, for attributes that are represented as Custom Types and Provider Specific Types, the static `Null` property of the type is returned. For attributes that are represented as Nullable types, for example, `System.String` and `System.Array` Types, null is returned, and for all other remaining built-in types such as `Int32` and `DateTime` `DBNull.Value` is returned.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleUdt Class](#)
- [OracleUdt Members](#)
- ["OracleUdtFetchOption Enumeration"](#)

## GetValue(OracleConnection, object, int)

This method gets the attribute or elements from the specified Oracle UDT, using the specified index.

### Declaration

```
// C#  
public static object GetValue(OracleConnection con, object Udt, int attrIndex,);
```

### Parameters

- *con*  
An `OracleConnection` instance.
- *Udt*  
An Oracle UDT object.
- *attrIndex*  
The zero-based index of the attribute to be retrieved. For retrieving collection elements from a Custom Type that represents an Oracle Collection, zero must be specified.

### Return Value

An object representing the returned attribute or collection elements.

### Exceptions

`ArgumentOutOfRangeException` - The specified index is not a valid attribute index.

### Remarks

The `IOracleCustomType.ToCustomObject` method invokes `OracleUdt.GetValue` method passing it the `con` and `Udt` parameters. The `OracleUdt.GetValue` method returns these types of object:

- Oracle Object Type  
For a Custom Type that represents an Oracle Object Type, the type returned for a specified attribute index is the type of the member in the custom class or struct that is mapped to the attribute using the `OracleObjectMappingAttribute` object.
- Oracle Collection Type

For a Custom Type that represents an Oracle Collection Type, the type returned is the type of the member in the custom class or struct to which the `OracleArrayMappingAttribute` object is applied.

In the case of `NULL` attribute values, the appropriate null representation of the type is returned. For example, for attributes that are represented as Custom Types and Provider Specific Types, the static `Null` property of the type is returned. For attributes that are represented as Nullable types, for example, `System.String` and `System.Array` Types, null is returned, and for all other remaining built-in types such as `Int32` and `DateTime` `DBNull.Value` is returned.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleUdt Class](#)
- [OracleUdt Members](#)
- ["OracleUdtFetchOption Enumeration"](#)

## GetValue(OracleConnection, object, string, out object)

This method returns either the elements of the specified collection attribute of the specified Oracle Object or the elements of the specified Oracle Collection.

### Declaration

```
// C#
public static object GetValue(OracleConnection con, object Udt, string attrName,
    out object statusArray);
```

### Parameters

- *con*  
An `OracleConnection` instance.
- *pUdt*  
An Oracle UDT object.
- *attrName*  
The case-sensitive name of the attribute to be retrieved. Null must specified for retrieving collection elements from a Custom Type that represents an Oracle Collection.
- *statusArray*  
The `OracleUdtStatus` array which returns the null status for the retrieved collection elements.

### Return Value

An object representing the returned attribute or collection elements.

## Exceptions

`ArgumentException` - The specified name is not a valid attribute name.

## Remarks

The `IOracleCustomType.ToCustomObject` method invokes `OracleUdt.GetValue` method passing it the `con` and `Udt` parameters. The `OracleUdt.GetValue` method returns these types of object:

- **Oracle Object Type**  
For a Custom Type that represents an Oracle Object Type, the type returned for a specified attribute name is the type of the member in the custom class or struct that is mapped to the attribute using the `OracleObjectMappingAttribute` object.
- **Oracle Collection Type**  
For a Custom Type that represents an Oracle Collection Type, the type returned is the type of the member in the custom class or struct to which the `OracleArrayMappingAttribute` object is applied.

In the case of `NULL` attribute values, the appropriate null representation of the type is returned. For example, for attributes that are represented as Custom Types and Provider Specific Types, the static `Null` property of the type is returned. For attributes that are represented as Nullable types, for example, `System.String` and `System.Array` Types, null is returned, and for all other remaining built-in types such as `Int32` and `DateTime` `DBNull.Value` is returned.

If the collection being returned is not `NULL`, the output `statusArray` parameter is populated with the null status for each of the collection elements.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleUdt Class](#)
- [OracleUdt Members](#)
- ["OracleUdtFetchOption Enumeration"](#)

## GetValue(OracleConnection, object, int, out object)

This method returns either the elements of the specified collection attribute of the specified Oracle Object or the elements of the specified Oracle Collection.

### Declaration

```
// C#
public static object GetValue(OracleConnection con, object Udt, int attrIndex,
    out object statusArray);
```

## Parameters

- *con*  
An `OracleConnection` instance.
- *Udt*  
An Oracle UDT object.
- *attrIndex*  
The zero-based index of the attribute to be retrieved. For retrieving collection elements from a Custom Type that represents an Oracle Collection, 0 is specified.
- *statusArray*  
The `OracleUdtStatus` array which returns the null status for the retrieved collection elements.

## Return Value

An object representing the returned attribute or collection elements.

## Exceptions

`ArgumentOutOfRangeException` - The specified index is not a valid attribute index.

## Remarks

The `IOracleCustomType.ToCustomObject` method invokes `OracleUdt.GetValue` method passing it the *con* and *Udt* parameters. The `OracleUdt.GetValue` method returns these types of object:

- Oracle Object Type  
For a Custom Type that represents an Oracle Object Type, the type returned for a specified attribute index is the type of the member in the custom class or struct that is mapped to the attribute using the `OracleObjectMappingAttribute` object.
- Oracle Collection Type  
For a Custom Type that represents an Oracle Collection Type, the type returned is the type of the member in the custom class or struct to which the `OracleArrayMappingAttribute` object is applied.

In the case of `NULL` attribute values, the appropriate null representation of the type is returned. For example, for attributes that are represented as Custom Types and Provider Specific Types, the static `Null` property of the type is returned. For attributes that are represented as Nullable types, for example, `System.String` and `System.Array` Types, null is returned, and for all other remaining built-in types such as `Int32` and `DateTime` `DBNull.Value` is returned.

If the collection being returned is not `NULL`, the output *statusArray* parameter is populated with the null status for each of the collection elements.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleUdt Class](#)
- [OracleUdt Members](#)
- ["OracleUdtFetchOption Enumeration"](#)

## IsDBNull

`IsDBNull` methods indicate whether or not the specified attribute being retrieved is `NULL`.

### Overload List for ODP.NET, Unmanaged Driver:

- [IsDBNull\(OracleConnection, IntPtr, string\)](#)  
This method indicates whether or not the attribute being retrieved, specified by `OracleConnection`, pointer, and attribute name, is `NULL`.
- [IsDBNull\(OracleConnection, IntPtr, int\)](#)  
This method indicates whether or not the attribute being retrieved, specified by `OracleConnection`, pointer, and attribute index, is `NULL`.

### Overload List for ODP.NET, Managed Driver and ODP.NET Core :

- [IsDBNull\(OracleConnection, object, string\)](#)  
This method indicates whether or not the attribute being retrieved, specified by `OracleConnection`, UDT, and attribute name, is `NULL`.
- [IsDBNull\(OracleConnection, object, int\)](#)  
This method indicates whether or not the attribute being retrieved, specified by `OracleConnection`, UDT, and attribute index, is `NULL`.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleUdt Class](#)
- [OracleUdt Members](#)
- ["OracleUdtFetchOption Enumeration"](#)

## IsDBNull(OracleConnection, IntPtr, string)

This method indicates whether or not the attribute being retrieved, specified by `OracleConnection`, pointer, and attribute name, is `NULL`.

## Declaration

```
// C#  
public static bool IsDBNull(OracleConnection con, IntPtr pUdt, string attrName);
```

## Parameters

- *con*  
An `OracleConnection` instance.
- *pUdt*  
A pointer to an Oracle UDT.
- *attrName*  
The case-sensitive name of the attribute.

## Return Value

True if the specified attribute is NULL; otherwise, false.

## Exceptions

`ArgumentException` - The specified name is not a valid attribute name.

## Remarks

This method is invoked from the `IOracleCustomType.ToCustomObject` method. The *con* and *pUdt* parameter is passed from the `IOracleCustomType.ToCustomObject` method to the `OracleUdt.IsDBNull` method. The *attrName* parameter is case-sensitive.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleUdt Class](#)
- [OracleUdt Members](#)

## IsDBNull(OracleConnection, IntPtr, int)

This method indicates whether or not the attribute being retrieved, specified by `OracleConnection`, pointer, and attribute index, is NULL.

## Declaration

```
// C#  
public static bool IsDBNull(OracleConnection con, IntPtr pUdt, int attrIndex);
```

## Parameters

- *con*

An `OracleConnection` instance.

- `pUdt`

An opaque pointer to an Oracle UDT.

- `attrIndex`

The zero-based index of the attribute.

### Return Value

True if the specified attribute is NULL; otherwise, false.

### Exceptions

`ArgumentOutOfRangeException` - The specified index is not a valid attribute index

### Remarks

This method is invoked from the `IOracleCustomType.ToCustomObject` method. The `con` and `pUdt` parameter is passed from the `IOracleCustomType.ToCustomObject` method to the `OracleUdt.IsDBNull` method.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleUdt Class](#)
- [OracleUdt Members](#)

## IsDBNull(OracleConnection, object, string)

This method indicates whether or not the attribute being retrieved, specified by `OracleConnection`, UDT, and attribute name, is NULL.

### Declaration

```
// C#  
public static bool IsDBNull(OracleConnection con, object Udt, string attrName);
```

### Parameters

- `con`

An `OracleConnection` instance.

- `Udt`

An Oracle UDT.

- `attrName`

The case-sensitive name of the attribute.

### Return Value

True if the specified attribute is NULL; otherwise, false.

### Exceptions

`ArgumentException` - The specified name is not a valid attribute name.

### Remarks

This method is invoked from the `IOracleCustomType.ToCustomObject` method. The `con` and `Udt` parameter is passed from the `IOracleCustomType.ToCustomObject` method to the `OracleUdt.IsDBNull` method. The `attrName` parameter is case-sensitive.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleUdt Class](#)
- [OracleUdt Members](#)

## IsDBNull(OracleConnection, object, int)

This method indicates whether or not the attribute being retrieved, specified by `OracleConnection`, UDT, and attribute index, is NULL.

### Declaration

```
// C#  
public static bool IsDBNull(OracleConnection con, object Udt, int attrIndex);
```

### Parameters

- `con`  
An `OracleConnection` instance.
- `pUdt`  
An Oracle UDT object.
- `attrIndex`  
The zero-based index of the attribute.

### Return Value

True if the specified attribute is NULL; otherwise, false.

### Exceptions

`ArgumentOutOfRangeException` - The specified index is not a valid attribute index

## Remarks

This method is invoked from the `IOracleCustomType.ToCustomObject` method. The `con` and `Udt` parameter is passed from the `IOracleCustomType.ToCustomObject` method to the `OracleUdt.IsDBNull` method.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleUdt Class](#)
- [OracleUdt Members](#)

## SetValue

`SetValue` methods set the attributes or elements on the specified Oracle UDT.

### Overload List for ODP.NET, Unmanaged Driver:

- [SetValue\(OracleConnection, IntPtr, string, object\)](#)

This method sets the attribute or elements on the specified Oracle UDT, using the specified attribute name and value.
- [SetValue\(OracleConnection, IntPtr, int, object\)](#)

This method sets the attribute or elements on the specified Oracle UDT, using the specified index and value.
- [SetValue\(OracleConnection, IntPtr, string, object, object\)](#)

This method sets either the specified collection attribute of the specified Oracle Object or elements of the specified Oracle Collection, to the specified value using the supplied null status of the collection elements.
- [SetValue\(OracleConnection, IntPtr, int, object, object\)](#)

This method sets either the specified collection attribute of the specified Oracle Object or elements of the specified Oracle Collection, to the specified value using the supplied null status of the collection elements.

### Overload List for ODP.NET, Managed Driver and ODP.NET Core

- [SetValue\(OracleConnection, object, string, object\)](#)

This method sets the attribute or elements on the specified Oracle UDT, using the specified attribute name and value.
- [SetValue\(OracleConnection, object, int, object\)](#)

This method sets the attribute or elements on the specified Oracle UDT, using the specified index and value.
- [SetValue\(OracleConnection, object, string, object, object\)](#)

This method sets either the specified collection attribute of the specified Oracle Object or elements of the specified Oracle Collection, to the specified value using the supplied null status of the collection elements.

- [SetValue\(OracleConnection, object, int, object, object\)](#)

This method sets either the specified collection attribute of the specified Oracle Object or elements of the specified Oracle Collection, to the specified value using the supplied null status of the collection elements.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleUdt Class](#)
- [OracleUdt Members](#)

## SetValue(OracleConnection, IntPtr, string, object)

This method sets the attribute or elements on the specified Oracle UDT, using the specified attribute name and value.

### Declaration

```
// C#
public static void SetValue(OracleConnection con, IntPtr pUdt, string attrName,
    object value);
```

### Parameters

- *con*  
An `OracleConnection` instance.
- *pUdt*  
An opaque pointer to an Oracle UDT.
- *attrName*  
The name of the attribute to be set. Specify null for setting collection elements from a Custom Type that represents an Oracle Collection.
- *value*  
The attribute or collection value to be set.

### Exceptions

`ArgumentException` - The specified value is not of the appropriate type.

### Remarks

The `IOracleCustomType.FromCustomObject` method invokes `OracleUdt.SetValue` method passing it the *con* and *pUdt* parameters. The `OracleUdt.SetValue` method returns these types of object:

- Oracle Object Type  
For a Custom Type that represents an Oracle Object Type, the type accepted for a specified attribute name is the type of the member in the custom class or struct that is mapped to the attribute using the `OracleObjectMappingAttribute` object.
- Oracle Collection Type  
For a Custom Type that represents an Oracle Collection Type, the type accepted is the type of the member in the custom class or struct to which the `OracleArrayMappingAttribute` object is applied.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleUdt Class](#)
- ["OracleUdt Members"](#)

## SetValue(OracleConnection, IntPtr, int, object)

This method sets the attribute or elements on the specified Oracle UDT, using the specified index and value.

### Declaration

```
// C#  
public static void SetValue(OracleConnection con, IntPtr pUdt, int attrIndex,  
object value);
```

### Parameters

- *con*  
An `OracleConnection` instance.
- *pUdt*  
An opaque pointer to an Oracle UDT.
- *attrIndex*  
The index of the attribute to be set. Specify 0 for setting collection elements from a Custom Type that represents an Oracle Collection.
- *value*  
The attribute or collection value to be set.

### Exceptions

`ArgumentException` - The specified value is not of the appropriate type.

## Remarks

The `IOracleCustomType.FromCustomObject` method invokes `OracleUdt.SetValue` method passing it the `con` and `pUdt` parameters. The `OracleUdt.SetValue` method returns these types of object:

- Oracle Object Type

For a Custom Type that represents an Oracle Object Type, the type accepted for a specified attribute index is the type of the member in the custom class or struct that is mapped to the attribute using the `OracleObjectMappingAttribute` object.

- Oracle Collection Type

For a Custom Type that represents an Oracle Collection Type, the type accepted is the type of the member in the custom class or struct to which the `OracleArrayMappingAttribute` object is applied.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleUdt Class](#)
- ["OracleUdt Members"](#)

## SetValue(OracleConnection, IntPtr, string, object, object)

This method sets either the specified collection attribute of the specified Oracle Object or elements of the specified Oracle Collection, to the specified value using the supplied null status of the collection elements.

### Declaration

```
// C#
public static void SetValue(OracleConnection con, IntPtr pUdt, string attrName,
    object value, object statusArray);
```

### Parameters

- `con`  
An `OracleConnection` instance.
- `pUdt`  
An opaque pointer to an Oracle UDT.
- `attrName`  
The name of the attribute to be set. Specify null for setting collection elements from a Custom Type that represents an Oracle Collection.
- `value`  
The attribute or collection value to be set.

- `statusArray`

The null status for the collection elements.

### Exceptions

`ArgumentException` - The specified value is not of the appropriate type.

### Remarks

The `IOracleCustomType.FromCustomObject` method invokes `OracleUdt.SetValue` method passing it the `con` and `pUdt` parameters. The `OracleUdt.SetValue` method returns these types of object:

- **Oracle Object Type**  
For a Custom Type that represents an Oracle Object Type, the type accepted for a specified attribute name is the type of the member in the custom class or struct that is mapped to the attribute using the `OracleObjectMappingAttribute` object.
- **Oracle Collection Type**  
For a Custom Type that represents an Oracle Collection Type, the type accepted is the type of the member in the custom class or struct to which the `OracleArrayMappingAttribute` object is applied.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleUdt Class](#)
- ["OracleUdt Members"](#)

## SetValue(OracleConnection, IntPtr, int, object, object)

This method sets either the specified collection attribute of the specified Oracle Object or elements of the specified Oracle Collection, to the specified value using the supplied null status of the collection elements.

### Declaration

```
// C#
public static void SetValue(OracleConnection con, IntPtr pUdt, int attrIndex,
    object value, object statusArray);
```

### Parameters

- `con`  
An `OracleConnection` instance.
- `pUdt`  
An opaque pointer to an Oracle UDT.
- `attrIndex`

The index of the attribute to be set. Specify 0 for setting collection elements from a Custom Type that represents an Oracle Collection.

- *value*

The attribute or collection value to be set.

- *statusArray*

The null status for the collection elements.

### Exceptions

`ArgumentException` - The specified value is not of the appropriate type.

### Remarks

The `IOracleCustomType.FromCustomObject` method invokes `OracleUdt.SetValue` method passing it the `con` and `pUdt` parameters. The `OracleUdt.SetValue` method returns these types of object:

- Oracle Object Type

For a Custom Type that represents an Oracle Object Type, the type accepted for a specified attribute index is the type of the member in the custom class or struct that is mapped to the attribute using the `OracleObjectMappingAttribute` object.

- Oracle Collection Type

For a Custom Type that represents an Oracle Collection Type, the type accepted is the type of the member in the custom class or struct to which the `OracleArrayMappingAttribute` object is applied.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleUdt Class](#)
- ["OracleUdt Members"](#)

## SetValue(OracleConnection, object, string, object)

This method sets the attribute or elements on the specified Oracle UDT, using the specified attribute name and value.

### Declaration

```
// C#
public static void SetValue(OracleConnection con, object Udt, string attrName,
    object value);
```

### Parameters

- *con*

An `OracleConnection` instance.

- *Udt*  
An Oracle UDT object.
- *attrName*  
The name of the attribute to be set. Specify null for setting collection elements from a Custom Type that represents an Oracle Collection.
- *value*  
The attribute or collection value to be set.

### Exceptions

`ArgumentException` - The specified value is not of the appropriate type.

### Remarks

The `IOracleCustomType.FromCustomObject` method invokes `OracleUdt.SetValue` method passing it the `con` and `Udt` parameters. The `OracleUdt.SetValue` method returns these types of object:

- Oracle Object Type  
For a Custom Type that represents an Oracle Object Type, the type accepted for a specified attribute name is the type of the member in the custom class or struct that is mapped to the attribute using the `OracleObjectMappingAttribute` object.
- Oracle Collection Type  
For a Custom Type that represents an Oracle Collection Type, the type accepted is the type of the member in the custom class or struct to which the `OracleArrayMappingAttribute` object is applied.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleUdt Class](#)
- ["OracleUdt Members"](#)

## SetValue(OracleConnection, object, int, object)

This method sets the attribute or elements on the specified Oracle UDT, using the specified index and value.

### Declaration

```
// C#  
public static void SetValue(OracleConnection con, object Udt, int attrIndex,  
object value);
```

### Parameters

- *con*

An `OracleConnection` instance.

- `Udt`

An Oracle UDT object.

- `attrIndex`

The index of the attribute to be set. Specify 0 for setting collection elements from a Custom Type that represents an Oracle Collection.

- `value`

The attribute or collection value to be set.

### Exceptions

`ArgumentException` - The specified value is not of the appropriate type.

