

**Oracle® Storage 12 Gb SAS PCIe HBA,
Internal Installation Guide For HBA Model
7113401**

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Using This Documentation

- **Overview** – Describes how to install and remove the Oracle Storage 12 Gb SAS PCIe HBA, Internal
- **Audience** – Technicians, system administrators, and authorized service providers
- **Required knowledge** – Advanced experience troubleshooting and replacing hardware

Product Documentation Library

Documentation and resources for this product and related products are available at http://docs.oracle.com/cd/E88190_01/index.html.

Feedback

Provide feedback about this documentation at <http://www.oracle.com/goto/docfeedback>.

◆◆◆ CHAPTER 1

HBA Overview

This chapter provides an overview of the Oracle Storage 12 Gigabit (Gb) Serial Attached SCSI (SAS) PCI Express (PCIe) host bus adapter (HBA), Internal, which uses Broadcom technology. The chapter also describes the various operating systems, host platforms, storage, and infrastructure configurations that support the HBA.

This chapter contains the following topics:

- [“Ship Kit Contents” on page 9](#)
- [“HBA Features” on page 9](#)
- [“Operating System and Technology Requirements” on page 10](#)
- [“System Interoperability” on page 11](#)

Ship Kit Contents

- Oracle Storage 12 Gb SAS PCIe HBA, Internal
- *Accessing Documentation* document

HBA Features

The Oracle Storage 12 Gb/s SAS PCIe HBA, Internal (part number: 7113401) is a low-profile, PCI Express 3.0 controller that supports eight internal 12 Gb/s SAS/SATA ports through two SFF-8643 x4 internal mini-SAS HD connectors.

The HBA supports the following features:

TABLE 1 HBA Features

Feature	Description
Ports	Two SAS3, x4 internal mini-SAS HD ports

Feature	Description
Host interface	PCIe, as defined in the <i>PCI Express Card Specification</i> , version 3.0
Target interface	SAS3 12-Gb/s, supporting 6-Gb/s and 3-Gb/s SAS link rates and 6-Gb/s and 3-Gb/s SATA link rates
Lane width	PCIe 3.0 x8 lane width up to 8 Gt/s per lane
Boot support	For all supported operating systems (OSs) (see Table 2, “Supported Operating System/Technology Versions ,” on page 10)
Power consumption	Maximum 25 Watts
Diagnostic support	Provided by OracleVTS
Oracle Solaris Dynamic Reconfiguration	Supported
PCIe Single Root I/O Virtualization (SR-IOV)	Supported
MSI-X	Supported
PCIe hot-plug and hot-swap capabilities	Supported

Operating System and Technology Requirements

The HBA requires the operating system (OS) and technology levels, at minimum, listed in [Table 2, “Supported Operating System/Technology Versions ,”](#) on page 10.

Note - If you need to contact Oracle Support, first verify that you have a supported OS installed on the host system, and install the latest HBA driver, utility, and firmware versions. Updating the system and HBA to the latest OS, driver, utility, and firmware versions might address the issue, preventing the need to contact Oracle Support about an issue that has already been fixed.

TABLE 2 Supported Operating System/Technology Versions

Operating System/Technology	Recommended Versions (minimum)
Oracle Solaris OS for the x86 (64-bit) platform	<ul style="list-style-type: none"> ■ Oracle Solaris 11.4 with SRU 16 ■ Oracle Solaris 11.3 with SRU 23 <p>To obtain the latest SRUs, go to https://support.oracle.com</p>
Oracle Virtual Machine (VM) Technology	Oracle VM 3.4.6
Linux OS (64-bit)	<ul style="list-style-type: none"> ■ Oracle Linux 8.4 with Red Hat Compatible Kernel (RHCK) and Unbreakable Enterprise Kernel (UEK) Release 6 (R6) ■ Oracle Linux 7.7 (RHCK and UEK Release 5, at minimum)
Microsoft Windows OS (64-bit)	<ul style="list-style-type: none"> ■ Window Server 2019 ■ Windows Server 2016
VMware Technology	<ul style="list-style-type: none"> ■ VMware ESXi 6.5 U1

System Interoperability

This section provides host platform, storage, and software support information. This section contains the following topics:

- [“Host Platform Support” on page 11](#)
- [“Storage System Support” on page 11](#)

Host Platform Support

The HBA is supported by the platforms listed in [Table 3, “Platform Support,” on page 11](#). For the latest information, see your system product notes and server platform product web pages.