### Remarks

The `IOracleCustomType.FromCustomObject` method invokes `OracleUdt.SetValue` method passing it the `con` and `Udt` parameters. The `OracleUdt.SetValue` method returns these types of object:

- Oracle Object Type

For a Custom Type that represents an Oracle Object Type, the type accepted for a specified attribute index is the type of the member in the custom class or struct that is mapped to the attribute using the `OracleObjectMappingAttribute` object.

- Oracle Collection Type

For a Custom Type that represents an Oracle Collection Type, the type accepted is the type of the member in the custom class or struct to which the `OracleArrayMappingAttribute` object is applied.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleUdt Class](#)
- ["OracleUdt Members"](#)

## SetValue(OracleConnection, object, string, object, object)

This method sets either the specified collection attribute of the specified Oracle Object or elements of the specified Oracle Collection, to the specified value using the supplied null status of the collection elements.

### Declaration

```
// C#  
public static void SetValue(OracleConnection con, object Udt, string attrName,  
    object value, object statusArray);
```

## Parameters

- *con*  
An `OracleConnection` instance.
- *Udt*  
An Oracle UDT object.
- *attrName*  
The name of the attribute to be set. Specify null for setting collection elements from a Custom Type that represents an Oracle Collection.
- *value*  
The attribute or collection value to be set.
- *statusArray*  
The null status for the collection elements.

## Exceptions

`ArgumentException` - The specified value is not of the appropriate type.

## Remarks

The `IOracleCustomType.FromCustomObject` method invokes `OracleUdt.SetValue` method passing it the *con* and *Udt* parameters. The `OracleUdt.SetValue` method returns these types of object:

- Oracle Object Type  
For a Custom Type that represents an Oracle Object Type, the type accepted for a specified attribute name is the type of the member in the custom class or struct that is mapped to the attribute using the `OracleObjectMappingAttribute` object.
- Oracle Collection Type  
For a Custom Type that represents an Oracle Collection Type, the type accepted is the type of the member in the custom class or struct to which the `OracleArrayMappingAttribute` object is applied.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleUdt Class](#)
- ["OracleUdt Members"](#)

## SetValue(OracleConnection, object, int, object, object)

This method sets either the specified collection attribute of the specified Oracle Object or elements of the specified Oracle Collection, to the specified value using the supplied null status of the collection elements.

### Declaration

```
// C#  
public static void SetValue(OracleConnection con, object Udt, int attrIndex,  
    object value, object statusArray);
```

### Parameters

- *con*  
An OracleConnection instance.
- *Udt*  
An Oracle UDT object.
- *attrIndex*  
The index of the attribute to be set. Specify 0 for setting collection elements from a Custom Type that represents an Oracle Collection.
- *value*  
The attribute or collection value to be set.
- *statusArray*  
The null status for the collection elements.

### Exceptions

ArgumentException - The specified value is not of the appropriate type.

### Remarks

The `IOracleCustomType.FromCustomObject` method invokes `OracleUdt.SetValue` method passing it the *con* and *Udt* parameters. The `OracleUdt.SetValue` method returns these types of object:

- Oracle Object Type  
For a Custom Type that represents an Oracle Object Type, the type accepted for a specified attribute index is the type of the member in the custom class or struct that is mapped to the attribute using the `OracleObjectMappingAttribute` object.
- Oracle Collection Type  
For a Custom Type that represents an Oracle Collection Type, the type accepted is the type of the member in the custom class or struct to which the `OracleArrayMappingAttribute` object is applied.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleUdt Class](#)
- ["OracleUdt Members"](#)

## OracleRef Class

An `OracleRef` instance represents an Oracle REF, which references a persistent, standalone, referenceable object that resides in the database. The `OracleRef` object provides methods to insert, update, and delete the Oracle REF.

### Class Inheritance

`System.Object`

`System.MarshalByRefObject`

`Oracle.DataAccess.Types.OracleRef`

### Declaration

```
// C#
public sealed class OracleRef : MarshalByRefObject, ICloneable, IDisposable,
    INullable
```

### Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	<code>Oracle.DataAccess.dll</code>	<code>Oracle.ManagedDataAccess.dll</code>	<code>Oracle.ManagedDataAccess.dll</code>
<b>Namespace</b>	<code>Oracle.DataAccess.Client</code>	<code>Oracle.ManagedDataAccess.Client</code>	<code>Oracle.ManagedDataAccess.Client</code>
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

### Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

### Remarks

If two or more `OracleRef` objects that refer to the same Oracle object in the database are retrieved through the same `OracleConnection`, then their operations on the referenced object must be synchronized.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRef Members](#)
- [OracleRef Constructors](#)
- [OracleRef Static Methods](#)
- [OracleRef Instance Properties](#)
- [Oracle Ref Instance Methods](#)

## OracleRef Members

OracleRef members are listed in the following tables.

### OracleRef Constructors

OracleRef constructors are listed in [Table 17-30](#).

**Table 17-30 OracleRef Constructors**

Constructor	Description
<a href="#">OracleRef Constructors</a>	Instantiates a new instance of OracleRef class (Overloaded) <i>Not Available in ODP.NET, Managed Driver and ODP.NET Core</i>

### OracleRef Static Fields

OracleRef static methods are listed in [Table 17-31](#)

**Table 17-31 OracleRef Static Fields**

Static Field	Description
<a href="#">Null</a>	Represents a null value that can be assigned to an OracleRef instance

### OracleRef Static Methods

OracleRef static methods are listed in [Table 17-32](#).

**Table 17-32 OracleRef Static Methods**

Method	Description
<a href="#">Equals</a>	Inherited from System.Object (Overloaded)

## OracleRef Instance Properties

OracleRef instance properties are listed in [Table 17-33](#).

**Table 17-33 OracleRef Instance Properties**

Property	Description
<a href="#">Connection</a>	References the connection used by the OracleRef
<a href="#">HasChanges</a>	References the connection used by the OracleRef <i>Not Available in ODP.NET, Managed Driver and ODP.NET Core</i>
<a href="#">IsLocked</a>	Indicates whether or not the REF is locked
<a href="#">IsNull</a>	Indicates whether or not the Oracle REF is NULL
<a href="#">ObjectTableName</a>	Returns the fully qualified object table name that is associated with the REF <i>Not Available in ODP.NET, Managed Driver and ODP.NET Core</i>
<a href="#">Value</a>	Returns a .NET representation of this Oracle REF

## OracleRef Instance Methods

OracleRef instance methods are listed in [Table 17-34](#).

**Table 17-34 OracleRef Instance Methods**

Method	Description
<a href="#">Clone</a>	Clones the REF
<a href="#">Delete</a>	Deletes the referenced object from the database See also <a href="#">Table 3-29</a>
<a href="#">Dispose</a>	Releases resources allocated for the OracleRef instance
<a href="#">Equals</a>	Inherited from System.Object
<a href="#">Flush</a>	Flushes changes made on the REF object to the database <i>Not Available in ODP.NET, Managed Driver and ODP.NET Core</i>
<a href="#">GetCustomObject</a>	Returns the object that the specified REF references as a custom type (Overloaded) See also <a href="#">Table 3-29</a>
<a href="#">GetCustomObjectForUpdate</a>	Returns the object that the specified REF references as a custom type (Overloaded) <i>Not Available in ODP.NET, Managed Driver and ODP.NET Core</i>
<a href="#">GetHashCode</a>	Inherited from System.Object
<a href="#">GetType</a>	Inherited from System.Object
<a href="#">IsEqual</a>	Compares two OracleREF objects
<a href="#">Lock</a>	Locks the REF in the database <i>Not Available in ODP.NET, Managed Driver and ODP.NET Core</i>
<a href="#">ToString</a>	Inherited from System.Object

Table 17-34 (Cont.) OracleRef Instance Methods

Method	Description
<a href="#">Update</a>	Updates the object referenced by the specified REF in the database using the specified custom object See also <a href="#">Table 3-29</a>

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRef Class](#)

## OracleRef Constructors

OracleRef constructors instantiate new instances of OracleRef class.

**Overload List:**

- [OracleRef\(OracleConnection, string\)](#)  
This constructor creates an instance of the OracleRef class with a connection and a HEX string that represents an REF instance in the database.  
*Not Available in ODP.NET, Managed Driver and ODP.NET Core*
- [OracleRef\(OracleConnection, string, string\)](#)  
This constructor creates an instance of the OracleRef class using the specified OracleConnection object, user-defined type name, and an object table name  
*Not Available in ODP.NET, Managed Driver and ODP.NET Core*

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRef Class](#)
- [OracleRef Members](#)

### OracleRef(OracleConnection, string)

This constructor creates an instance of the OracleRef class with a connection and a HEX string that represents an REF instance in the database.

### Declaration

```
// C#  
public OracleRef(OracleConnection con, string hexStr);
```

### Parameters

- *con*  
An `OracleConnection` instance.
- *hexStr*  
A HEX string that represents an `REF` instance in the database.

### Exceptions

`ArgumentException` - The HEX string does not represent a valid `REF` in the database.

`ArgumentNullException` - The connection or HEX string is null.

`InvalidOperationException` - The `OracleConnection` object is not open.

### Remarks

When an `OracleRef` instance is created, it is referenced to a specific table in the database.

The connection must be opened explicitly by the application. `OracleRef` does not open the connection implicitly.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRef Class](#)
- [OracleRef Members](#)

## OracleRef(OracleConnection, string, string)

This constructor creates an instance of the `OracleRef` class using the specified `OracleConnection` object, user-defined type name, and an object table name.

### Declaration

```
// C#  
public OracleRef(OracleConnection con, string udtTypeName, string objTabName);
```

### Parameters

- *con*  
An `OracleConnection` instance.
- *udtTypeName*

A user-defined type name.

- `objTabName`

An object table name.

### Exceptions

`ArgumentException` - The object type name or the object table name is not valid.

`ArgumentNullException` - The object type name or the table name is null.

`InvalidOperationException` - The `OracleConnection` object is not open.

### Remarks

When an `OracleRef` instance is created, this `OracleRef` instance is associated with the specific table in the database. In other words, it represents a persistent REF.

This constructor creates a reference to the object table. However, it does not cause any entries to be made in database tables until the object is flushed to the database, that is, until the `OracleRef.Flush` or the `OracleConnection.FlushCache` method is called on the `OracleRef` Connection. Therefore, any operation that attempts to operate on the database copy of the object before flushing the object, such as, lock the object or fetch the latest copy of the object from the database, results in an `OracleException`.

The connection must be opened explicitly by the application. `OracleRef` does not open the connection implicitly.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRef Class](#)
- [OracleRef Members](#)
- ["FlushCache"](#)

## OracleRef Static Fields

`OracleRef` static fields are listed in [Table 17-35](#).

**Table 17-35 OracleRef Static Fields**

Static Field	Description
<a href="#">Null</a>	Represents a null value that can be assigned to an <code>OracleRef</code> instance

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRef Class](#)
- [OracleRef Members](#)

## Null

This static field represents a null value that can be assigned to an `OracleRef` instance.

### Declaration

```
// C#  
public static readonly OracleRef Null;
```

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRef Class](#)
- [OracleRef Members](#)

## OracleRef Static Methods

`OracleRef` static methods are listed in [Table 17-36](#).

**Table 17-36 OracleRef Static Methods**

Method	Description
<code>Equals</code>	Inherited from <code>System.Object</code> (Overloaded)

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRef Class](#)
- [OracleRef Members](#)

## OracleRef Instance Properties

OracleRef instance properties are listed in [Table 17-37](#).

**Table 17-37 OracleRef Instance Properties**

Property	Description
<a href="#">Connection</a>	References the connection used by the OracleRef
<a href="#">HasChanges</a>	References the connection used by the OracleRef <i>Not Available in ODP.NET, Managed Driver and ODP.NET Core</i>
<a href="#">IsLocked</a>	Indicates whether or not the REF is locked
<a href="#">IsNull</a>	Indicates whether or not the Oracle REF is NULL
<a href="#">ObjectTableName</a>	Returns the fully qualified object table name that is associated with the REF <i>Not Available in ODP.NET, Managed Driver and ODP.NET Core</i>
<a href="#">Value</a>	Returns a .NET representation of this Oracle REF

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRef Class](#)
- [OracleRef Members](#)

## Connection

This instance property references the connection used by the OracleRef.

### Declaration

```
// C#  
public OracleConnection Connection{get;}
```

### Property Value

An OracleConnection object associated with the REF.

### Exceptions

ObjectDisposedException - The object is already disposed.

### Remarks

Once the Dispose method is invoked, this property is set to null.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRef Class](#)
- [OracleRef Members](#)

## HasChanges

This instance property indicates whether or not the object referenced by the Oracle REF in the object cache has any changes that can be flushed to the database.

### Declaration

```
// C#  
public bool HasChanges {get;}
```

### Property Value

Returns `true` if the object referenced by the Oracle REF in the object cache has any changes that can be flushed to the database; otherwise, returns `false`.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

### Remarks

This property returns `true` if a copy of the referenced object in the object cache is updated or deleted.

If there is no copy of the referenced object in the object cache, the latest copy of the referenced object in the database is cached in the object cache and `false` is returned.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRef Class](#)
- [OracleRef Members](#)

## IsLocked

This instance property indicates whether or not the REF is locked.

### Declaration

```
// C#  
public bool IsLocked {get;}
```

### Property Value

Returns `true` if the REF is locked; otherwise returns `false`.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRef Class](#)
- [OracleRef Members](#)

## IsNull

This instance property indicates whether or not the Oracle REF is `NULL`.

### Declaration

```
// C#  
public bool IsNull {get;}
```

### Property Value

Returns `true` if the REF is `NULL`; otherwise, returns `false`.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

### Remarks

If the Oracle REF is `NULL`, this property returns `true`. Otherwise, it returns `false`.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRef Class](#)
- [OracleRef Members](#)

## ObjectTableName

This instance property returns the fully-qualified object table name that is associated with the REF.

### Declaration

```
// C#  
public string ObjectTableName{get;}
```

### Property Value

A fully-qualified object table name that is associated with the REF.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

### Remarks

The object table name is in the form `schema_Name.Table_Name`.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRef Class](#)
- [OracleRef Members](#)

## Value

This instance property returns a .NET representation of this Oracle REF.

### Declaration

```
// C#  
public string Value{get;}
```

### Property Value

A .NET representation of the Oracle REF.

### Exceptions

`ObjectDisposedException` - The object is already disposed.

### Remarks

This property returns a HEX string that represents the REF.

The returned string can be used to create a new `OracleRef` instance by using the `OracleRef(OracleConnection, string)` constructor.

 See Also:

- "Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"
- OracleRef Class
- OracleRef Members
- "OracleRef(OracleConnection, string)"

## Oracle Ref Instance Methods

OracleRef instance methods are listed in [Table 17-38](#).

**Table 17-38 OracleRef Instance Methods**

Method	Description
<a href="#">Clone</a>	Clones the REF
<a href="#">Delete</a>	Deletes the referenced object from the database See also <a href="#">Table 3-29</a>
<a href="#">Dispose</a>	Releases resources allocated for the OracleRef instance
Equals	Inherited from System.Object
<a href="#">Flush</a>	Flushes changes made on the REF object to the database <i>Not Available in ODP.NET, Managed Driver and ODP.NET Core</i>
<a href="#">GetCustomObject</a>	Returns the object that the specified REF references as a custom type (Overloaded) See also <a href="#">Table 3-29</a>
<a href="#">GetCustomObjectForUpdate</a>	Returns the object that the specified REF references as a custom type (Overloaded) <i>Not Available in ODP.NET, Managed Driver and ODP.NET Core</i>
GetHashCode	Inherited from System.Object
GetType	Inherited from System.Object
<a href="#">IsEqual</a>	Compares two OracleREF objects
<a href="#">Lock</a>	Locks the REF in the database <i>Not Available in ODP.NET, Managed Driver and ODP.NET Core</i>
ToString	Inherited from System.Object
<a href="#">Update</a>	Updates the object referenced by the specified REF in the database using the specified custom object See also <a href="#">Table 3-29</a>

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRef Class](#)
- [OracleRef Members](#)

## Clone

This instance method clones the REF.

### Declaration

```
// C#  
public OracleRef Clone();
```

### Return Value

A clone of the current instance.

### Implements

ICloneable

### Exceptions

InvalidOperationException - The associated connection is not open.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRef Class](#)
- [OracleRef Members](#)

## Delete

This method deletes the referenced object from the database.

### Declaration

```
// C# - managed and core ODP.NET  
public void Delete();  
  
// C# - unmanaged ODP.NET  
public void Delete(bool bFlush);
```

## Parameters

- *bFlush*

A `bool` that specifies whether or not the `REF` is flushed immediately.

## Remarks

This method marks the specified `REF` for deletion.

In managed ODP.NET and ODP.NET Core, `Delete()` has the same behavior as unmanaged ODP.NET `Delete(true)`.

Depending on whether the value of *bFlush* is set to `true` or `false`, the following occurs:

- `True`

The object referenced by the specified `REF` is deleted immediately from the database.

Before flushing objects, it is required that the application has explicitly started a transaction by executing the `BeginTransaction` method on the `OracleConnection` object. This is because if the object being flushed has not already been locked by the application, an exclusive lock is obtained implicitly for the object. The lock is only released when the transaction commits or rolls back.

- `False`

The object referenced by the `REF` is not deleted immediately from the database, but only when a subsequent `Flush` method is invoked for the specified `REF` or the `FlushCache` method is invoked on the `OracleRef` or the `FlushCache` method is invoked on the `OracleRef` connection.



### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRef Class](#)
- [OracleRef Members](#)
- [OracleConnection "FlushCache"](#)

## Dispose

This instance method releases resources allocated for the `OracleRef` instance.

### Declaration

```
// C#  
public void Dispose();
```

### Implements

`IDisposable`

### Remarks

The object cannot be reused after it is disposed. Although some properties can still be accessed, their values may not be up-to-date.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRef Class](#)
- [OracleRef Members](#)

## Flush

This instance method flushes changes made on the `REF` object to the database, such as updates or deletes.

### Declaration

```
// C#  
public void Flush();
```

### Exceptions

`InvalidOperationException` - The associated connection is not open.

### Remarks

Before flushing objects, it is required that the application has explicitly started a transaction by executing the `BeginTransaction` method on the `OracleConnection` object. This is because if the object being flushed has not already been locked by the application, an exclusive lock is obtained implicitly for the object. The lock is only released when the transaction commits or rollbacks.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRef Class](#)
- [OracleRef Members](#)

## GetCustomObject

`GetCustomObject` methods return the object that the specified `REF` references as a custom type.

### Overload List

- [GetCustomObject\(OracleUdtFetchOption\)](#)

This method returns the object that the specified REF references as a custom type using the specified fetch option.

- [GetCustomObject\(OracleUdtFetchOption, int\)](#)

This method returns the object that the specified REF references as a custom type using the specified fetch option and depth level.

*Not supported in ODP.NET, Managed Driver and ODP.NET Core.*

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRef Class](#)
- [OracleRef Members](#)

## GetCustomObject(OracleUdtFetchOption)

This method returns the object that the specified REF references, as a custom type, using the specified fetch option.

### Declaration

```
// C# - managed and core ODP.NET
public object GetCustomObject();

// C# - unmanaged ODP.NET
public object GetCustomObject(OracleUdtFetchOption fetchOption);
```

### Parameters

- *fetchOption*  
An OracleUdtFetchOption value.

### Return Value

A custom object that represents the object that the specified REF references.

### Exceptions

*InvalidOperationException* - The specified connection is not open, or a valid custom type has not been registered for the type of the referenced object.

### Remarks

This method returns a custom type determined by the UDT mappings on the specified connection.

The connection must be opened explicitly by the application. This method does not open the connection implicitly.

Managed ODP.NET and ODP.NET Core always retrieves the object from the database as it does not have an object cache.

The application can use the `OracleUdtFetchOption` method to control the copy of the Object that is returned according to the specified option:

- `OracleUdtFetchOption.Cache` option

If this option is specified, and there is a copy of the referenced object in the object cache, it is returned immediately. If no cached copy exists, the latest copy of the referenced object in the database is cached in the object cache and returned.

- `OracleUdtFetchOption.Server` option

If this option is specified, the latest copy of the referenced object from the database is cached in the object cache and returned. If a copy of the referenced object already exists in the cache, the latest copy overwrites the existing one.

- `OracleUdtFetchOption.TransactionCache` option

If this option is specified, and a copy of the referenced object is cached in the current transaction, the copy is returned. Otherwise, the latest copy of the referenced object from the database is cached in the object cache and returned. If a copy of the referenced object already exists in the cache, the latest copy overwrites the existing one.

Note that if a cached copy of the referenced object was modified before the current transaction began, that is, if the `OracleRef.HasChanges` property returns `true`, then the `Recent` option returns the cached copy of the referenced object. Outside of a transaction, the `Recent` option behaves like the `Any` option.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRef Class](#)
- [OracleRef Members](#)
- ["OracleUdtFetchOption Enumeration"](#)

## GetCustomObject(OracleUdtFetchOption, int)

This method returns the object that the specified `REF` references, as a custom type, using the specified fetch option and depth level.

### Declaration

```
// C#  
public object GetCustomObject(OracleUdtFetchOption fetchOption, int depthLevel);
```

### Parameters

- *fetchOption*

An `OracleUdtFetchOption` value.

- `depthLevel`

The number of levels to be fetched for nested `REF` attributes.

### Return Value

A custom object that represents the object that the specified `REF` references.

### Exceptions

`InvalidOperationException` - The specified connection is not open, or a valid custom type has not been registered for the type of the referenced object.

### Remarks

This method returns a custom type determined by the UDT mappings on the specified connection.

If the object that the `REF` references contains nested `REF` attributes, the `depthLevel` can be specified to optimize the subsequent object retrieval. The value of `depthLevel` determines the number of levels that are optimized.

For example, if the `depthLevel` is specified as two, the optimization is applied to all top-level nested `REF` attributes in the object being fetched and also to all nested `REF` attributes within the objects referenced by the top-level nested `REF` attributes.

The connection must be opened explicitly by the application. This method does not open the connection implicitly.

The application can use the `OracleUdtFetchOption` method to control the copy of the Object that is returned according to the specified option:

- `OracleUdtFetchOption.Cache` option

If this option is specified, and there is a copy of the referenced object in the object cache, it is returned immediately. If no cached copy exists, the latest copy of the referenced object in the database is cached in the object cache and returned.

- `OracleUdtFetchOption.Server` option

If this option is specified, the latest copy of the referenced object from the database is cached in the object cache and returned. If a copy of the referenced object already exists in the cache, the latest copy overwrites the existing one.

- `OracleUdtFetchOption.TransactionCache` option

If this option is specified, and a copy of the referenced object is cached in the current transaction, the copy is returned. Otherwise, the latest copy of the referenced object from the database is cached in the object cache and returned. If a copy of the referenced object already exists in the cache, the latest copy overwrites the existing one.

Note that if a cached copy of the referenced object was modified before the current transaction began, that is, if the `OracleRef.HasChanges` property returns `true`, then the `Recent` option returns the cached copy of the referenced object. Outside of a transaction, the `Recent` option behaves like the `Any` option.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRef Class](#)
- [OracleRef Members](#)
- ["OracleUdtFetchOption Enumeration"](#)

## GetCustomObjectForUpdate

`GetCustomObjectForUpdate` methods return the object that the specified REF references as a custom type.

- [GetCustomObjectForUpdate\(bool\)](#)

This method locks the specified REF in the database and returns the object that the specified REF references as a custom type using the specified wait option.

*Not supported in ODP.NET, Managed Driver and ODP.NET Core.*

- [GetCustomObjectForUpdate\(bool, int\)](#)

This method locks the specified REF in the database and returns the object that the specified REF references as a custom type using the specified wait option and depth level.

*Not supported in ODP.NET, Managed Driver and ODP.NET Core.*

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRef Class](#)
- [OracleRef Members](#)

## GetCustomObjectForUpdate(bool)

This method locks the specified REF in the database and returns the object that the specified REF references, as a custom type, using the specified wait option.

### Declaration

```
// C#  
public object GetCustomObjectForUpdate(bool bWait);
```

### Parameters

- `bWait`

Specifies if the `REF` is to be locked with the no-wait option. If `wait` is set to `true`, this method invocation does not return until the `REF` is locked.

### Return Value

A custom object that represents the object that the specified `REF` references.

### Exceptions

`InvalidOperationException` - The specified connection is not open, or a valid custom type has not been registered for type of the referenced object.

`OracleException` - `bWait` is set to `false`, and the lock cannot be acquired.

### Remarks

This method returns the latest copy of the referenced object, as a custom type, determined by the custom types registered on the `OracleRef` connection.

To be able to release the lock on the `REF` appropriately after flushing the `REF` using the `Flush` method on the `OracleRef` or `FlushCache` method on the `OracleConnection`, the application must commit or rollback the transaction. Therefore, it is required that, before invoking this method, a transaction is explicitly started by executing the `BeginTransaction` method on the `OracleConnection` object.

This method makes a network round-trip to lock the `REF` in the database. After this call, programmers can modify the associated row object exclusively. Then a call to the `Flush` method on the `OracleRef` or `FlushCache` method on the `OracleConnection` flushes the changes to the database.

If `true` is passed, this method blocks until the lock can be acquired. If `false` is passed, this method immediately returns. If the lock cannot be acquired, an `OracleException` is thrown.

The connection must be opened explicitly by the application. This method does not open the connection implicitly.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRef Class](#)
- [OracleRef Members](#)

## GetCustomObjectForUpdate(bool, int)

This method locks the specified `REF` in the database and returns the object that the specified `REF` references, as a custom type, using the specified wait option and depth level

### Declaration

```
public object GetCustomObjectForUpdate(bool bWait, int depthlevel);
```

## Parameters

- *bWait*  
A boolean value that specifies if the REF is to be locked with the no-wait option. If wait is set to `true`, this method invocation does not return until the REF is locked.
- *depthLevel*  
The number of levels to be fetched for nested REF attributes.

## Return Value

A custom object that represents the object that the specified REF references.

## Exceptions

`InvalidOperationException` - The specified connection is not open, or a valid custom type has not been registered for type of the referenced object.

`OracleException` - *bWait* is set to `false`, and the lock cannot be acquired.

## Remarks

This method returns the latest copy of the referenced object, as a custom type, determined by the custom types registered on the `OracleRef` connection.

To be able to release the lock on the REF appropriately after flushing the REF using the `Flush` method on the `OracleRef` or `FlushCache` method on the `OracleConnection`, the application must commit or rollback the transaction. Therefore, it is required that, before invoking this method, a transaction is explicitly started by executing the `BeginTransaction` method on the `OracleConnection` object.

This method makes a network round-trip to lock the REF in the database. After this call, programmers can modify the associated row object exclusively. Then a call to the `Flush` method on the `OracleRef` or `FlushCache` method on the `OracleConnection` flushes the changes to the database.

If `true` is passed, this method blocks until the lock can be acquired. If `false` is passed, this method immediately returns. If the lock cannot be acquired, an `OracleException` is thrown.

If the object that the REF references contains nested REF attributes, the *depthLevel* can be specified to optimize the subsequent object retrieval. The value of *depthLevel* determines the number of levels that are optimized.

For example, if the *depthLevel* is specified as 2, the optimization is applied to all top-level nested REF attributes in the object being fetched and also to all nested REF attributes within the objects referenced by the top-level nested REF attributes.

The connection must be opened explicitly by the application. This method does not open the connection implicitly.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRef Class](#)
- [OracleRef Members](#)

## IsEqual

This instance method compares two `OracleREF` objects.

### Declaration

```
// C#  
public bool IsEqual(OracleRef oraRef);
```

### Parameters

- `oraRef`  
The provided `OracleRef` object.

### Return Value

`bool`

### Remarks

This instance method returns `true` if the `OracleRef` instance and the `OracleRef` parameter both reference the same object. Otherwise, it returns `false`.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRef Class](#)
- [OracleRef Members](#)

## Lock

This instance method locks the `REF` in the database.

### Declaration

```
// C#  
public bool Lock(bool bWait);
```

### Parameters

- `bWait`

Specifies if the lock is set to the no-wait option. If `bWait` is set to `true`, the method invocation does not return until the REF is locked.

### Return Value

A boolean value that indicates whether or not the lock has been acquired.

### Exceptions

`InvalidOperationException` - The associated connection is not open.

`ObjectDisposedException` - The object is already disposed.

### Remarks

In order for the application to release the lock on the REF appropriately after the `Flush` invocation on the `OracleRef` or `FlushCache` methods, the application must commit or rollback the transaction. Therefore, it is required that, before invoking a lock on an `OracleRef` object, a transaction is explicitly started by executing the `BeginTransaction` method on the `OracleConnection` object.

This instance method makes a network round-trip to lock the REF in the database. After this call, programmers can modify the attribute values of the associated row object exclusively. Then a call to the `Flush` instance method on the `OracleRef` or `FlushCache` method on the `OracleConnection` flushes the changes to the database.

If `true` is passed, this method blocks, that is, does not return, until the lock is acquired. Consequently, the return value is always `true`.

If `false` is passed, this method immediately returns. The return value indicates `true` if the lock is acquired, and `false` if it is not.

#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRef Class](#)
- [OracleRef Members](#)

## Update

This method updates the object referenced by the specified REF in the database using the specified custom object.

### Declaration

```
// C# - managed and core ODP.NET
public void Update(object customObject);
```

```
// C# - unmanaged ODP.NET  
public void Update(object customObject, bool bFlush);
```

### Parameters

- *customObject*  
The custom object used to update the referenced object.
- *bFlush*  
A boolean that specifies if the changes must be flushed immediately. If *bFlush* is set to true, this method invocation flushes the changes immediately.

### Exceptions

`InvalidOperationException` - The specified connection is not open or the custom object does not map to the type of referenced object.

### Remarks

This method marks the specified `REF` for update. In managed ODP.NET and ODP.NET Core, `Update(customObject)` has the same behavior as unmanaged ODP.NET `Update(customObject, true)`. Depending on whether the value of *bFlush* is set to true or false, the following occurs:

- True  
The object referenced by the specified `REF` is updated immediately in the database.  
Before flushing objects, it is required that the application has explicitly started a transaction by executing the `BeginTransaction` method on the `OracleConnection` object. This is because if the object being flushed has not already been locked by the application, an exclusive lock is obtained implicitly for the object. The lock is only released when the transaction commits or rollbacks.
- False  
The object referenced by the `REF` is not updated immediately in the database, but only when a subsequent `Flush` method is invoked for the specified `REF` or the `FlushCache` method is invoked for the specified connection.

The connection must be opened explicitly by the application. This method does not open the connection implicitly.



#### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRef Class](#)
- [OracleRef Members](#)

## OracleUdtFetchOption Enumeration

`OracleUdtFetchOption` enumeration values specify how to retrieve a copy of the referenceable object.

[Table 17-39](#) lists all the `OracleUdtFetchOption` enumeration values with a description of each enumerated value.

**Table 17-39 OracleUdtFetchOption Enumeration Values**

Member Name	Description
Cache	If there is a copy of the referenced object in the object cache, it is returned immediately. If no cached copy exists, the latest copy of the referenced object in the database is cached in the object cache and returned.
Server	The latest copy of the referenced object from the database is cached in the object cache and returned. If a copy of the referenced object already exists in the cache, the latest copy overwrites the existing one.
TransactionCache	If a copy of the referenced object is cached in the current transaction, the copy is returned. Otherwise, the latest copy of the referenced object from the database is cached in the object cache and returned. If a copy of the referenced object already exists in the cache, the latest copy overwrites the existing one.  Note that if a cached copy of the referenced object was modified before the current transaction began, that is, if the <code>OracleRef.HasChanges</code> property returns <code>true</code> , then the <code>Recent</code> option returns the cached copy of the referenced object. Outside of a transaction, the <code>Recent</code> option behaves like the <code>Any</code> option.

### See Also:

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRef Class](#)
- [OracleRef Members](#)

## OracleUdtStatus Enumeration

`OracleUdtStatus` enumeration values specify the status of an object attribute or collection element. An object attribute or a collection element can be a valid value or a null value.

[Table 17-40](#) lists all the `OracleUdtStatus` enumeration values with a description of each enumerated value:

**Table 17-40 OracleUdtStatus Enumeration Values**

Member Name	Description
Null	Indicates that an object attribute or collection element is NULL.
NotNull	Indicates that a non-NULL value exists for the object attribute or collection element.

 **See Also:**

- ["Oracle.DataAccess.Types and Oracle.ManagedDataAccess.Types Namespaces"](#)
- [OracleRef Class](#)
- [OracleRef Members](#)

# 18

## Oracle Data Provider for .NET Bulk Copy Classes

This chapter describes Oracle Data Provider for .NET support for Bulk Copy operations.



### Note:

Oracle Data Provider for .NET bulk copy operations do not support loading of UDT type columns.

This chapter includes the following topics:

- [OracleBulkCopy Class](#)
- [OracleBulkCopyColumnMapping Class](#)
- [OracleBulkCopyColumnMappingCollection Class](#)
- [OracleBulkCopyOptions Enumeration](#)
- [OracleRowsCopiedEventHandler Delegate](#)
- [OracleRowsCopiedEventArgs Class](#)

## OracleBulkCopy Class

An `OracleBulkCopy` object efficiently bulk loads or copies data into an Oracle table from another data source.

### Class Inheritance

`System.Object`

`System.OracleBulkCopy`

### Declaration

```
// C#  
public sealed class OracleBulkCopy : IDisposable
```

### Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
Assembly	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

### Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

### Remarks

The `OracleBulkCopy` class can be used to write data to Oracle database tables only. However, the data source is not limited to Oracle databases; any data source can be used, as long as the data can be loaded to a `DataTable` instance or read with an `IDataReader` instance.

Bulk copy of string data to destination number column is currently not supported.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopy Members](#)
- [OracleBulkCopy Constructors](#)
- [OracleBulkCopy Properties](#)
- [OracleBulkCopy Public Methods](#)
- [OracleBulkCopy Events](#)

## OracleBulkCopy Members

`OracleBulkCopy` members are listed in the following tables.

### OracleBulkCopy Constructors

`OracleBulkCopy` constructors are listed in [Table 18-1](#).

**Table 18-1 OracleBulkCopy Constructors**

Constructor	Description
<a href="#">OracleBulkCopy Constructors</a>	<code>OracleBulkCopy</code> constructors create new instances of the <code>OracleBulkCopy</code> class

## OracleBulkCopy Properties

OracleBulkCopy properties are listed in [Table 18-2](#).

**Table 18-2 OracleBulkCopy Properties**

Property	Description
<a href="#">BatchSize</a>	Specifies the number of rows to be sent as a batch to the database
<a href="#">BulkCopyOptions</a>	Specifies the <code>OracleBulkCopyOptions</code> enumeration value that determines the behavior of the bulk copy operation
<a href="#">BulkCopyTimeout</a>	Specifies the number of seconds allowed for the bulk copy operation to complete before it is aborted
<a href="#">ColumnMappings</a>	Specifies the column mappings between the data source and destination table
<a href="#">Connection</a>	Specifies the <code>OracleConnection</code> object that the Oracle database uses to perform the bulk copy operation
<a href="#">DestinationPartitionName</a>	Specifies the database partition that the data is loaded into
<a href="#">DestinationSchemaName</a>	Specifies the database schema that the data is loaded into
<a href="#">DestinationTableName</a>	Specifies the database table that the data is loaded in
<a href="#">NotifyAfter</a>	Defines the number of rows to be processed before a notification event is generated

## OracleBulkCopy Public Methods

OracleBulkCopy public methods are listed in [Table 18-3](#).

**Table 18-3 OracleBulkCopy Public Methods**

Method	Description
<a href="#">Close</a>	Closes the <code>OracleBulkCopy</code> instance
<a href="#">Dispose</a>	Releases any resources or memory allocated by the object
<a href="#">WriteToServer</a>	Copies rows to a destination table

## OracleBulkCopy Events

OracleBulkCopy events are listed in [Table 18-4](#).

**Table 18-4 OracleBulkCopy Events**

Event	Description
<a href="#">OracleRowsCopied</a>	Triggered every time the number of rows specified by the <code>OracleBulkCopy.NotifyAfter</code> property has been processed

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopy Class](#)

## OracleBulkCopy Constructors

OracleBulkCopy constructors create new instances of the OracleBulkCopy class.

### Overload List:

- [OracleBulkCopy\(OracleConnection\)](#)  
This constructor instantiates a new instance of OracleBulkCopy class using the specified connection and default value for OracleBulkCopyOptions.
- [OracleBulkCopy\(string\)](#)  
This constructor instantiates a new instance of OracleBulkCopy based on the supplied *connectionString* and default value for OracleBulkCopyOptions.
- [OracleBulkCopy\(OracleConnection, OracleBulkCopyOptions\)](#)  
This constructor instantiates a new instance of OracleBulkCopy using the specified connection object and OracleBulkCopyOptions value.
- [OracleBulkCopy\(string, OracleBulkCopyOptions\)](#)  
This constructor instantiates a new instance of OracleConnection based on the supplied *connectionString* and OracleBulkCopyOptions value.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopy Class](#)
- [OracleBulkCopy Members](#)

## OracleBulkCopy(OracleConnection)

This constructor instantiates a new instance of OracleBulkCopy class using the specified connection and default OracleBulkCopyOptions enumeration values.

### Declaration

```
// C#  
public OracleBulkCopy(OracleConnection connection);
```

### Parameters

- *connection*

The open instance of `OracleConnection` that performs the bulk copy operation.

### Exceptions

`ArgumentNullException` - The connection parameter is null.

`InvalidOperationException` - The connection is not in the open state.

### Remarks

The connection object passed to this constructor must be open. It remains open after the `OracleBulkCopy` instance is closed.

This constructor uses the default enumeration value `OracleBulkCopyOptions.Default`.

The `Connection` property is set to the supplied connection.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopy Class](#)
- [OracleBulkCopy Members](#)
- ["OracleBulkCopyOptions Enumeration"](#)

## OracleBulkCopy(string)

This constructor instantiates a new instance of the `OracleBulkCopy` class by first creating an `OracleConnection` object based on the supplied *connectionString*, then initializing the new `OracleBulkCopy` object with the `OracleConnection` object and `OracleBulkCopyOptions` default value.

### Declaration

```
// C#  
public OracleBulkCopy(string connectionString);
```

### Parameters

- *connectionString*

The connection information used to connect to the Oracle database and perform the bulk copy operation.

### Exception

`ArgumentNullException` - The *connectionString* parameter is null.

`ArgumentException` - The *connectionString* parameter is empty.

### Remarks

The `WriteToServer` method opens the connection, if it is not already opened. The connection is automatically closed when the `OracleBulkCopy` instance is closed.

This constructor uses the default enumeration value `OracleBulkCopyOptions.Default`.

The `Connection` property is set to the `OracleConnection` object initialized using the supplied `connectionString`.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopy Class](#)
- [OracleBulkCopy Members](#)
- ["OracleBulkCopyOptions Enumeration"](#)

## OracleBulkCopy(OracleConnection, OracleBulkCopyOptions)

This constructor instantiates a new instance of `OracleBulkCopy` using the specified connection object and `OracleBulkCopyOptions` value.

### Declaration

```
// C#  
public OracleBulkCopy(OracleConnection connection, OracleBulkCopyOptions  
    copyOptions);
```

### Parameters

- `connection`  
The open instance of an `OracleConnection` object that performs the bulk copy operation.
- `copyOptions`  
The combination of `OracleBulkCopyOptions` enumeration values that determine the behavior of the `OracleBulkCopy` object.

### Exceptions

`ArgumentNullException` - The `connection` parameter is null.

`InvalidOperationException` - The connection is not in the open state.