TABLE 3 Platform Support

Platform	Supported OS/Technology
Oracle x86 Servers:	
Oracle Server X5-2 and X5-2L	Oracle Solaris, Oracle VM, Windows, Linux
Oracle Server X5-4	Oracle Solaris, Oracle VM, Windows, Linux
Oracle Server X5-8	Oracle Solaris, Oracle VM, Windows, Linux
Oracle Server X6-2 and X6-2L	Oracle Solaris, Oracle VM, Windows, Linux
Oracle Server X7-2 and X7-2L	Oracle Solaris, Oracle VM, Windows, Linux
Oracle Server X8-2 and X8-2L	Oracle Solaris, Oracle VM, Windows, Linux
Oracle Exalytics In-Memory Machine X6-4	Oracle Solaris, Oracle VM, Windows, Linux
Oracle Exadata Database Machine X6-8	Oracle Solaris, Oracle VM, Windows, Linux

Storage System Support

Internal disk drives are the only storage supported by the HBA.

◆◆◆ CHAPTER 2

Hardware Installation and Removal

This chapter describes how to install and remove the HBA. For detailed instructions, see your storage system installation or service guide and the installation guide for the storage devices to be connected to the HBA.

This chapter contains the following topics:

- [“Observing ESD and Handling Precautions” on page 13](#)
- [“Installing the HBA” on page 14](#)
- [“Removing the HBA” on page 17](#)

Observing ESD and Handling Precautions



Caution - Damage to the HBA can occur as the result of careless handling or electrostatic discharge (ESD). Always handle the HBA with care to avoid damage to electrostatic-sensitive components.

To minimize the possibility of ESD-related damage, use both a workstation antistatic mat and an ESD wrist strap. You can get an ESD wrist strap from any reputable electronics store or from Oracle as part number 250-1007.

Observe the following precautions to avoid ESD-related problems:

- Leave the HBA in its antistatic bag until you are ready to install it in the system.
- Always use a properly fitted and grounded wrist strap or other suitable ESD protection when handling the HBA and observe proper ESD grounding techniques.
- Always hold the HBA by the metal enclosure.
- Place the HBA on a properly grounded antistatic work surface pad when it is out of its protective antistatic bag.

Best Practices for HBA Installation

Follow these general best practices for installing and configuring the HBA:

- If more than one HBA model is present in the configuration, enable only the OptionROM (OpROM) for the first HBA seen in the boot sequence. There is a limited amount of space for OpROMs; therefore, do *not* unnecessarily enable all OpROMs, as space usage issues might occur.
- When installing the HBA, be sure to also install the latest version of the command-line utility available from the manufacturer's web site. Keep the HBA utilities, firmware, and drivers up-to-date, and update them in that order.

Installing the HBA

This section provides the following procedures:

- [“To Prepare for Hardware Installation” on page 14](#)
- [“To Install the HBA” on page 15](#)
- [“To Connect the HBA to Internal Storage Devices” on page 16](#)
- [“To Complete the Installation” on page 17](#)

▼ To Prepare for Hardware Installation

- 1. Read and observe the safety information for this product.**
See the *Oracle Storage 12 Gb/s SAS PCIe HBA, Internal Safety and Compliance Guide* at: http://docs.oracle.com/cd/E88190_01/index.html.
- 2. Familiarize yourself with the physical features of the HBA.**
- 3. Ensure that you have the proper cables for the HBA and the internal disk drives.**
Use only Oracle-provided SAS cables (provided with your Oracle system at time of purchase). Cable connectors are keyed so that you cannot insert them incorrectly.
- 4. Unpack the box containing the HBA in a static-free environment and inspect it for damage.**

Note - Leave the HBA in the protective bag until you are ready to install it. If there is damage, contact Oracle customer support.

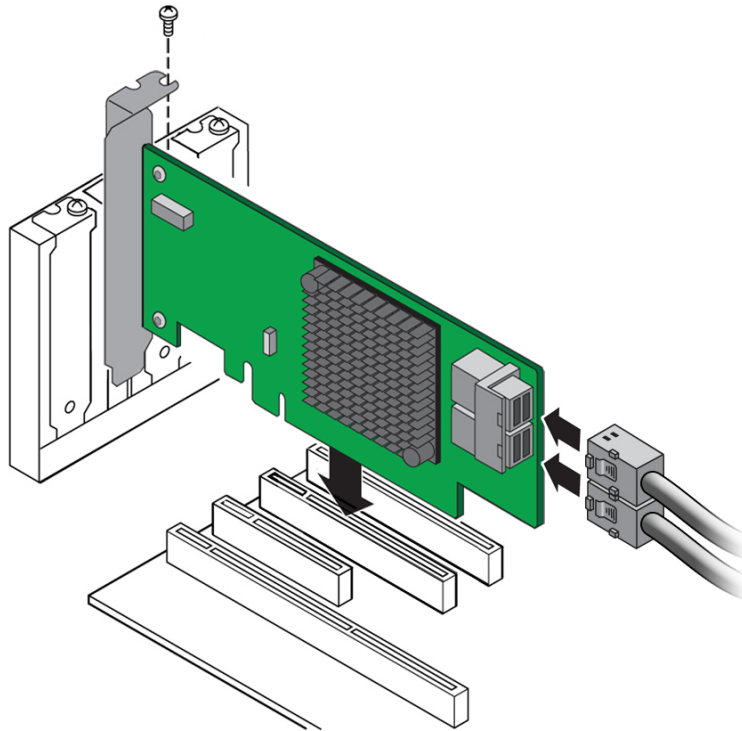
5. Refer to your system installation guide or service manual for instructions on how to remove the system cover, disconnect the AC power cords, and turn off power from the system, if required.

▼ To Install the HBA

1. Attach an antistatic wrist strap and remove the HBA from its protective bag.
See [“Observing ESD and Handling Precautions” on page 13.](#)
2. Refer to the installation guide or service manual for your particular system for instructions on how to locate an available PCIe slot in the system.
3. Align the PCIe bus connector of the HBA to the PCIe slot.

Note - Some PCIe slots support PCIe graphics cards only; if the HBA is installed in one of those PCIe slots, the HBA will not function.

4. **Press down gently and firmly to seat the HBA in the PCIe slot, and then secure the bracket to the system chassis with the retention clip (see the following figure).**



Note - The configuration of the enclosure might not be the same as shown in this illustration.

▼ To Connect the HBA to Internal Storage Devices

1. **Install and configure the SAS devices in the system.**
For more information, see the documentation for the devices.
2. **Connect the SFF-8643 x4 Mini SAS HD connector on one end of the SAS cable to an internal port.**

Use only Oracle-provided SAS cables (provided with your Oracle system at time of purchase).

▼ To Complete the Installation

1. **Replace the system cover and reconnect the AC power cords, if required, as described in the system documentation.**
2. **If you needed to turn the system power off to install the HBA, power on the system.**

Note - If you do need to return power to the system, ensure that the power is turned on to the SAS devices before or at the same time that the power is turned on to the host system. If the system is powered up before these devices, the devices might not be recognized.

3. **Install any software required by the HBA, as described in the next chapter.**

Removing the HBA

If you need to remove the HBA from the system, follow the procedure in this section.

▼ To Remove the HBA

1. **Prepare your operating system for HBA removal.**
2. **Attach an antistatic wrist strap.**
See [“Observing ESD and Handling Precautions” on page 13.](#)
3. **Refer to the service manual for your specific system to remove the system cover, power down the system, and remove AC power cords from the system, if required.**
4. **Refer to the service manual for your specific system to locate the HBA in the chassis of the system.**
5. **Disengage the retention clip that is securing the HBA to the chassis of the system and pull up carefully to unseat the HBA from the PCIe slot.**

- 6. Detach all cables from the HBA.**
- 7. Refer to the service manual for your specific system to reattach the system cover, reinstall AC power cords to the system, and power on the system, as necessary.**

HBA Software Installation

After you have completed the HBA hardware installation and powered on the system, follow the instructions in this chapter to install any HBA utilities, firmware, and operating system (OS)-specific drivers, in that order, that might be required by the HBA.

Note - Software listed in this chapter as being located at the Oracle designated web site will only be available at the web site if required by the HBA.