### Remarks

The connection passed to this constructor must be open. It remains open after the `OracleBulkCopy` instance is closed.

The `Connection` property is set to the supplied connection.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopy Class](#)
- [OracleBulkCopy Members](#)
- ["OracleBulkCopyOptions Enumeration"](#)

## OracleBulkCopy(string, OracleBulkCopyOptions)

This constructor instantiates a new instance of the `OracleBulkCopy` class by first creating an `OracleConnection` object based on the supplied `connectionString`, then initializing the new `OracleBulkCopy` object with the `OracleConnection` object and the supplied `OracleBulkCopyOptions` enumeration values.

### Declaration

```
// C#  
public OracleBulkCopy(string connectionString, OracleBulkCopyOptions copyOptions);
```

### Parameters

- `connectionString`  
The connection information used to connect to the Oracle database to perform the bulk copy operation.
- `copyOptions`  
The combination of `OracleBulkCopyOptions` enumeration values that determine the behavior of the bulk copy operation.

### Exceptions

`ArgumentNullException` - The `connectionString` is null.

`ArgumentException` - The `connectionString` parameter is empty.

### Remarks

The constructor uses the new instance of the `OracleConnection` class to initialize a new instance of the `OracleBulkCopy` class. The `OracleBulkCopy` instance behaves according to options supplied in the `copyOptions` parameter.

The connection is automatically closed when the `OracleBulkCopy` instance is closed.

The `Connection` property is set to an `OracleConnection` object initialized using the supplied `connectionString`.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopy Class](#)
- [OracleBulkCopy Members](#)
- ["OracleBulkCopyOptions Enumeration"](#)

## OracleBulkCopy Properties

OracleBulkCopy properties are listed in [Table 18-5](#).

**Table 18-5 OracleBulkCopy Properties**

Property	Description
<a href="#">BatchSize</a>	Specifies the number of rows to be sent as a batch to the database
<a href="#">BulkCopyOptions</a>	Specifies the <code>OracleBulkCopyOptions</code> enumeration value that determines the behavior of the bulk copy operation
<a href="#">BulkCopyTimeout</a>	Specifies the number of seconds allowed for the bulk copy operation to complete before it is aborted
<a href="#">ColumnMappings</a>	Specifies the column mappings between the data source and destination table
<a href="#">Connection</a>	Specifies the <code>OracleConnection</code> object that the Oracle database uses to perform the bulk copy operation
<a href="#">DestinationPartitionName</a>	Specifies the database partition that the data is loaded into
<a href="#">DestinationSchemaName</a>	Specifies the database schema that the data is loaded into
<a href="#">DestinationTableName</a>	Specifies the database table that the data is loaded in
<a href="#">NotifyAfter</a>	Defines the number of rows to be processed before a notification event is generated

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopy Class](#)
- [OracleBulkCopy Members](#)

### BatchSize

This property specifies the number of rows to be sent as a batch to the database.

## Declaration

```
// C#  
public int BatchSize {get; set;}
```

## Property Value

An integer value for the number of rows to be sent to the database as a batch.

## Exceptions

`ArgumentOutOfRangeException` - The batch size is less than zero.

## Remarks

The default value is zero, indicating that the rows are not sent to the database in batches. The entire set of rows are sent in one single batch.

A large batch size reduces database round trips, but it can also consume large amounts of client side memory. Excessive memory consumption slows down overall machine performance and leads to errors if the process runs out of accessible memory. It is recommended that client side memory is not consumed in excess. This can be done by reducing the batch size.

A batch is complete when `BatchSize` number of rows have been processed or there are no more rows to send to the database.

- If `BatchSize > 0` and the `UseInternalTransaction` bulk copy option is specified, each batch of the bulk copy operation occurs within a transaction. If the connection used to perform the bulk copy operation is already part of a transaction, an `InvalidOperationException` exception is raised.
- If `BatchSize > 0` and the `UseInternalTransaction` option is not specified, rows are sent to the database in batches of size `BatchSize`, but no transaction-related action is taken.

The `BatchSize` property can be set at any time. If a bulk copy is already in progress, the current batch size is determined by the previous batch size. Subsequent batches use the new batch size.

If the `BatchSize` property is initially zero and changes while a `WriteToServer` operation is in progress, that operation loads the data as a single batch. Any subsequent `WriteToServer` operations on the same `OracleBulkCopy` instance use the new `BatchSize`.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopy Class](#)
- [OracleBulkCopy Members](#)
- ["OracleBulkCopyOptions Enumeration"](#)

## BulkCopyOptions

This property specifies the `OracleBulkCopyOptions` enumeration value that determines the behavior of the bulk copy option.

### Declaration

```
// C#  
public OracleBulkCopyOptions BulkCopyOptions {get; set;}
```

### Property Value

The `OracleBulkCopyOptions` enumeration object that defines the behavior of the bulk copy operation.

### Exceptions

`ArgumentNullException` - The bulk copy options set is null.

### Remarks

The default value of this property is `OracleBulkCopyOptions.Default` value. This property can be used to change the bulk copy options between the batches of a bulk copy operation.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopy Class](#)
- [OracleBulkCopy Members](#)
- ["OracleBulkCopyOptions Enumeration"](#)

## BulkCopyTimeout

This property specifies the number of seconds allowed for the bulk copy operation to complete before it is aborted.

### Declaration

```
// C#  
public int BulkCopyTimeout {get; set;}
```

### Property Value

An integer value for the number of seconds after which the bulk copy operation times out.

### Exceptions

`ArgumentOutOfRangeException` - The timeout value is set to less than zero.

## Remarks

The default value is 30 seconds.

If `BatchSize>0`, rows that were sent to the database in the previous batches remain committed. The rows that are processed in the current batch are not sent to the database. If `BatchSize=0`, no rows are sent to the database.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopy Class](#)
- [OracleBulkCopy Members](#)

## ColumnMappings

This property specifies the column mappings between the data source and destination table.

### Declaration

```
// C#  
public OracleBulkCopyColumnMappingCollection ColumnMappings {get;}
```

### Property Value

The `OracleBulkCopyColumnMappingCollection` object that defines the column mapping between the source and destination table.

### Remarks

The `ColumnMappings` collection is unnecessary if the data source and the destination table have the same number of columns, and the ordinal position of each source column matches the ordinal position of the corresponding destination column. However, if the column counts differ, or the ordinal positions are not consistent, the `ColumnMappings` collection must be used to ensure that data is copied into the correct columns.

During the execution of a bulk copy operation, this collection can be accessed, but it cannot be changed.

By default, this property specifies an empty collection of column mappings.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopy Class](#)
- [OracleBulkCopy Members](#)

## Connection

This property specifies the `OracleConnection` object that the Oracle database uses to perform the bulk copy operation.

### Declaration

```
// C#  
public OracleConnection Connection {get; }
```

### Property Value

The `OracleConnection` object used for the bulk copy operations.

### Remarks

This property gets the connection constructed by the `OracleBulkCopy`, if the `OracleBulkCopy` object is initialized using a connection string.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopy Class](#)
- [OracleBulkCopy Members](#)

## DestinationPartitionName

This property specifies the database partition that the data is loaded into.

### Declaration

```
// C#  
public string DestinationPartitionName {get; set;}
```

### Property Value

A string value that identifies the destination partition name.

### Remarks

If `DestinationPartitionName` is modified while a `WriteToServer` operation is running, the change does not affect the current operation. The new `DestinationPartitionName` value is used the next time a `WriteToServer` method is called.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopy Class](#)
- [OracleBulkCopy Members](#)

## DestinationSchemaName

This property specifies the database schema that the data is loaded into.

### Declaration

```
// C#  
public string DestinationSchemaName {get; set;}
```

### Property Value

A string value that identifies the destination schema name.

### Remarks

By default, this property is set to the schema or the user associated with the connection used by the `OracleBulkCopy` object. This default can be modified by setting this property to a different destination schema or user name.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopy Class](#)
- [OracleBulkCopy Members](#)

## DestinationTableName

This property specifies the database table that the data is loaded into.

### Declaration

```
// C#  
public string DestinationTableName {get; set;}
```

### Property Value

A string value that identifies the destination table name.

### Exceptions

`ArgumentNullException` - The destination table name set is null.

`ArgumentException` - The destination table name is empty.

### Remarks

If `DestinationTableName` is modified while a `WriteToServer` operation is running, the change does not affect the current operation. The new `DestinationTableName` value is used the next time a `WriteToServer` method is called.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopy Class](#)
- [OracleBulkCopy Members](#)

## NotifyAfter

This property defines the number of rows to be processed before a notification event is generated.

### Declaration

```
// C#  
public int NotifyAfter {get; set;}
```

### Property Value

An integer value that specifies the number of rows to be processed before the notification event is raised.

### Exceptions

`ArgumentOutOfRangeException` - The property value is set to a number less than zero.

### Remarks

The default value for this property is zero, to specify that no notifications events are to be generated.

This property can be retrieved in user interface components to display the progress of a bulk copy operation. The `NotifyAfter` property can be set at anytime, even during a bulk copy operation. The changes take effect for the next notification and any subsequent operations on the same instance.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopy Class](#)
- [OracleBulkCopy Members](#)

## OracleBulkCopy Public Methods

OracleBulkCopy methods are listed in [Table 18-6](#).

**Table 18-6 OracleBulkCopy Public Methods**

Method	Description
<a href="#">Close</a>	Closes the OracleBulkCopy instance
<a href="#">Dispose</a>	Releases any resources or memory allocated by the object
<a href="#">WriteToServer</a>	Copies rows to a destination table

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopy Class](#)
- [OracleBulkCopy Members](#)

### Close

This method closes the OracleBulkCopy instance.

#### Declaration

```
// C#  
public void Close();
```

#### Exceptions

InvalidOperationException - The Close method was called from a OracleRowsCopied event.

#### Remarks

After the Close method is called on a OracleBulkCopy object, no other operation can succeed. Calls to the WriteToServer method throw an InvalidOperationException. The Close method closes the connection if the connection was opened by the OracleBulkCopy

object, that is, if the `OracleBulkCopy` object was created by a constructor that takes a connection string.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopy Class](#)
- [OracleBulkCopy Members](#)

## Dispose

This method releases any resources or memory allocated by the object.

### Declaration

```
// C#  
public void Dispose();
```

### Implements

`IDisposable`

### Remarks

After the `Dispose` method is called on the `OracleBulkCopy` object, no other operation can succeed. The connection is closed if the connection was opened by the `OracleBulkCopy` object, that is, if a constructor that takes a connection string created the `OracleBulkCopy` object.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopy Class](#)
- [OracleBulkCopy Members](#)

## WriteToServer

`WriteToServer` copies rows to a destination table.

### Overload List:

- [WriteToServer\(DataRow\[\]\)](#)

This method copies all rows from the supplied `DataRow` array to a destination table specified by the `DestinationTableName` property of the `OracleBulkCopy` object.

- [WriteToServer\(DataTable\)](#)  
This method copies all rows in the supplied `DataTable` to a destination table specified by the `DestinationTableName` property of the `OracleBulkCopy` object.
- [WriteToServer\(IDataReader\)](#)  
This method copies all rows in the supplied `IDataReader` to a destination table specified by the `DestinationTableName` property of the `OracleBulkCopy` object.
- [WriteToServer\(DataTable, DataRowState\)](#)  
This method copies rows that match the supplied row state in the supplied `DataTable` to a destination table specified by the `DestinationTableName` property of the `OracleBulkCopy` object.
- [WriteToServer\(OracleRefCursor\)](#)  
This method copies all rows from the specified `OracleRefCursor` to a destination table specified by the `DestinationTableName` property of the `OracleBulkCopy` object.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopy Class](#)
- [OracleBulkCopy Members](#)

## WriteToServer(DataRow[])

This method copies all rows from the supplied `DataRow` array to a destination table specified by the `DestinationTableName` property of the `OracleBulkCopy` object.

### Declaration

```
// C#  
public void WriteToServer(DataRow[] rows);
```

### Parameters

- *rows*  
An array of `DataRow` objects to be copied to the destination table.

### Exceptions

`ArgumentNullException` - The *rows* parameter is null.

`InvalidOperationException` - The connection is not in an open state.

### Remarks

The `ColumnMappings` collection maps from the `DataRow` columns to the destination database table.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopy Class](#)
- [OracleBulkCopy Members](#)

## WriteToServer(DataTable)

This method copies all rows in the supplied `DataTable` to a destination table specified by the `DestinationTableName` property of the `OracleBulkCopy` object.

### Declaration

```
// C#  
public void WriteToServer(DataTable table);
```

### Parameters

- `table`

The source `DataTable` containing rows to be copied to the destination table.

### Exceptions

`ArgumentNullException` - The `table` parameter is null.

`InvalidOperationException` - The connection is not in an open state.

### Remarks

All rows in the `DataTable` are copied to the destination table except those that have been deleted.

The `ColumnMappings` collection maps from the `DataTable` columns to the destination database table.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopy Class](#)
- [OracleBulkCopy Members](#)

## WriteToServer(IDataReader)

This method copies all rows in the supplied `IDataReader` to a destination table specified by the `DestinationTableName` property of the `OracleBulkCopy` object.

### Declaration

```
// C#  
public void WriteToServer(IDataReader reader);
```

### Parameters

- *reader*  
A `IDataReader` instance containing rows to be copied to the destination table.

### Exceptions

`ArgumentNullException` - The *reader* parameter is null.

`InvalidOperationException` - The connection is not in an open state.

### Remarks

The bulk copy operation starts with the next available row of the data reader. Typically, the *reader* returned by a call to the `ExecuteReader` method is passed to the `WriteToServer` method so that the next row becomes the first row. To copy multiple result sets, the application must call `NextResult` on the *reader* and then call the `WriteToServer` method again.

This `WriteToServer` method changes the state of the reader as it calls `reader.Read` internally to get the source rows. Thus, at the end of the `WriteToServer` operation, the *reader* is at the end of the result set.

The `ColumnMappings` collection maps from the data reader columns to the destination database table.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopy Class](#)
- [OracleBulkCopy Members](#)

## WriteToServer(DataTable, DataRowState)

This method copies rows that match the supplied row state in the supplied `DataTable` to a destination table specified by the `DestinationTableName` property of the `OracleBulkCopy` object.

### Declaration

```
// C#  
public void WriteToServer(DataTable table, DataRowState rowState);
```

### Parameters

- *table*

A `DataTable` containing rows to be copied to the destination table.

- `rowState`

The `DataRowState` enumeration value. Only rows matching the row state are copied to the destination.

### Exceptions

`ArgumentNullException` - The `table` or `rowState` parameter is null.

`InvalidOperationException` - The connection is not in an open state.

### Remarks

Only rows in the `DataTable` that are in the state indicated in the `rowState` argument and have not been deleted are copied to the destination table.

The `ColumnMappings` collection maps from the `DataTable` columns to the destination database table.

`DataRowState.Deleted` is not supported and the behavior would be that all the rows except the deleted ones are copied.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopy Class](#)
- [OracleBulkCopy Members](#)

## WriteToServer(OracleRefCursor)

This method copies all rows from the specified `OracleRefCursor` to a destination table specified by the `DestinationTableName` property of the `OracleBulkCopy` object.

### Declaration

```
// C#  
public void WriteToServer(OracleRefCursor refCursor);
```

### Parameters

- `refCursor`

An `OracleRefCursor` object containing rows to be copied to the destination table.

### Exceptions

`ArgumentNullException` - The `refCursor` parameter is null

`InvalidOperationException` - The connection is not in an open state.

## Remarks

The `ColumnMappings` collection maps from the `OracleRefCursor` columns to the destination database table.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopy Class](#)
- [OracleBulkCopy Members](#)

## OracleBulkCopy Events

`OracleBulkCopy` events are listed in [Table 18-7](#).

**Table 18-7 OracleBulkCopy Events**

Event	Description
<a href="#">OracleRowsCopied</a>	Triggered every time the number of rows specified by the <code>OracleBulkCopy.NotifyAfter</code> property has been processed

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopy Class](#)
- [OracleBulkCopy Members](#)

## OracleRowsCopied

This event is triggered every time the number of rows specified by the `OracleBulkCopy.NotifyAfter` property has been processed.

### Declaration

```
// C#  
public event OracleRowsCopiedEventHandler OracleRowsCopied;
```

### Exceptions

`InvalidOperationException` - The `Close` method is called inside this event.

## Remarks

This event is raised when the number of rows specified by the `NotifyAfter` property has been processed. It does not imply that the rows have been sent to the database or committed.

To cancel the operation from this event, use the `Abort` property of `OracleRowsCopiedEventArgs` class.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopy Class](#)
- [OracleBulkCopy Members](#)
- ["NotifyAfter"](#)

# OracleBulkCopyColumnMapping Class

The `OracleBulkCopyColumnMapping` class defines the mapping between a column in the data source and a column in the destination database table.

## Class Inheritance

`System.Object`

`System.OracleBulkCopyColumnMapping`

## Declaration

```
// C#
public sealed class OracleBulkCopyColumnMapping
```

## Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	<code>Oracle.DataAccess.dll</code>	<code>Oracle.ManagedDataAccess.dll</code>	<code>Oracle.ManagedDataAccess.dll</code>
<b>Namespace</b>	<code>Oracle.DataAccess.Client</code>	<code>Oracle.ManagedDataAccess.Client</code>	<code>Oracle.ManagedDataAccess.Client</code>
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

## Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

## Remarks

Column mappings define the mapping between data source and the target table.

It is not necessary to specify column mappings for all the columns in the data source. If a `ColumnMapping` is not specified, then, by default, columns are mapped based on the ordinal position. This succeeds only if the source and destination table schema match. If there is a mismatch, an `InvalidOperationException` is thrown.

All the mappings in a mapping collection must be by name or ordinal position.



### Note:

Oracle Data Provider for .NET makes one or more round-trips to the database to determine the column name if the mapping is specified by ordinal position. To avoid this performance overhead, specify the mapping by column name.

## Example

```
// C#
```



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopyColumnMapping Members](#)
- [OracleBulkCopyColumnMapping Constructors](#)
- [OracleBulkCopyColumnMapping Methods](#)
- [OracleBulkCopyColumnMapping Properties](#)

## OracleBulkCopyColumnMapping Members

`OracleBulkCopyColumnMapping` members are listed in the following tables.

### OracleBulkCopyColumnMapping Constructors

The `OracleBulkCopyColumnMapping` constructors are listed in [Table 18-8](#).

**Table 18-8 OracleBulkCopyColumnMapping Constructors**

Constructor	Description
<a href="#">OracleBulkCopyColumnMapping Constructors</a>	Instantiates new instances of the <code>OracleBulkCopyColumnMapping</code> class

## OracleBulkCopyColumnMapping Methods

The `OracleBulkCopyColumnMapping` method is listed in [Table 18-9](#).

**Table 18-9 OracleBulkCopyColumnMapping Method**

Constructor	Description
<a href="#">CompareTo</a>	Compares the current instance to the supplied object and returns an integer that represents their relative values

## OracleBulkCopyColumnMapping Properties

The `OracleBulkCopyColumnMapping` properties are listed in [Table 18-10](#).

**Table 18-10 OracleBulkCopyColumnMapping Properties**

Property	Description
<a href="#">DestinationColumn</a>	Specifies the column name of the destination table that is being mapped
<a href="#">DestinationOrdinal</a>	Specifies the column ordinal value of the destination table that is being mapped
<a href="#">SourceColumn</a>	Specifies the column name of the data source that is being mapped
<a href="#">SourceOrdinal</a>	Specifies the column ordinal value of the data source that is being mapped



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopyColumnMapping Class](#)

## OracleBulkCopyColumnMapping Constructors

`OracleBulkCopyColumnMapping` constructors instantiates new instances of the `OracleBulkCopyColumnMapping` class.

### Overload List:

- [OracleBulkCopyColumnMapping\(\)](#)  
This constructor instantiates a new instance of the `OracleBulkCopyColumnMapping` class
- [OracleBulkCopyColumnMapping\(int, int\)](#)  
This constructor instantiates a new instance of the `OracleBulkCopyColumnMapping` class using the provided source column ordinal and destination column ordinal.

- [OracleBulkCopyColumnMapping\(int, string\)](#)

This constructor instantiates a new instance of the `OracleBulkCopyColumnMapping` class using the provided source column ordinal and destination column name.

- [OracleBulkCopyColumnMapping\(string, int\)](#)

This constructor instantiates a new instance of the `OracleBulkCopyColumnMapping` class using the provided source column name and destination column ordinal.

- [OracleBulkCopyColumnMapping\(string, string\)](#)

This constructor instantiates a new instance of the `OracleBulkCopyColumnMapping` class using the provided source column name and destination column name.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopyColumnMapping Class](#)
- [OracleBulkCopyColumnMapping Members](#)

## OracleBulkCopyColumnMapping()

This constructor instantiates a new instance of the `OracleBulkCopyColumnMapping` class.

### Declaration

```
// C#  
public OracleBulkCopyColumnMapping();
```

### Remarks

Applications that use this constructor must define the source for the mapping using the `SourceColumn` or `SourceOrdinal` property, and must define the destination for the mapping using the `DestinationColumn` or `DestinationOrdinal` property.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopyColumnMapping Class](#)
- [OracleBulkCopyColumnMapping Members](#)

## OracleBulkCopyColumnMapping(int, int)

This constructor instantiates a new instance of the `OracleBulkCopyColumnMapping` class using the provided source and destination column ordinal positions.

**Declaration**

```
// C#  
public OracleBulkCopyColumnMapping(int sourceColumnOrdinal,  
    int destinationOrdinal);
```

**Parameters**

- *sourceColumnOrdinal*  
The ordinal position of the source column within the data source.
- *destinationOrdinal*  
The ordinal position of the destination column within the destination table.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopyColumnMapping Class](#)
- [OracleBulkCopyColumnMapping Members](#)

## OracleBulkCopyColumnMapping(int, string)

This constructor instantiates a new instance of the `OracleBulkCopyColumnMapping` class using the provided source column ordinal and destination column name.

**Declaration**

```
// C#  
public OracleBulkCopyColumnMapping(int sourceColumnOrdinal,  
    string destinationColumn);
```

**Parameters**

- *sourceColumnOrdinal*  
The ordinal position of the source column within the data source.
- *destinationColumn*  
The name of the destination column within the destination table.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopyColumnMapping Class](#)
- [OracleBulkCopyColumnMapping Members](#)

## OracleBulkCopyColumnMapping(string, int)

This constructor instantiates a new instance of the `OracleBulkCopyColumnMapping` class using the provided source column name and destination column ordinal.

### Declaration

```
// C#  
public OracleBulkCopyColumnMapping(string sourceColumn, int destinationOrdinal);
```

### Parameters

- *sourceColumn*  
The name of the source column within the data source.
- *destinationOrdinal*  
The ordinal position of the destination column within the destination table.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopyColumnMapping Class](#)
- [OracleBulkCopyColumnMapping Members](#)

## OracleBulkCopyColumnMapping(string, string)

This constructor instantiates a new instance of the `OracleBulkCopyColumnMapping` class using the provided source and destination column names.

### Declaration

```
// C#  
public OracleBulkCopyColumnMapping(string sourceColumn, string destinationColumn);
```

### Parameters

- *sourceColumn*  
The name of the source column within the data source.
- *destinationColumn*  
The name of the destination column within the destination table.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopyColumnMapping Class](#)
- [OracleBulkCopyColumnMapping Members](#)

## OracleBulkCopyColumnMapping Methods

The `OracleBulkCopyColumnMapping` method is listed in [Table 18-11](#).

**Table 18-11 OracleBulkCopyColumnMapping Method**

Property	Description
<a href="#">CompareTo</a>	Compares the current instance to the supplied object and returns an integer that represents their relative values

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopyColumnMapping Class](#)
- [OracleBulkCopyColumnMapping Members](#)

## CompareTo

This method compares the current instance to the supplied object and returns an integer that represents their relative values.

### Declaration

```
// C#
public int CompareTo(object obj);
```

### Parameters

`obj` - The supplied instance.

### Return Value

Less than zero: if the value of the current instance is less than `obj`.

Zero: if the value of the current instance is equal to `obj`.

Greater than zero: if the value of the current instance is greater than `obj`.

**Implements**

IComparable

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopyColumnMapping Class](#)
- [OracleBulkCopyColumnMapping Members](#)

## OracleBulkCopyColumnMapping Properties

The `OracleBulkCopyColumnMapping` properties are listed in [Table 18-12](#).

**Table 18-12 OracleBulkCopyColumnMapping Properties**

Property	Description
<a href="#">DestinationColumn</a>	Specifies the column name of the destination table that is being mapped
<a href="#">DestinationOrdinal</a>	Specifies the column ordinal value of the destination table that is being mapped
<a href="#">SourceColumn</a>	Specifies the column name of the data source that is being mapped
<a href="#">SourceOrdinal</a>	Specifies the column ordinal value of the data source that is being mapped

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopyColumnMapping Class](#)
- [OracleBulkCopyColumnMapping Members](#)

## DestinationColumn

This property specifies the column name of the destination table that is being mapped.

**Declaration**

```
// C#
public string DestinationColumn {get; set;}
```

### Property Value

A string value that represents the destination column name of the mapping.

### Remarks

The `DestinationColumn` and `DestinationOrdinal` properties are mutually exclusive. The last value set takes precedence.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopyColumnMapping Class](#)
- [OracleBulkCopyColumnMapping Members](#)

## DestinationOrdinal

This property specifies the column ordinal value of the destination table that is being mapped.

### Declaration

```
// C#  
public int DestinationOrdinal {get; set;}
```

### Property Value

An integer value that represents the destination column ordinal of the mapping.

### Exceptions

`IndexOutOfRangeException` - The destination ordinal is invalid.

### Remarks

The `DestinationOrdinal` and `DestinationColumn` properties are mutually exclusive. The last value set takes precedence.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopyColumnMapping Class](#)
- [OracleBulkCopyColumnMapping Members](#)

## SourceColumn

This property specifies the column name of the data source that is being mapped.

### Declaration

```
// C#  
public string SourceColumn {get; set;}
```

### Property Value

A string value that represents the source column name of the mapping.

### Remarks

The `SourceColumn` and `SourceOrdinal` properties are mutually exclusive. The last value set takes precedence.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopyColumnMapping Class](#)
- [OracleBulkCopyColumnMapping Members](#)

## SourceOrdinal

This property specifies the column ordinal value of the data source that is being mapped.

### Declaration

```
// C#  
public int SourceOrdinal {get; set;}
```

### Property Value

An integer value that represents the source column ordinal of the mapping.

### Exceptions

`IndexOutOfRangeException` - The source ordinal is invalid.

### Remarks

The `SourceOrdinal` and `SourceColumn` properties are mutually exclusive. The last value set takes precedence.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopyColumnMapping Class](#)
- [OracleBulkCopyColumnMapping Members](#)

## OracleBulkCopyColumnMappingCollection Class

The `OracleBulkCopyColumnMappingCollection` class represents a collection of `OracleBulkCopyColumnMapping` objects that are used to map columns in the data source to columns in a destination table.

### Class Inheritance

`System.Object`

`System.CollectionBase`

`System.OracleBulkCopyColumnMappingCollection`

### Declaration

```
// C#
public sealed class OracleBulkCopyColumnMappingCollection : CollectionBase
```

### Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	<code>Oracle.DataAccess.dll</code>	<code>Oracle.ManagedDataAccess.dll</code>	<code>Oracle.ManagedDataAccess.dll</code>
<b>Namespace</b>	<code>Oracle.DataAccess.Client</code>	<code>Oracle.ManagedDataAccess.Client</code>	<code>Oracle.ManagedDataAccess.Client</code>
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

### Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

### Remarks

Column mappings define the mapping between data source and the target table.

It is not necessary to specify column mappings for all the columns in the data source. If a `ColumnMapping` is not specified, then, by default, columns are mapped based on the ordinal position. This succeeds only if the source and destination table schema match. If there is a mismatch, an `InvalidOperationException` is thrown.

All the mappings in a mapping collection must be by name or ordinal position.

 **Note:**

Oracle Data Provider for .NET makes one or more round-trips to the database to determine the column name if the mapping is specified by ordinal position. To avoid this performance overhead, specify the mapping by column name.

**Example**

```
// C#
```

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopyColumnMappingCollection Class](#)
- [OracleBulkCopyColumnMappingCollection Members](#)
- [OracleBulkCopyColumnMappingCollection Properties](#)
- [OracleBulkCopyColumnMappingCollection Public Methods](#)

## OracleBulkCopyColumnMappingCollection Members

`OracleBulkCopyColumnMappingCollection` members are listed in the following tables.

### OracleBulkCopyColumnMappingCollection Properties

The `OracleBulkCopyColumnMappingCollection` properties are listed in [Table 18-13](#).

**Table 18-13 OracleBulkCopyColumnMappingCollection Properties**

Property	Description
<a href="#">Item[index]</a>	Gets or sets the <code>OracleBulkCopyColumnMappingCollection</code> object at the specified index

### OracleBulkCopyColumnMappingCollection Public Methods

The `OracleBulkCopyColumnMappingCollection` public methods are listed in [Table 18-14](#).

**Table 18-14 OracleBulkCopyColumnMappingCollection Public Methods**

Public Method	Description
<a href="#">Add</a>	Adds objects to the collection
<a href="#">Clear</a>	Clears the contents of the collection

**Table 18-14 (Cont.) OracleBulkCopyColumnMappingCollection Public Methods**

Public Method	Description
<a href="#">Contains</a>	Returns a value indicating whether or not a specified <code>OracleBulkCopyColumnMapping</code> object exists in the collection
<a href="#">CopyTo</a>	Copies the elements of the <code>OracleBulkCopyColumnMappingCollection</code> to an array of <code>OracleBulkCopyColumnMapping</code> items, starting at a specified index
<a href="#">IndexOf</a>	Returns the index of the specified <code>OracleBulkCopyColumnMapping</code> object
<a href="#">Insert</a>	Inserts a new <code>OracleBulkCopyColumnMapping</code> object in the collection, at the index specified.
<a href="#">Remove</a>	Removes the specified <code>OracleBulkCopyColumnMapping</code> element from the <code>OracleBulkCopyColumnMappingCollection</code> .
<a href="#">RemoveAt</a>	Removes the mapping from the collection at the specified index.



**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopyColumnMappingCollection Class](#)

## OracleBulkCopyColumnMappingCollection Properties

The `OracleBulkCopyColumnMappingCollection` properties are listed in [Table 18-15](#).

**Table 18-15 OracleBulkCopyColumnMappingCollection Properties**

Property	Description
<a href="#">Item[index]</a>	Gets or sets the <code>OracleBulkCopyColumnMappingCollection</code> object at the specified index



**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopyColumnMappingCollection Class](#)
- [OracleBulkCopyColumnMappingCollection Members](#)

## Item[index]

This property gets or sets the `OracleBulkCopyColumnMapping` object at the specified index.

### Declaration

```
// C#
public OracleBulkCopyColumnMapping this[int index] {get;set;}
```

### Parameters

- `index`

The zero-based index of the `OracleBulkCopyColumnMapping` being set or retrieved.

### Property Value

An `OracleBulkCopyColumnMapping` object at the specified index.

### Exceptions

`IndexOutOfRangeException` - The specified index does not exist.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopyColumnMappingCollection Class](#)
- [OracleBulkCopyColumnMappingCollection Members](#)

## OracleBulkCopyColumnMappingCollection Public Methods

The `OracleBulkCopyColumnMappingCollection` public methods are listed in [Table 18-16](#).

**Table 18-16 OracleBulkCopyColumnMappingCollection Public Methods**

Public Method	Description
<a href="#">Add</a>	Adds objects to the collection
<a href="#">Clear</a>	Clears the contents of the collection
<a href="#">Contains</a>	Returns a value indicating whether or not a specified <code>OracleBulkCopyColumnMapping</code> object exists in the collection
<a href="#">CopyTo</a>	Copies the elements of the <code>OracleBulkCopyColumnMappingCollection</code> to an array of <code>OracleBulkCopyColumnMapping</code> items, starting at a specified index
<a href="#">IndexOf</a>	Returns the index of the specified <code>OracleBulkCopyColumnMapping</code> object
<a href="#">Insert</a>	Inserts a new <code>OracleBulkCopyColumnMapping</code> object in the collection, at the index specified.

Table 18-16 (Cont.) OracleBulkCopyColumnMappingCollection Public Methods

Public Method	Description
<a href="#">Remove</a>	Removes the specified <code>OracleBulkCopyColumnMapping</code> element from the <code>OracleBulkCopyColumnMappingCollection</code> .
<a href="#">RemoveAt</a>	Removes the mapping from the collection at the specified index.

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopyColumnMappingCollection Class](#)
- [OracleBulkCopyColumnMappingCollection Members](#)

## Add

Add methods add objects to the collection.

**Overload List:**

- [Add\(OracleBulkCopyColumnMapping\)](#)  
This method adds the supplied `OracleBulkCopyColumnMapping` object to the collection.
- [Add\(int, int\)](#)  
This method creates and adds an `OracleBulkCopyColumnMapping` object to the collection using the supplied source and destination column ordinal positions.
- [Add\(int, string\)](#)  
This method creates and adds an `OracleBulkCopyColumnMapping` object to the collection using the supplied source column ordinal and destination column name.
- [Add\(string, int\)](#)  
This method creates and adds an `OracleBulkCopyColumnMapping` object to the collection using the supplied source column name and destination column ordinal.
- [Add\(string, string\)](#)  
This method creates and adds an `OracleBulkCopyColumnMapping` object to the collection using the supplied source and destination column names.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopyColumnMappingCollection Class](#)
- [OracleBulkCopyColumnMappingCollection Members](#)

## Add(OracleBulkCopyColumnMapping)

This method adds the supplied `OracleBulkCopyColumnMapping` object to the collection.

### Declaration

```
// C#
public OracleBulkCopyColumnMapping Add(OracleBulkCopyColumnMapping
    bulkCopyColumnMapping);
```

### Parameters

- *bulkCopyColumnMapping*

The `OracleBulkCopyColumnMapping` object that describes the mapping to be added to the collection.

### Exceptions

`InvalidOperationException` - The bulk copy operation is in progress.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopyColumnMappingCollection Class](#)
- [OracleBulkCopyColumnMappingCollection Members](#)

## Add(int, int)

This method creates and adds an `OracleBulkCopyColumnMapping` object to the collection using the supplied source and destination column ordinal positions.

### Declaration

```
// C#
public OracleBulkCopyColumnMapping Add(int sourceColumnIndex,
    int destinationColumnIndex);
```

### Parameters

- *sourceColumnIndex*

The ordinal position of the source column within the data source.

- `destinationColumnIndex`

The ordinal position of the destination column within the destination table.

### Exceptions

`InvalidOperationException` - The bulk copy operation is in progress.

### Return Value

The newly created `OracleBulkCopyColumnMapping` object that was added to the collection.

### Remarks

It is not necessary to specify column mappings for all the columns in the data source. If a `ColumnMapping` is not specified, then, by default, columns are mapped based on the ordinal position. This succeeds only if the source and destination table schema match. If there is a mismatch, an `InvalidOperationException` is thrown.

All the mappings in a mapping collection must be by name or ordinal position.



#### Note:

Oracle Data Provider for .NET makes one or more round-trips to the database to determine the column name if the mapping is specified by ordinal position. To avoid this performance overhead, specify the mapping by column name.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopyColumnMappingCollection Class](#)
- [OracleBulkCopyColumnMappingCollection Members](#)

## Add(int, string)

This method creates and adds an `OracleBulkCopyColumnMapping` object to the collection using the supplied source column ordinal and destination column name.

### Declaration

```
// C#
public OracleBulkCopyColumnMapping Add(int sourceColumnIndex,
    string destinationColumn);
```

### Parameters

- *sourceColumnIndex*  
The ordinal position of the source column within the data source.
- *destinationColumn*  
The name of the destination column within the destination table.

### Exceptions

`InvalidOperationException` - The bulk copy operation is in progress.

### Return Value

The newly created `OracleBulkCopyColumnMapping` object that was added to the collection.

### Remarks

It is not necessary to specify column mappings for all the columns in the data source. If a `ColumnMapping` is not specified, then, by default, columns are mapped based on the ordinal position. This succeeds only if the source and destination table schema match. If there is a mismatch, an `InvalidOperationException` is thrown.

All the mappings in a mapping collection must be by name or ordinal position.



#### Note:

Oracle Data Provider for .NET makes one or more round trips to the database to determine the column names if the mapping is specified by ordinal resulting in a performance overhead. Therefore, it is recommended to specify the mapping by column names.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopyColumnMappingCollection Class](#)
- [OracleBulkCopyColumnMappingCollection Members](#)

## Add(string, int)

This method creates and adds an `OracleBulkCopyColumnMapping` object to the collection using the supplied source column name and destination column ordinal.

### Declaration

```
// C#  
public OracleBulkCopyColumnMapping Add(string sourceColumn,  
    int destinationColumnIndex);
```

### Parameters

- *sourceColumn*  
The name of the source column within the data source.
- *destinationColumnIndex*  
The ordinal position of the destination column within the destination table.

### Return Value

The newly created `OracleBulkCopyColumnMapping` object that was added to the collection.

### Exceptions

`InvalidOperationException` - The bulk copy operation is in progress.

### Remarks

It is not necessary to specify column mappings for all the columns in the data source. If a `ColumnMapping` is not specified, then, by default, columns are mapped based on the ordinal position. This succeeds only if the source and destination table schema match. If there is a mismatch, an `InvalidOperationException` is thrown.

All the mappings in a mapping collection must be by name or ordinal position.



#### Note:

Oracle Data Provider for .NET makes one or more round trips to the database to determine the column names if the mapping is specified by ordinal resulting in a performance overhead. Therefore, it is recommended to specify the mapping by column names.



#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopyColumnMappingCollection Class](#)
- [OracleBulkCopyColumnMappingCollection Members](#)

## Add(string, string)

This method creates and adds an `OracleBulkCopyColumnMapping` object to the collection using the supplied source and destination column names.

## Declaration

```
// C#  
public OracleBulkCopyColumnMapping Add(string sourceColumn,  
    string destinationColumn);
```

## Parameters

- *sourceColumn*  
The name of the source column within the data source.
- *destinationColumn*  
The name of the destination column within the destination table.

## Exceptions

`InvalidOperationException` - The bulk copy operation is in progress.

## Return Value

The newly created `OracleBulkCopyColumnMapping` object that was added to the collection.

## Remarks

It is not necessary to specify column mappings for all the columns in the data source. If a `ColumnMapping` is not specified, then, by default, columns are mapped based on the ordinal position. This succeeds only if the source and destination table schema match. If there is a mismatch, an `InvalidOperationException` is thrown.

All the mappings in a mapping collection must be by name or ordinal position.

### Note:

Oracle Data Provider for .NET makes one or more round-trips to the database to determine the column name if the mapping is specified by ordinal position. To avoid this performance overhead, specify the mapping by column name.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopyColumnMappingCollection Class](#)
- [OracleBulkCopyColumnMappingCollection Members](#)

## Clear

This method clears the contents of the collection.

## Declaration

```
// C#  
public void Clear();
```

## Exceptions

`InvalidOperationException` - The bulk copy operation is in progress.

## Remarks

The `Clear` method is most commonly used when an application uses a single `OracleBulkCopy` instance to process more than one bulk copy operation. If column mappings are created for one bulk copy operation, the `OracleBulkCopyColumnMappingCollection` must be cleared after the `WriteToServer` method invocation and before the next bulk copy is processed.

It is usually more efficient to perform several bulk copies using the same `OracleBulkCopy` instance than to use a separate `OracleBulkCopy` for each operation.



### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopyColumnMappingCollection Class](#)
- [OracleBulkCopyColumnMappingCollection Members](#)

## Contains

This method returns a value indicating whether or not a specified `OracleBulkCopyColumnMapping` object exists in the collection.

## Declaration

```
// C#  
public bool Contains(OracleBulkCopyColumnMapping value);
```

## Parameters

- `value`  
A valid `OracleBulkCopyColumnMapping` object.

## Return Value

Returns `true` if the specified mapping exists in the collection; otherwise, returns `false`.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopyColumnMappingCollection Class](#)
- [OracleBulkCopyColumnMappingCollection Members](#)

## CopyTo

This method copies the elements of the `OracleBulkCopyColumnMappingCollection` to an array of `OracleBulkCopyColumnMapping` items, starting at a specified index.

### Declaration

```
// C#  
public void CopyTo(OracleBulkCopyColumnMapping[] array, int index);
```

### Parameters

- *array*  
The one-dimensional `OracleBulkCopyColumnMapping` array that is the destination for the elements copied from the `OracleBulkCopyColumnMappingCollection` object. The array must have zero-based indexing.
- *index*  
The zero-based array index at which copying begins.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopyColumnMappingCollection Class](#)
- [OracleBulkCopyColumnMappingCollection Members](#)

## IndexOf

This method returns the index of the specified `OracleBulkCopyColumnMapping` object.

### Declaration

```
// C#  
public int IndexOf(OracleBulkCopyColumnMapping value);
```

### Parameters

- *value*  
The `OracleBulkCopyColumnMapping` object that is being returned.

## Return Value

The zero-based index of the column mapping or -1 if the column mapping is not found in the collection.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopyColumnMappingCollection Class](#)
- [OracleBulkCopyColumnMappingCollection Members](#)

## Insert

This method inserts a new `OracleBulkCopyColumnMapping` object in the collection, at the index specified.

### Declaration

```
// C#  
public void Insert(int index, OracleBulkCopyColumnMapping value);
```

### Parameters

- *index*  
The integer value of the location within the `OracleBulkCopyColumnMappingCollection` at which the new `OracleBulkCopyColumnMapping` is inserted.
- *value*  
The `OracleBulkCopyColumnMapping` object to be inserted in the collection.

### Exceptions

`InvalidOperationException` - The bulk copy operation is in progress.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopyColumnMappingCollection Class](#)
- [OracleBulkCopyColumnMappingCollection Members](#)

## Remove

This method removes the specified `OracleBulkCopyColumnMapping` element from the `OracleBulkCopyColumnMappingCollection`.

### Declaration

```
// C#  
public void Remove(OracleBulkCopyColumnMapping value);
```

### Parameters

- *value*  
The `OracleBulkCopyColumnMapping` object to be removed from the collection.

### Exceptions

`InvalidOperationException` - The bulk copy operation is in progress.

### Remarks

The `Remove` method is most commonly used when a single `OracleBulkCopy` instance processes more than one bulk copy operation. If column mappings are created for one bulk copy operation, mappings that no longer apply must be removed after the `WriteToServer` method invocation and before mappings are defined for the next bulk copy. The `Clear` method can clear the entire collection, and the `Remove` and the `RemoveAt` methods can remove mappings individually.

It is usually more efficient to perform several bulk copies using the same `OracleBulkCopy` instance than to use a separate `OracleBulkCopy` for each operation.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopyColumnMappingCollection Class](#)
- [OracleBulkCopyColumnMappingCollection Members](#)

## RemoveAt

This method removes the mapping from the collection at the specified index.

### Declaration

```
// C#  
public void RemoveAt(int index);
```

### Parameters

- *index*

The zero-based index of the `OracleBulkCopyColumnMapping` object to be removed from the collection.

### Exceptions

`InvalidOperationException` - The bulk copy operation is in progress.

### Remarks

The `RemoveAt` method is most commonly used when a single `OracleBulkCopy` instance is used to process more than one bulk copy operation. If column mappings are created for one bulk copy operation, mappings that no longer apply must be removed after the `WriteToServer` method invocation and before the mappings for the next bulk copy are defined. The `Clear` method can clear the entire collection, and the `Remove` and the `RemoveAt` methods can remove mappings individually.

It is usually more efficient to perform several bulk copies using the same `OracleBulkCopy` instance than to use a separate `OracleBulkCopy` for each operation.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleBulkCopyColumnMappingCollection Class](#)
- [OracleBulkCopyColumnMappingCollection Members](#)

## OracleBulkCopyOptions Enumeration

The `OracleBulkCopyOptions` enumeration specifies the values that can be combined with an instance of the `OracleBulkCopy` class and used as options to determine its behavior and the behavior of the `WriteToServer` methods for that instance.

[Table 18-17](#) lists all the `OracleBulkCopyOptions` enumeration values with a description of each enumerated value.

**Table 18-17 OracleBulkCopyOptions Enumeration Members**

Member Name	Description
Default	Indicates that the default value for all options are to be used
UseInternalTransaction	Indicates that each batch of the bulk copy operation occurs within a transaction. If the connection used to perform the bulk copy operation is already part of a transaction, an <code>InvalidOperationException</code> exception is raised.  If this member is not specified, <code>BatchSize</code> number of rows are sent to the database, without any transaction-related activity.

 **Note:**

All bulk copy operations are agnostic of any local or distributed transaction created by the application.

**Requirements**

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

 **See Also:**

- "[Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces](#)"
- OracleBulkCopy "[BulkCopyOptions](#)"

## OracleRowsCopiedEventHandler Delegate

The `OracleRowsCopiedEventHandler` delegate represents the method that handles the `OracleRowsCopied` event of an `OracleBulkCopy` object.

**Declaration**

```
// C#
public delegate void OracleRowsCopiedEventHandler (object sender,
    OracleRowsCopiedEventArgs eventArgs);
```

**Requirements**

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

### Parameters

- *sender*  
The source of the event.
- *EventArgs*  
The `OracleRowsCopiedEventArgs` object that contains the event data.

### Remarks

Event callbacks can be registered through this event delegate for applications that wish to be notified every time the number of rows specified by the `OracleBulkCopy.NotifyAfter` property has been processed.

If the event handler calls the `OracleBulkCopy.Close` method, an exception is generated, and the `OracleBulkCopy` object state does not change.

The event handler can also set the `OracleRowsCopiedEventArgs.Abort` property to `true` to indicate that the bulk copy operation must be aborted. If the bulk copy operation is part of an external transaction, an exception is generated and the transaction is not rolled back. The application is responsible for either committing or rolling back the external transaction.

If there is no external transaction, the internal transaction for the current batch of rows is automatically rolled back. However the previous batches of imported rows are unaffected, as their transactions have already been committed.

#### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- ["OracleRowsCopied"](#)
- ["NotifyAfter"](#)

## OracleRowsCopiedEventArgs Class

The `OracleRowsCopiedEventArgs` class represents the set of arguments passed as part of event data for the `OracleRowsCopied` event.

### Class Inheritance

`System.Object`

`System.EventArgs`

`System.OracleRowsCopiedEventArgs`

### Declaration

```
// C#  
public class OracleRowsCopiedEventArgs : EventArgs
```

## Requirements

Provider	ODP.NET, Unmanaged Driver	ODP.NET, Managed Driver	ODP.NET Core
<b>Assembly</b>	Oracle.DataAccess.dll	Oracle.ManagedDataAccess.dll	Oracle.ManagedDataAccess.dll
<b>Namespace</b>	Oracle.DataAccess.Client	Oracle.ManagedDataAccess.Client	Oracle.ManagedDataAccess.Client
<b>.NET Framework</b>	4.8	4.8	-
<b>.NET (Core)</b>	-	-	See <a href="#">System Requirements</a>

## Thread Safety

All public static methods are thread-safe, although instance methods do not guarantee thread safety.

## Remarks

Each time the number of rows represented by the `OracleBulkCopy.NotifyAfter` property is processed, the `OracleBulkCopy.OracleRowsCopied` event is raised, providing an `OracleRowsCopiedEventArgs` object that stores the event data.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleRowsCopiedEventArgs Members](#)
- [OracleRowsCopiedEventArgs Constructors](#)
- [OracleRowsCopiedEventArgs Properties](#)

## OracleRowsCopiedEventArgs Members

`OracleRowsCopiedEventArgs` members are listed in the following tables.

### OracleRowsCopiedEventArgs Constructors

`OracleRowsCopiedEventArgs` constructors are listed in [Table 18-18](#).

**Table 18-18 OracleRowsCopiedEventArgs Constructors**

Constructor	Description
<a href="#">OracleRowsCopiedEventArgs Constructors.</a>	<code>OracleRowsCopiedEventArgs</code> creates new instances of the <code>OracleRowsCopiedEventArgs</code> class

## OracleRowsCopiedEventArgs Properties

OracleRowsCopiedEventArgs properties are listed in [Table 18-19](#).

**Table 18-19 OracleRowsCopiedEventArgs Properties**

Property	Description
<a href="#">Abort</a>	Retrieves or sets a value that indicates whether or not the bulk copy operation is aborted
<a href="#">RowsCopied</a>	Retrieves a value that represents the number of rows copied during the current bulk copy operation

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleRowsCopiedEventArgs Class](#)

## OracleRowsCopiedEventArgs Constructors

OracleRowsCopiedEventArgs creates new instances of the OracleRowsCopiedEventArgs class.

### Overload List:

- [OracleRowsCopiedEventArgs\(long\)](#)  
This constructor creates a new instance of the OracleRowsCopiedEventArgs object.

### See Also:

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleRowsCopiedEventArgs Class](#)
- [OracleRowsCopiedEventArgs Members](#)

## OracleRowsCopiedEventArgs(long)

This constructor creates a new instance of the OracleRowsCopiedEventArgs object.

### Declaration

```
// C#  
public OracleRowsCopiedEventArgs(long rowsCopied);
```

**Parameters**

- *rowsCopied*

An `Int64` value that indicates the number of rows copied during the current bulk copy operation.

**Remarks**

The value in the *rowsCopied* parameter is reset by each call to a `WriteToServer` method.

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleRowsCopiedEventArgs Class](#)
- [OracleRowsCopiedEventArgs Members](#)

## OracleRowsCopiedEventArgs Properties

`OracleRowsCopiedEventArgs` properties are listed in [Table 18-20](#).

**Table 18-20 OracleRowsCopiedEventArgs Properties**

Property	Description
<a href="#">Abort</a>	Retrieves or sets a value that indicates whether or not the bulk copy operation is aborted
<a href="#">RowsCopied</a>	Retrieves a value that represents the number of rows copied during the current bulk copy operation

**See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleRowsCopiedEventArgs Class](#)
- [OracleRowsCopiedEventArgs Members](#)

### Abort

This property retrieves or sets a value that indicates whether or not the bulk copy operation is aborted.

**Declaration**

```
// C#  
public bool Abort {get; set;}
```

**Property Value**

Returns `true` if the bulk copy operation is to be aborted; otherwise, returns `false`.

**Remarks**

Set the `Abort` property to `true` to cancel the bulk copy operation.

If the `Close` method is called from `OracleRowsCopied`, an exception is generated, and the `OracleBulkCopy` object state does not change.

If the application does not create a transaction, the internal transaction corresponding to the current batch is automatically rolled back. However, changes related to previous batches within the bulk copy operation are retained, because the transactions in those batches are committed. This case is applicable only when `UseInternalTransaction` bulk copy option is chosen.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleRowsCopiedEventArgs Class](#)
- [OracleRowsCopiedEventArgs Members](#)

## RowsCopied

This property retrieves a value that represents the number of rows copied during the current bulk copy operation.

**Declaration**

```
// C#  
public long RowsCopied {get;}
```

**Property Value**

An `Int64` value that returns the number of rows copied.

**Remarks**

The value in the `RowsCopied` property is reset by each call to a `WriteToServer` method.

 **See Also:**

- ["Oracle.DataAccess.Client and Oracle.ManagedDataAccess.Client Namespaces"](#)
- [OracleRowsCopiedEventArgs Class](#)
- [OracleRowsCopiedEventArgs Members](#)

# A

## Oracle Schema Collections

ODP.NET provides standard metadata collections as well as various Oracle database-specific metadata collections that can be retrieved through the `OracleConnection.GetSchema` API.

### See Also:

- ["Schema Discovery"](#)
- ["GetSchema"](#)

This appendix contains the following topics:

- [Common Schema Collections](#)
- [ODP.NET-Specific Schema Collection](#)

## Common Schema Collections

The common schema collections are available for all .NET Framework managed providers. ODP.NET supports the same common schema collections.

- [MetaDataCollections](#)
- [DataSourceInformation](#)
- [DataTypes](#)
- [Restrictions](#)
- [ReservedWords](#)

### See Also:

"Common Schema Collections" in the [MSDN Library](#)

## MetaDataCollections

[Table A-1](#) is a list of metadata collections that is available from the data source, such as tables, columns, indexes, and stored procedures.

**Table A-1 MetaDataCollections**

Column Name	Data Type	Description
CollectionName	string	The name of the collection passed to the <code>GetSchema</code> method for retrieval.
NumberOfRestrictions	int	Number of restrictions specified for the named collection.
NumberOfIdentifierParts	int	Number of parts in the composite identifier/database object name.

## DataSourceInformation

[Table A-2](#) lists `DataSourceInformation` information which may include these columns and possibly others.

**Table A-2 DataSource Information**

Columns	Data Type	Description
<code>CompositeIdentifierSeparatorPattern</code>	string	Separator for multipart names: @   \ .
<code>DataSourceProductName</code>	string	Database name: Oracle
<code>DataSourceProductVersion</code>	string	Database version. Note that this is the version of the database instance currently being accessed by <code>DbConnection</code> .
<code>DataSourceProductVersionNormalized</code>	string	A normalized <code>DataSource</code> version for easier comparison between different versions. For example: DataSource Version: 10.2.0.1.0 Normalized DataSource Version: 10.02.00.01.00
<code>GroupByBehavior</code>	<code>GroupByBehavior</code>	An enumeration that indicates the relationship between the columns in a <code>GROUP BY</code> clause and the non-aggregated columns in a select list.
<code>IdentifierPattern</code>	string	Format for a valid identifier.
<code>IdentifierCase</code>	<code>IdentifierCase</code>	An enumeration that specifies whether or not to treat non-quoted identifiers as case sensitive.
<code>OrderByColumnsInSelect</code>	bool	A boolean that indicates whether or not the select list must contain the columns in an <code>ORDER BY</code> clause.
<code>ParameterMarkerFormat</code>	string	A string indicating whether or not parameter markers begin with a special character.
<code>ParameterMarkerPattern</code>	string	The format of a parameter marker.
<code>ParameterNameMaxLength</code>	int	Maximum length of a parameter.
<code>ParameterNamePattern</code>	string	The format for a valid parameter name.
<code>QuotedIdentifierPattern</code>	string	The format of a quoted identifier.

Table A-2 (Cont.) DataSource Information

Columns	Data Type	Description
QuotedIdentifierCase	IdentifierCase	An enumeration that specifies whether or not to treat quote identifiers as case sensitive.
StringLiteralPattern	string	The format for a string literal.
SupportedJoinOperators	SupportedJoinOperators	An enumeration indicating the types of SQL join statements supported by the data source.

## DataTypes

Table A-3 lists DataTypes Collection information which may include these columns and possibly others.



### Note:

As an example, the description column includes complete information for the `TIMESTAMP WITH LOCAL TIME ZONE` data type.

Table A-3 Data Types

ColumnName	Data Type	Description
TypeName	string	The provider-specific data type name. Example: <code>TIMESTAMP WITH LOCAL TIME ZONE</code>
ProviderDbType	int	The provider-specific type value. Example: 124
ColumnSize	long	The length of a non-numeric column or parameter. Example: 27
CreateFormat	string	A format string that indicates how to add this column to a DDL statement. Example: <code>TIMESTAMP({0}) WITH LOCAL TIME ZONE</code>
CreateParameters	string	The parameters specified to create a column of this data type. Example: 8
DataType	string	The .NET type for the data type. Example: <code>System.DateTime</code>

**Table A-3 (Cont.) Data Types**

ColumnName	Data Type	Description
IsAutoIncrementable	bool	A boolean value that indicates whether or not this data type can be auto-incremented. Example: false
IsBestMatch	bool	A boolean value that indicates whether or not this data type is the best match to values in the <code>DataType</code> column. Example: false
IsCaseSensitive	bool	A boolean value that indicates whether or not this data type is case-sensitive. Example: false
IsFixedLength	bool	A boolean value that indicates whether or not this data type has a fixed length. Example: true
IsFixedPrecisionScale	bool	A boolean value that indicates whether or not this data type has a fixed precision and scale. Example: false
IsLong	bool	A boolean value that indicates whether or not this data type contains very long data. Example: false
IsNullable	bool	A boolean value that indicates whether or not this data type is nullable. Example: true
IsSearchable	bool	A boolean value that indicates whether or not the data type can be used in a <code>WHERE</code> clause with any operator, except the <code>LIKE</code> predicate. Example: true
IsSearchableWithLike	bool	A boolean value that indicates whether or not this data type can be used with the <code>LIKE</code> predicate. Example: false
IsUnsigned	bool	A boolean value that indicates whether or not the data type is unsigned.
MaximumScale	short	The maximum number of digits allowed to the right of the decimal point.

**Table A-3 (Cont.) Data Types**

ColumnName	Data Type	Description
MinimumScale	short	The minimum number of digits allowed to the right of the decimal point.
IsConcurrencyType	bool	A boolean value that indicates whether or not the database updates the data type every time the row is changed and the value of the column differs from all previous values. Example: false
MinimumVersion	String	The earliest version of the database that can be used. Example:09.00.00.00
IsLiteralSupported	bool	A boolean value that indicates whether or not the data type can be expressed as a literal. Example: true
LiteralPrefix	string	The prefix of a specified literal. Example: TO_TIMESTAMP_TZ ('
LiteralSuffix	string	The suffix of a specified literal. Example: ', 'YYYY-MM-DD HH24:MI:SS.FF')

## Restrictions

[Table A-4](#) lists Restrictions, including the following columns.

**Table A-4 Restrictions**

ColumnName	Data Type	Description
CollectionName	string	The collection that the restrictions apply to.
RestrictionName	string	The restriction name.
RestrictionNumber	int	A number that indicates the location of the restriction.

## ReservedWords

The `ReservedWords` collection exposes information about the words that are reserved by the database currently connected to ODP.NET.

[Table A-5](#) lists the `ReservedWords` Collection.

**Table A-5 ReservedWords**

ColumnName	Data Type	Description
ReservedWord	string	Provider-specific reserved words

## ODP.NET-Specific Schema Collection

Oracle Data Provider for .NET supports both the common schema collections described previously and the following Oracle-specific schema collections:

- [Tables](#)
- [Columns](#)
- [Views](#)
- [XMLSchema](#)
- [Users](#)
- [Synonyms](#)
- [Sequences](#)
- [Functions](#)
- [Procedures](#)
- [ProcedureParameters](#)
- [Arguments](#)
- [Packages](#)
- [PackageBodies](#)
- [JavaClasses](#)
- [Indexes](#)
- [IndexColumns](#)
- [PrimaryKeys](#)
- [ForeignKeys](#)
- [ForeignKeyColumns](#)
- [UniqueKeys](#)

## Tables

[Table A-6](#) lists the column name, data type, and description of the Tables Schema Schema Collection.

**Table A-6 Tables**

Column Name	Data Type	Description
OWNER	String	Owner of the Table.
TABLE_NAME	String	Name of the Table.

**Table A-6 (Cont.) Tables**

Column Name	Data Type	Description
TYPE	String	Type of Table, for example, System or User.

## Columns

[Table A-7](#) lists the column name, data type, and description of the Columns Schema Collection .

**Table A-7 Columns**

ColumnName	Data Type	Description
OWNER	String	Owner of the table or view.
TABLE_NAME	String	Name of the table or view.
COLUMN_NAME	String	Name of the column.
ID	Decimal	Sequence number of the column as created.
DATATYPE	String	Data type of the column.
LENGTH	Decimal	Length of the column in bytes.
PRECISION	Decimal	Decimal precision for NUMBER data type; binary precision for FLOAT data type, null for all other data types.
Scale	Decimal	Digits to right of decimal point in a number.
NULLABLE	String	Specifies whether or not a column allows NULLs.
CHAR_USED	String	Indicates whether the column uses BYTE length semantics (B) or CHAR length semantics (C).
LengthInChars	Decimal	Length of the column in characters. This value only applies to CHAR, VARCHAR2, NCHAR, and NVARCHAR2.

## Views

[Table A-8](#) lists the column name, data type, and description of the Views Schema Collection.

**Table A-8 Views**

Column Name	Data Type	Description
OWNER	String	Owner of the view.
VIEW_NAME	String	Name of the view.
TEXT_LENGTH	Decimal	Length of the view text.
TEXT	String	View text.
TYPE_TEXT_LENGTH	Decimal	Length of the type clause of the typed view.
TYPE_TEXT	String	Type clause of the typed view.

**Table A-8 (Cont.) Views**

Column Name	Data Type	Description
OID_TEXT_LENGTH	Decimal	Length of the WITH OID clause of the typed view.
OID_TEXT	String	WITH OID clause of the typed view.
VIEW_TYPE_OWNER	String	Owner of the view type if the view is a typed view.
VIEW_TYPE	String	Type of the view if the view is a typed view.
SUPERVIEW_NAME	String	Name of the superview. (Oracle9i or later)

## XMLSchema

Table A-9 lists the column name, data type and description of the XMLSchema Schema Collection.



**Note:**

This collection is only available with Oracle Database 10g and later.

**Table A-9 XMLSchema**

Column Name	Data Type	Description
OWNER	String	Owner of the XML schema.
SCHEMA_URL	String	Schema URL of the XML schema.
LOCAL	String	Indicates whether the XML schema is local (YES) or global (NO).
SCHEMA	String	XML schema document.
INT_OBJNAME	String	Internal database object name for the schema.
QUAL_SCHEMA_URL	String	Fully qualified schema URL.
HIER_TYPE	String	Hierarchy type for the schema.

## Users

Table A-10 lists the column name, data type and description of the Users Schema Collection.

**Table A-10 Users**

Column Name	Data Type	Description
NAME	String	Name of the user.
ID	Decimal	ID number of the user.

**Table A-10 (Cont.) Users**

Column Name	Data Type	Description
CREATEDATE	DateTime	User creation date.

## Synonyms

[Table A-11](#) lists the column name, data type and description of the Synonyms Schema Collection.

**Table A-11 Synonyms**

Column Name	Data Type	Description
OWNER	String	Owner of the synonym.
SYNONYM_NAME	String	Name of the synonym.
TABLE_OWNER	String	Owner of the object referenced by the synonym. Although the column is called <code>TABLE_OWNER</code> , the object owned is not necessarily a table. It can be any general object such as a view, sequence, stored procedure, synonym, and so on.
TABLE_NAME	String	Name of the object referenced by the synonym. Although the column is called <code>TABLE_NAME</code> , the object does not necessarily have to be a table. It can be any general object such as a view, sequence, stored procedure, synonym, and so on.
DB_LINK	String	Name of the database link referenced, if any.

## Sequences

[Table A-12](#) lists the column name, data type, and description of the Sequences Schema Collection.

**Table A-12 Sequences**

Column Name	Data Type	Description
SEQUENCE_OWNER	String	Name of the owner of the sequence.
SEQUENCE_NAME	String	Sequence name.
MIN_VALUE	Decimal	Minimum value of the sequence.
MAX_VALUE	Decimal	Maximum value of the sequence.
INCREMENT_BY	Decimal	Value by which sequence is incremented.
CYCLE_FLAG	String	Indicates if sequence wraps around on reaching limit.
ORDER_FLAG	String	Indicates if sequence numbers are generated in order.
CACHE_SIZE	Decimal	Number of sequence numbers to cache.

**Table A-12 (Cont.) Sequences**

Column Name	Data Type	Description
LAST_NUMBER	Decimal	Last sequence number written to disk. If a sequence uses caching, the number written to disk is the last number placed in the sequence cache. This number is likely to be greater than the last sequence number that was used.

## Functions

[Table A-13](#) lists the column name, data type, and description of the Functions Schema Collection.

**Table A-13 Functions**

Column Name	Data Type	Description
OWNER	String	Owner of the function.
OBJECT_NAME	String	Name of the function.
SUBOBJECT_NAME	String	Name of the subobject (for example, partition).
OBJECT_ID	Decimal	Dictionary object number of the function.
DATA_OBJECT_ID	Decimal	Dictionary object number of the segment that contains the function.
CREATED	DateTime	Timestamp for the creation of the function.
LAST_DDL_TIME	DateTime	Timestamp for the last modification of the function resulting from a DDL statement (including grants and revokes).
TIMESTAMP	String	Timestamp for the specification of the function (character data).
STATUS	String	Status of the function (VALID, INVALID, or N/A).
TEMPORARY	String	Whether or not the function is temporary (the current session can see only data that it placed in this object itself).
GENERATED	String	Indicates whether the name of this function is system generated (Y) or not (N).
SECONDARY	String	Whether or not this is a secondary object created by the <code>ODCIIndexCreate</code> method of the Oracle Data Cartridge (Y   N).

## Procedures

[Table A-14](#) lists the column name, data type, and description of the Procedures Schema Collection.

**Table A-14 Procedures**

Column Name	Data Type	Description
OWNER	String	Owner of the procedure.
OBJECT_NAME	String	Name of the procedure.
SUBOBJECT_NAME	String	Name of the subobject (for example, partition).
OBJECT_ID	Decimal	Dictionary object number of the procedure.
DATA_OBJECT_ID	Decimal	Dictionary object number of the segment that contains the procedure.
CREATED	DateTime	Timestamp for the creation of the procedure.
LAST_DDL_TIME	Decimal	Timestamp for the last modification of the procedure resulting from a DDL statement (including grants and revokes).
TIMESTAMP	String	Timestamp for the specification of the procedure (character data).
STATUS	String	Status of the procedure (VALID, INVALID, or N/A).
TEMPORARY	String	Whether or not the procedure is temporary (the current session can see only data that it placed in this object itself).
GENERATED	String	Indicates whether the name of this procedure is system generated (Y) or not (N).
SECONDARY	String	Whether or not this is a secondary object created by the ODCIIndexCreate method of the Oracle Data Cartridge (Y   N).

## ProcedureParameters

Table A-15 lists the column name, data type and description of the ProcedureParameters Schema Collection.

**Table A-15 ProcedureParameters**

Column Name	Data Type	Description
OWNER	String	Owner of the object.
OBJECT_NAME	String	Name of the procedure or function.
PACKAGE_NAME	String	Name of the package.
OBJECT_ID	Decimal	Object number of the object.
OVERLOAD	String	Indicates the <i>n</i> th overloading ordered by its appearance in the source; otherwise, it is NULL.
SUBPROGRAM_ID	Decimal	Subprogram id for the procedure or function
ARGUMENT_NAME	String	If the argument is a scalar type, then the argument name is the name of the argument. A null argument name is used to denote a function return value.
POSITION	Decimal	If DATA_LEVEL is zero, then this column holds the position of this item in the argument list, or zero for a function return value.

**Table A-15 (Cont.) ProcedureParameters**

Column Name	Data Type	Description
SEQUENCE	Decimal	Defines the sequential order of the argument. Argument sequence starts from 1.
DATA_LEVEL	Decimal	Nesting depth of the argument for composite types.
DATA_TYPE	String	Data type of the argument.
DEFAULT_VALUE	String	Default value for the argument.
DEFAULT_LENGTH	Decimal	Length of the default value for the argument.
IN_OUT	String	Direction of the argument: [IN] [OUT] [IN/OUT].
DATA_LENGTH	Decimal	Length of the column (in bytes).
DATA_PRECISION	Decimal	Length in decimal digits (NUMBER) or binary digits (FLOAT).
DATA_SCALE	Decimal	Digits to the right of the decimal point in a number.
RADIX	Decimal	Argument radix for a number.
CHARACTER_SET_NAME	String	Character set name for the argument.
TYPE_OWNER	String	Owner of the type of the argument.
TYPE_NAME	String	Name of the type of the argument. If the type is a package local type (that is, it is declared in a package specification), then this column displays the name of the package.
TYPE_SUBNAME	String	Displays the name of the type declared in the package identified in the TYPE_NAME column. Relevant only for package local types.
TYPE_LINK	String	Displays the database link that refers to the remote package. Relevant only for package local types when the package identified in the TYPE_NAME column is a remote package.
PLS_TYPE	String	For numeric arguments, the name of the PL/SQL type of the argument. Otherwise, Null.
CHAR_LENGTH	Decimal	Character limit for string data types.
CHAR_USED	String	Indicates whether the byte limit (B) or character limit (C) is official for the string.

## Arguments

Table A-16 lists the column name, data type, and description of the Arguments Schema Collection.

**Table A-16 Arguments**

Column Name	Data Type	Description
OWNER	String	Owner of the object.
PACKAGE_NAME	String	Name of the package.

**Table A-16 (Cont.) Arguments**

Column Name	Data Type	Description
OBJECT_NAME	String	Name of the procedure or function.
ARGUMENT_NAME	String	If the argument is a scalar type, then the argument name is the name of the argument. A null argument name is used to denote a function return value.
POSITION	Decimal	If DATA_LEVEL is zero, then this column holds the position of this item in the argument list, or zero for a function return value.
SEQUENCE	Decimal	Defines the sequential order of the argument. Argument sequence starts from 1.
DEFAULT_VALUE	String	Default value for the argument.
DEFAULT_LENGTH	Decimal	Length of the default value for the argument.
IN_OUT	String	Direction of the argument: [IN] [OUT] [IN/OUT].
DATA_LENGTH	Decimal	Length of the column (in bytes).
DATA_PRECISION	Decimal	Length in decimal digits (NUMBER) or binary digits (FLOAT).
DATA_SCALE	Decimal	Digits to the right of the decimal point in a number.
DATA_TYPE	String	Data type of the argument.
CHAR_USED	String	Indicates whether the column uses BYTE length semantics (B) or CHAR length semantics (C).

## Packages

[Table A-17](#) lists the column name, data type, and description of the Packages Schema Collection.

**Table A-17 Packages**

Column Name	Data Type	Description
OWNER	String	Owner of the package.
OBJECT_NAME	String	Name of the package.
SUBOBJECT_NAME	String	Name of the subobject (for example, partition).
OBJECT_ID	Decimal	Dictionary object number of the package.
DATA_OBJECT_ID	Decimal	Dictionary object number of the segment that contains the package.
CREATED	DateTime	Timestamp for the creation of the package.
LAST_DDL_TIME	DateTime	Timestamp for the last modification of the package resulting from a DDL statement (including grants and revokes).
TIMESTAMP	String	Timestamp for the specification of the package (character data).
STATUS	String	Status of the package (VALID, INVALID, or N/A).

**Table A-17 (Cont.) Packages**

Column Name	Data Type	Description
TEMPORARY	String	Whether or not the package is temporary (the current session can see only data that it placed in this object itself).
GENERATED	String	Indicates whether the name of this package was system generated (Y) or not (N).
SECONDARY	String	Whether or not this is a secondary object created by the <code>ODCIIndexCreate</code> method of the Oracle Data Cartridge (Y   N).

## PackageBodies

[Table A-18](#) lists the column name, data type, and description of the PackageBodies Schema Collection.

**Table A-18 PackageBodies**

Column Name	Data Type	Description
OWNER	String	Owner of the package body.
OBJECT_NAME	String	Name of the package body.
SUBOBJECT_NAME	String	Name of the subobject (for example, partition).
OBJECT_ID	Decimal	Dictionary object number of the package body.
DATA_OBJECT_ID	Decimal	Dictionary object number of the segment that contains the package body.
CREATED	DateTime	Timestamp for the creation of the package body.
LAST_DDL_TIME	DateTime	Timestamp for the last modification of the package body resulting from a DDL statement (including grants and revokes).
TIMESTAMP	String	Timestamp for the specification of the package body (character data).
STATUS	String	Status of the package body (VALID, INVALID, or N/A).
TEMPORARY	String	Whether the package body is temporary (the current session can see only data that it placed in this object itself).
GENERATED	String	Indicates whether the name of this package body is system generated (Y) or not (N).
SECONDARY	String	Whether or not this is a secondary object created by the <code>ODCIIndexCreate</code> method of the Oracle Data Cartridge (Y   N).

## JavaClasses

[Table A-19](#) lists the column name, data type, and description of the JavaClasses Schema Collection.

**Table A-19 JavaClasses**

Column Name	Data Type	Description
OWNER	String	Owner of the Java class.
NAME	String	Name of the Java class.
MAJOR	Decimal	Major version number of the Java class, as defined in the JVM specification.
MINOR	Decimal	Minor version number of the Java class, as defined in the JVM specification.
KIND	String	Indicates whether the stored object is a Java class (CLASS) or a Java interface (INTERFACE).
ACCESSIBILITY	String	Accessibility of the Java class.
IS_INNER	String	Indicates whether this Java class is an inner class (YES) or not (NO).
IS_ABSTRACT	String	Indicates whether this Java class is an abstract class (YES) or not (NO).
IS_FINAL	String	Indicates whether this Java class is a final class (YES) or not (NO).
IS_DEBUG	String	Indicates whether this Java class contains debug information (YES) or not (NO).
SOURCE	String	Source designation of the Java class.
SUPER	String	Super class of this Java class.
OUTER	String	Outer class of this Java class if this Java class is an inner class.

## Indexes

[Table A-20](#) lists the column name, data type, and description of the Indexes Schema Collection.

**Table A-20 Indexes**

Column Name	Data Type	Description
OWNER	String	Owner of the index.
INDEX_NAME	String	Name of the index.
INDEX_TYPE	String	Type of the index: <ul style="list-style-type: none"> <li>• NORMAL</li> <li>• BITMAP</li> <li>• FUNCTION-BASED NORMAL</li> <li>• FUNCTION-BASED BITMAP</li> <li>• DOMAIN</li> </ul>
TABLE_OWNER	String	Owner of the indexed object.
TABLE_NAME	String	Name of the indexed object.
TABLE_TYPE	String	Type of the indexed object (for example, TABLE or CLUSTER).

**Table A-20 (Cont.) Indexes**

Column Name	Data Type	Description
UNIQUENESS	String	Indicates whether the index is <code>UNIQUE</code> or <code>NONUNIQUE</code> .
COMPRESSION	String	Indicates whether index compression is enabled ( <code>ENABLED</code> ) or not ( <code>DISABLED</code> ).
PREFIX_LENGTH	Decimal	Number of columns in the prefix of the compression key.
TABLESPACE_NAME	String	Name of the tablespace containing the index.
INI_TRANS	Decimal	Initial number of transactions.
MAX_TRANS	Decimal	Maximum number of transactions.
INITIAL_EXTENT	Decimal	Size of the initial extent.
NEXT_EXTENT	Decimal	Size of secondary extents.
MIN_EXTENTS	Decimal	Minimum number of extents allowed in the segment.
MAX_EXTENTS	Decimal	Maximum number of extents allowed in the segment.
PCT_INCREASE	Decimal	Percentage increase in extent size.
PCT_THRESHOLD	Decimal	Threshold percentage of block space allowed per index entry.
INCLUDE_COLUMN	Decimal	Column ID of the last column to be included in index-organized table primary key (non-overflow) index. This column maps to the <code>COLUMN_ID</code> column of the <code>*_TAB_COLUMNS</code> data dictionary views.
FREELISTS	Decimal	Number of process freelists allocated to this segment.
FREELIST_GROUPS	Decimal	Number of freelist groups allocated to this segment.
PCT_FREE	Decimal	Minimum percentage of free space in a block.
LOGGING	String	Logging information.
BLEVEL	Decimal	B*-Tree level: depth of the index from its root block to its leaf blocks. A depth of 0 indicates that the root block and leaf block are the same.
LEAF_BLOCKS	Decimal	Number of leaf blocks in the index.
DISTINCT_KEYS	Decimal	Number of distinct indexed values. For indexes that enforce <code>UNIQUE</code> and <code>PRIMARY KEY</code> constraints, this value is the same as the number of rows in the table ( <code>USER_TABLES.NUM_ROWS</code> ).
AVG_LEAF_BLOCKS_PER_KEY	Decimal	Average number of leaf blocks in which each distinct value in the index appears, rounded to the nearest integer. For indexes that enforce <code>UNIQUE</code> and <code>PRIMARY KEY</code> constraints, this value is always 1.
AVG_DATA_BLOCKS_PER_KEY	Decimal	Average number of data blocks in the table that are pointed to by a distinct value in the index, rounded to the nearest integer. This statistic is the average number of data blocks that contain rows that contain a given value for the indexed columns.
CLUSTERING_FACTOR	Decimal	Indicates the amount of order of the rows in the table based on the values of the index.
STATUS	String	Indicates whether a nonpartitioned index is <code>VALID</code> or <code>UNUSABLE</code> .

**Table A-20 (Cont.) Indexes**

Column Name	Data Type	Description
NUM_ROWS	Decimal	Number of rows in the index.
SAMPLE_SIZE	Decimal	Size of the sample used to analyze the index.
LAST_ANALYZED	Date	Date on which this index was most recently analyzed.
DEGREE	String	Number of threads per instance for scanning the index.
INSTANCES	String	Number of instances across which the indexes to be scanned.
PARTITIONED	String	Indicates whether the index is partitioned (YES) or not (NO).
TEMPORARY	String	Indicates whether or not the index is on a temporary table.
GENERATED	String	Indicates whether the name of the index is system generated (Y) or not (N).
SECONDARY	String	Indicates whether the index is a secondary object created by the <code>ODCIIndexCreate</code> method of the Oracle Data Cartridge (Y) or not (N).
BUFFER_POOL	String	Name of the default buffer pool to be used for the index blocks.
USER_STATS	String	Indicates whether statistics were entered directly by the user (YES) or not (NO).
DURATION	String	Indicates the duration of a temporary table.
PCT_DIRECT_ACCESS	Decimal	For a secondary index on an index-organized table, the percentage of rows with <code>VALID</code> guess.
ITYP_OWNER	String	For a domain index, the owner of the index type.
ITYP_NAME	String	For a domain index, the name of the index type.
PARAMETERS	String	For a domain index, the parameter string.
GLOBAL_STATS	String	For partitioned indexes, indicates whether statistics are collected by analyzing the index as a whole (YES) or estimated from statistics on underlying index partitions and subpartitions (NO).
DOMIDX_STATUS	String	Status of the domain index: <ul style="list-style-type: none"> <li>• NULL - Index is not a domain index.</li> <li>• VALID - Index is a valid domain index.</li> <li>• <code>IDXTYP_INVLD</code> - Indextype of the domain index is invalid.</li> </ul>
DOMIDX_OPSTATUS	String	Status of the operation on the domain index: <ul style="list-style-type: none"> <li>• NULL - Index is not a domain index.</li> <li>• VALID - Operation performed without errors.</li> <li>• FAILED - Operation failed with an error.</li> </ul>
FUNCIDX_STATUS	String	Status of a function-based index: <ul style="list-style-type: none"> <li>• NULL - Index is not a function-based index.</li> <li>• ENABLED - Function-based index is enabled.</li> <li>• DISABLED - Function-based index is disabled.</li> </ul>

**Table A-20 (Cont.) Indexes**

Column Name	Data Type	Description
JOIN_INDEX	String	Indicates whether the index is a join index (YES) or not (NO).
IOT_REDUNDANT_PKEY_ELIM	String	Indicates whether redundant primary key columns are eliminated from secondary indexes on index-organized tables (YES) or not (NO).
DROPPED	String	Indicates whether the index has been dropped and is in the recycle bin (YES) or not (NO); null for partitioned tables.

## IndexColumns

[Table A-21](#) lists the column name, data type, and description of the IndexColumns Schema Collection.

**Table A-21 IndexColumns**

Column Name	Data Type	Description
INDEX_OWNER	String	Owner of the index.
INDEX_NAME	String	Name of the index.
TABLE_OWNER	String	Owner of the table or cluster.
TABLE_NAME	String	Name of the table or cluster.
COLUMN_NAME	String	Column name or attribute of object type column.
COLUMN_POSITION	Decimal	Position of column or attribute within the index.
COLUMN_LENGTH	Decimal	Indexed length of the column.
DESCEND	String	Whether the column is sorted in descending order (Y/N).
CHAR_LENGTH	Decimal	Maximum codepoint length of the column. (Oracle9i or later)

## PrimaryKeys

[Table A-22](#) lists the column name, data type, and description of the PrimaryKeys Schema Collection.

**Table A-22 PrimaryKeys**

Column Name	Data Type	Description
OWNER	String	Owner of the constraint definition.
CONSTRAINT_NAME	String	Name of the constraint definition.
TABLE_NAME	String	Name associated with the table (or view) with constraint definition.
SEARCH_CONDITION	String	Text of search condition for a check constraint.

**Table A-22 (Cont.) PrimaryKeys**

Column Name	Data Type	Description
R_OWNER	String	Owner of table referred to in a referential constraint.
R_CONSTRAINT_NAME	String	Name of the unique constraint definition for referenced table.
DELETE_RULE	String	Delete rule for a referential constraint (CASCADE or NO ACTION).
STATUS	String	Enforcement status of constraint (ENABLED or DISABLED).
DEFERRABLE	String	Whether or not the constraint is deferrable.
VALIDATED	String	Whether all data obeys the constraint (VALIDATED or NOT VALIDATED).
GENERATED	String	Whether the name of the constraint is user or system generated.
BAD	String	Indicates that this constraint specifies a century in an ambiguous manner. (Yes  No)  To avoid errors resulting from this ambiguity, rewrite the constraint using the TO_DATE function with a four-digit year.
RELY	String	Whether an enabled constraint is enforced or unenforced.
LAST_CHANGE	DateTime	When the constraint was last enabled or disabled.
INDEX_OWNER	String	Name of the user owning the index. (Oracle9i or later)
INDEX_NAME	String	Name of the index (only shown for unique and primary-key constraints). (Oracle9i or later)

## ForeignKeys

[Table A-23](#) lists the column name, data type, and description of the ForeignKeys Schema Collection.

**Table A-23 ForeignKeys**

Column Name	Data Type	Description
PRIMARY_KEY_CONSTR INT_NAME	String	Name of the constraint definition.
PRIMARY_KEY_OWNER	String	Owner of the constraint definition.
PRIMARY_KEY_TABLE_N AME	String	Name associated with the table (or view) with constraint definition.
FOREIGN_KEY_OWNER	String	Owner of the constraint definition.
FOREIGN_KEY_CONSTR INT_NAME	String	Name of the constraint definition.

**Table A-23 (Cont.) ForeignKeys**

Column Name	Data Type	Description
FOREIGN_KEY_TABLE_NAME	String	Name associated with the table (or view) with constraint definition.
SEARCH_CONDITION	String	Text of search condition for a check constraint
R_OWNER	String	Owner of table referred to, in a referential constraint.
R_CONSTRAINT_NAME	String	Name of the unique constraint definition for referenced table.
DELETE_RULE	String	Delete rule for a referential constraint (CASCADE or NO ACTION).
STATUS	String	Enforcement status of constraint (ENABLED or DISABLED).
VALIDATED	String	Whether or not all data obeys the constraint (VALIDATED or NOT VALIDATED).
GENERATED	String	Whether the name of the constraint is user or system generated.
RELY	String	Whether an enabled constraint is enforced or unenforced.
LAST_CHANGE	DateTime	When the constraint was last enabled or disabled.
INDEX_OWNER	String	Name of the user owning the index. (Oracle9i or later)
INDEX_NAME	String	Name of the index. (Oracle9i or later)

## ForeignKeyColumns

[Table A-24](#) lists the column name, data type, and description of the ForeignKeyColumns Schema Collection.

**Table A-24 ForeignKeyColumns**

Column Name	Data Type	Description
OWNER	String	Owner of the constraint definition.
CONSTRAINT_NAME	String	Name of the constraint definition.
TABLE_NAME	String	Name of the table with constraint definition.
COLUMN_NAME	String	Name of the column or attribute of the object type column specified in the constraint definition.
POSITION	String	Original position of column or attribute in the definition of the object.

## UniqueKeys

[Table A-25](#) lists the column name, data type, and description of the UniqueKeys Schema Collection.

**Table A-25 UniqueKeys**

Column Name	Data Type	Description
OWNER	String	Owner of the constraint definition.
CONSTRAINT_NAME	String	Name of the constraint definition.
TABLE_NAME	String	Name associated with the table (or view) with constraint definition.
SEARCH_CONDITION	String	Text of search condition for a check constraint.
R_OWNER	String	Owner of table referred to in a referential constraint.
R_CONSTRAINT_NAME	String	Name of the unique constraint definition for referenced table.
DELETE_RULE	String	Delete rule for a referential constraint (CASCADE or NO ACTION).
STATUS	String	Enforcement status of constraint (ENABLED or DISABLED).
DEFERRABLE	String	Whether or not the constraint is deferrable.
VALIDATED	String	Whether all data obeys the constraint (VALIDATED or NOT VALIDATED).
GENERATED	String	Whether the name of the constraint is user or system generated.
BAD	String	Indicates that this constraint specifies a century in an ambiguous manner. (Yes No)  To avoid errors resulting from this ambiguity, rewrite the constraint using the TO_DATE function with a four-digit year.
RELY	String	Whether an enabled constraint is enforced or not.
LAST_CHANGE	String	When the constraint was last enabled or disabled.
INDEX_OWNER	String	Name of the user owning the index. (Oracle9i or later)
INDEX_NAME	String	Name of the index (only shown for unique and primary-key constraints). (Oracle9i or later)

# B

## Mapping LINQ Canonical Functions and Oracle Functions

This appendix lists the Entity Framework canonical functions and the corresponding ODP.NET provider functions to which they map.

### Aggregate Canonical Functions

**Table B-1 Mapping of Aggregate Canonical Functions and Oracle Functions**

Canonical Function	Oracle Function
Avg ( <i>expression</i> )	AVG( <i>expression</i> )
BigCount ( <i>expression</i> )	COUNT( <i>expression</i> )
Count ( <i>expression</i> )	COUNT( <i>expression</i> )
Max ( <i>expression</i> )	MAX( <i>expression</i> )
Min ( <i>expression</i> )	MIN( <i>expression</i> )
StDev ( <i>expression</i> )	STDDEV( <i>expression</i> )
StDevP( <i>expression</i> )	STDEV( <i>expression</i> )
Sum ( <i>expression</i> )	SUM ( <i>expression</i> )
Var( <i>expression</i> )	VAR( <i>expression</i> )
VarP( <i>expression</i> )	VARP( <i>expression</i> )

### Math Canonical Functions

**Table B-2 Mapping of Math Canonical Functions and Oracle Functions**

Canonical Function	Oracle Function
Abs ( <i>value</i> )	ABS ( <i>value</i> )
Ceiling ( <i>value</i> )	CEIL( <i>value</i> )
Floor ( <i>value</i> )	FLOOR( <i>value</i> )
Power( <i>value</i> , <i>exponent</i> )	POWER( <i>value</i> , <i>exponent</i> )
Round ( <i>value</i> )	ROUND( <i>value</i> )
Round ( <i>value</i> , <i>digits</i> )	ROUND( <i>value</i> , <i>digits</i> )
Truncate( <i>value</i> , <i>digits</i> )	TRUNC( <i>value</i> , <i>digits</i> )

## String Canonical Functions

**Table B-3 Mapping of String Canonical Functions and Oracle Functions**

Canonical Function	Oracle Function
Concat ( <i>string1</i> , <i>string2</i> )	CONCAT( <i>string1</i> , <i>string2</i> ) or ( <i>string1</i>    <i>string2</i> )
Contains( <i>string</i> , <i>target</i> )	INSTR( <i>string</i> , <i>target</i> )
EndsWith( <i>string</i> , <i>target</i> )	INSTR(REVERSE( <i>string</i> ), REVERSE( <i>target</i> ))
<b>Comparison operators</b> (<, <=, >, >=, <>, !=)	<b>Comparison operators</b> (<, <=, >, >=, <>, !=)
IndexOf( <i>target</i> , <i>string</i> )	INSTR( <i>string2</i> , <i>target</i> )
Left ( <i>string1</i> , <i>length</i> )	SUBSTR( <i>string1</i> , <i>length</i> )
Length ( <i>string</i> )	LENGTH( <i>string</i> )
LTrim( <i>string</i> )	LTRIM( <i>string</i> )
Replace ( <i>string1</i> , <i>string2</i> , <i>string3</i> )	REPLACE( <i>string1</i> , <i>string2</i> , <i>string3</i> )
Reverse ( <i>string</i> )	REVERSE( <b>string</b> )
Right ( <i>string</i> , <i>length</i> )	(CASE WHEN LENGTH( <i>string</i> ) >= ( <i>length</i> ) THEN SUBSTR ( <i>string</i> ,-( <i>length</i> ), <i>length</i> ) ELSE <i>string</i> END)
RTrim( <i>string</i> )	RTRIM( <i>string</i> )
Substring ( <i>string</i> , <i>start</i> , <i>length</i> )	SUBSTR( <i>string</i> , <i>start</i> , <i>length</i> )
StartsWith( <i>string</i> , <i>target</i> )	INSTR( <i>string</i> , <i>target</i> )
ToLower ( <i>string</i> )	LOWER( <i>string</i> )
ToUpper( <i>string</i> )	UPPER
Trim ( <i>string</i> )	LTRIM(RTRIM( <i>string</i> ))

## Date And Time Canonical Functions

**Table B-4 Mapping of Date And Time Canonical Functions and Oracle Functions**

Canonical Function	Oracle Function
AddNanoseconds( <i>expression</i> , <i>number</i> )	( <i>expression</i> ) + INTERVAL
AddMicroseconds( <i>expression</i> , <i>number</i> )	( <i>expression</i> ) + INTERVAL
AddMilliseconds( <i>expression</i> , <i>number</i> )	( <i>expression</i> ) + INTERVAL
AddSeconds( <i>expression</i> , <i>number</i> )	( <i>expression</i> ) + INTERVAL

**Table B-4 (Cont.) Mapping of Date And Time Canonical Functions and Oracle Functions**

<b>Canonical Function</b>	<b>Oracle Function</b>
AddMinutes( <i>expression</i> , <i>number</i> )	( <i>expression</i> ) + INTERVAL
AddHours( <i>expression</i> , <i>number</i> )	( <i>expression</i> ) + INTERVAL
AddDays( <i>expression</i> , <i>number</i> )	( <i>expression</i> ) + INTERVAL
AddMonths( <i>expression</i> , <i>number</i> )	( <i>expression</i> ) + INTERVAL
AddYears( <i>expression</i> , <i>number</i> )	( <i>expression</i> ) + INTERVAL
CreateDateTime( <i>year</i> , <i>month</i> , <i>day</i> , <i>hour</i> , <i>minute</i> , <i>second</i> )	TO_TIMESTAMP
CreateDateTimeOffset( <i>year</i> , <i>month</i> , <i>day</i> , <i>hour</i> , <i>minute</i> , <i>second</i> , <i>tzoffset</i> )	TO_TIMESTAMP_TZ
CreateTime( <i>hour</i> , <i>minute</i> , <i>second</i> )	Time literals are not supported in Oracle
CurrentDateTime()	LOCALTIMESTAMP
CurrentDateTimeOffset()	SYSTIMESTAMP
CurrentUtcDateTime()	SYS_EXTRACT_UTC (LOCALTIMESTAMP)
Day( <i>expression</i> )	EXTRACT(DAY FROM <i>expression</i> )
DayOfYear( <i>expression</i> )	TO_NUMBER(TO_CHAR(CAST( <i>expression</i> AS TIMESTAMP), 'DDD'))
DiffNanoseconds( <i>startExpression</i> , <i>endExpression</i> )	EXTRACT and arithmetic operations
DiffMilliseconds( <i>startExpression</i> , <i>endExpression</i> )	EXTRACT and arithmetic operations
DiffMicroseconds( <i>startExpression</i> , <i>endExpression</i> )	EXTRACT and arithmetic operations
DiffSeconds( <i>startExpression</i> , <i>endExpression</i> )	EXTRACT and arithmetic operations
DiffMinutes( <i>startExpression</i> , <i>endExpression</i> )	EXTRACT and arithmetic operations
DiffHours( <i>startExpression</i> , <i>endExpression</i> )	EXTRACT and arithmetic operations
DiffDays( <i>startExpression</i> , <i>endExpression</i> )	EXTRACT and arithmetic operations
DiffMonths( <i>startExpression</i> , <i>endExpression</i> )	EXTRACT and arithmetic operations
DiffYears( <i>startExpression</i> , <i>endExpression</i> )	EXTRACT and arithmetic operations

**Table B-4 (Cont.) Mapping of Date And Time Canonical Functions and Oracle Functions**

Canonical Function	Oracle Function
Comparison operators ( <i>&lt;</i> , <i>&lt;=</i> , <i>&gt;</i> , <i>&gt;=</i> , <i>&lt;&gt;</i> , <i>!=</i> )	<i>&lt;</i> , <i>&lt;=</i> , <i>&gt;</i> , <i>&gt;=</i> , <i>&lt;&gt;</i> , <i>!=</i> operators
GetTotalOffsetMinutes ( <i>datetimetypeoffset</i> )	(EXTRACT(TIMEZONE_HOUR FROM ( <i>expression</i> )) * 60 + EXTRACT (TIMEZONE_MINUTE FROM( <i>expression</i> )) (Require multiple operations.)
Hour ( <i>expression</i> )	EXTRACT(HOUR FROM <i>expression</i> )
Millisecond( <i>expression</i> )	NVL(TO_NUMBER(SUBSTR(TO_CHAR(CAST( <i>expression</i> ) AS TIMESTAMP), 'DD- MON-RR HH24:MI:SSXFF'), 20, 3)), 0)
Minute( <i>expression</i> )	EXTRACT(MINUTE FROM <i>expression</i> )
Month ( <i>expression</i> )	EXTRACT(MONTH FROM <i>expression</i> )
Second( <i>expression</i> )	EXTRACT (SECOND FROM <i>expression</i> )
TruncateDate( <i>expression</i> )	TRUNC( <i>expression</i> )
Year( <i>expression</i> )	EXTRACT(YEAR FROM <i>expression</i> )

**Bitwise Canonical Functions****Table B-5 Mapping of Bitwise Canonical Functions and Oracle Functions**

Canonical Function	Oracle Function
BitWiseAnd ( <i>value1</i> , <i>value2</i> )	BITAND( <i>value1</i> , <i>value2</i> )
BitWiseNot ( <i>value</i> )	( 0 - <i>value</i> ) - 1
BitWiseOr ( <i>value1</i> , <i>value2</i> )	<i>value1</i> - BITAND( <i>value1</i> , <i>value2</i> ) + <i>value2</i>
BitWiseXor ( <i>value1</i> , <i>value2</i> )	<i>value1</i> - 2 * BITAND( <i>value1</i> , <i>value2</i> ) + <i>value2</i>

**Other Canonical Functions****Table B-6 Mapping of Other Canonical Functions and Oracle Functions**

Canonical Function	Oracle Function
NewGuid()	SYS_GUID

# Glossary

## **assembly**

Assembly is Microsoft's term for the module that is created when a DLL or .EXE is compiled by a .NET compiler.

## **BFILES**

External binary files that exist outside the database tablespaces residing in the operating system. BFILES are referenced from the database semantics, and are also known as external LOBs.

## **Binary Large Object (BLOB)**

A large object data type whose content consists of binary data. Additionally, this data is considered raw as its structure is not recognized by the database.

## **Character Large Object (CLOB)**

The LOB data type whose value is composed of character data corresponding to the database character set. A CLOB may be indexed and searched by the Oracle Text search engine.

## **data provider**

As the term is used with Oracle Data Provider for .NET, a data provider is the connected component in the ADO.NET model and transfers data between a data source and the DataSet.

## **DataSet**

A DataSet is an in-memory copy of database data. The DataSet exists in memory without an active connection to the database.

## **dirty writes**

Dirty writes means writing uncommitted or dirty data.

**DDL**

DDL refers to data definition language, which includes statements defining or changing data structure.

**DOM**

Document Object Model (DOM) is an application program interface (API) for HTML and XML documents. It defines the logical structure of documents and the way that a document is accessed and manipulated.

**Extensible Stylesheet Language Transformation (XSLT)**

The XSL W3C standard specification that defines a transformation language to convert one XML document into another.

**flush**

Flush or flushing refers to recording changes (that is, sending modified data) to the database.

**Global Assembly Cache (GAC)**

A cache for .NET assemblies.

**goodness**

The degree of load in the Oracle database. The lighter load is better and vice versa.

**implicit database connection**

The connection that is implicitly available from the context of the .NET stored procedure execution.

**instantiate**

A term used in object-based languages such as C# to refer to the creation of an object of a specific class.

**invalidation message**

The content of a change notification which indicates that the cache is now invalid

**Large Object (LOB)**

The class of SQL data type that is further divided into internal LOBs and external LOBs. Internal LOBs include `BLOBS`, `CLOBs`, and `NCLOBs` while external LOBs include `BFILES`.

**Microsoft .NET Framework Class Library**

The Microsoft .NET Framework Class Library provides the classes for the .NET framework model.

**namespace**

- **.NET:**

A namespace is naming device for grouping related types. More than one namespace can be contained in an assembly.

- **XML Documents:**

A namespace describes a set of related element names or attributes within an XML document.

**National Character Large Object (NCLOB)**

The LOB data type whose value is composed of character data corresponding to the database national character set.

**Oracle Net Services**

The Oracle client/server communication software that offers transparent operation to Oracle tools or databases over any type of network protocol and operating system.

**OracleDataReader**

An `OracleDataReader` is a read-only, forward-only result set.

**Oracle XML DB**

Oracle XML DB is the name for a distinct group of technologies related to high-performance XML storage and retrieval that are available within the Oracle database. Oracle XML DB is not a separate server.

Oracle XML DB is based on the W3C XML data model.

**PL/SQL**

The Oracle procedural language extension to SQL.

**primary key**

The column or set of columns included in the definition of a table's PRIMARY KEY constraint.

**reference semantics**

Reference semantics indicates that assignment is to a reference (an address such as a pointer) rather than to a value. See [value semantics](#).

**REF**

A data type that encapsulates references to row objects of a specified object type.

**result set**

The output of a SQL query, consisting of one or more rows of data.

**Safe Type Mapping**

Safe Type Mapping allows the `OracleDataAdapter` to populate a `DataSet` with .NET type representations of Oracle data without any data or precision loss.

**savepoint**

A point in the workspace to which operations can be rolled back.

**stored procedure**

A stored procedure is a PL/SQL block that Oracle stores in the database and can be executed from an application.

**Transparent Application Failover (TAF)**

Transparent Application Failover is a runtime failover for high-availability environments. It enables client applications to automatically reconnect to the database if the connection fails. This reconnect happens automatically from within the Oracle Call Interface (OCI) library.

**Unicode**

Unicode is a universal encoded character set that enables information from any language to be stored using a single character set.

**URL**

URL (Universal Resource Locator).

**value semantics**

Value semantics indicates that assignment copies the value, not the reference or address (such as a pointer). See [reference semantics](#).

**XPath**

XML Path Language (XPath), based on a W3C recommendation, is a language for addressing parts of an XML document. It is designed to be used by both XSLT and XPointer. It can be used as a searching or query language as well as in hypertext linking.

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