This chapter contains the following topics:

- “Installing the Utility for Firmware Updates” on page 19
- “Installing Diagnostic Software” on page 19
- “Installing Drivers” on page 21

Installing the Utility for Firmware Updates

Use the `sas3flash` utility to update the firmware for the HBA. The `sas3flash` utility, and its associated documentation, are available for download at the Oracle designated web site:

<https://www.broadcom.com/support/oem/oracle/>

Installing Diagnostic Software

This section contains the following topics:

- “Diagnostic Support for the Oracle Solaris OS” on page 20
- “Diagnostic Support for All Other Supported Operating Systems” on page 20

Diagnostic Support for the Oracle Solaris OS

In an Oracle Solaris OS environment, diagnostic support for the HBA is included in the Oracle VTS software. The Oracle VTS software is available for download at: <http://support.oracle.com/>

For information about the Oracle VTS software, see the Oracle VTS documentation at: <http://docs.oracle.com/cd/E19719-01/index.html>

The Oracle VTS software supports the following functions:

- Connectivity verification
- Firmware version and checksum test
- Self-test
- Loopback tests
 - External
 - Internal, single-bit
 - Mailbox

Diagnostic Support for All Other Supported Operating Systems

Diagnostic support for the HBA with all supported operating systems other than the Oracle Solaris OS is available at the Oracle designated web site at:

<https://www.broadcom.com/support/oem/oracle/>

▼ To Install Diagnostic Support Utilities for Supported OSes Other Than the Oracle Solaris OS:

1. **Go to the Broadcom support site for Oracle at:**
<https://www.broadcom.com/support/oem/oracle/>
2. **Click the type of HBA, and then click the model number of the HBA for which you want to install diagnostic software.**

3. In the Utilities section, click the diagnostic support utility for the OS that you want, and download the diagnostic utility to a local file system.
4. Install the diagnostic utility as described in the Broadcom documentation, located on the Broadcom web site.

Installing Drivers

This section contains the following topics:

- [“Installing Drivers For the Oracle Solaris OS” on page 21](#)
- [“Installing Drivers For All Other Supported Operating Systems” on page 21](#)

Installing Drivers For the Oracle Solaris OS

The latest driver (lmrc) for this HBA is included as part of the Oracle Solaris 11.4 OS with SRU 16, if the Oracle Solaris OS is ordered. You can obtain the latest version of the Oracle Solaris OS at:

<http://www.oracle.com/technetwork/server-storage/solaris11/overview/index.html>

You can obtain the latest Oracle Solaris SRUs at the My Oracle Support web site:

<http://support.oracle.com>

Before downloading any SRUs, install the utilities and then the firmware, in that order, for the HBA.

▼ Installing Drivers For All Other Supported Operating Systems

If drivers for specific operating systems are required by the HBA, the drivers will be available for download at the Broadcom support site for Oracle. Before installing any drivers, install the utilities and then the firmware, in that order, for the HBA. For more information about installing utilities and firmware, see [Chapter 3, “HBA Software Installation”](#).

1. After installing the utilities and the latest firmware for the HBA, go to the Broadcom support site for Oracle at:

<https://www.broadcom.com/support/oem/oracle/>

2. **Click the type of HBA, and then click the model number of the HBA for which you want to install a driver.**
3. **In the Driver section, click the OS driver that you want, and download the driver files to a local file system.**
4. **Install the driver for OS, as described in the Broadcom documentation, located on the Broadcom web site.**

Important Information and Known Issues

This chapter provides supplementary and workaround information for the HBA. Specific bug identification numbers are provided for service personnel.

This chapter contains the following topic:

- “HBA Product Accessibility” on page 23
- “Diversity and Inclusion ” on page 26

HBA Product Accessibility

Oracle strives to make its products, services, and supporting documentation usable and accessible to the disabled community. To that end, products, services, and documentation include features that make the product accessible to users of assistive technology.

For more information about Oracle's commitment to accessibility, go to <http://www.oracle.com/us/corporate/accessibility/index.html>.

HBA Hardware Accessibility

Oracle Storage 12 Gb SAS PCIe HBA, Internal Oracle Storage 12 Gb SAS PCIe HBA, Internal hardware has color-coded labels, component touch points, and status indicators (LEDs) that provide information about the system. These labels, touch points, and indicators can be inaccessible features for sight-impaired users. The product's HTML documentation provides context and descriptive text available to assistive technologies to aid in interpreting status and understanding the system.

You can also use the built-in Oracle Integrated Lights Out Manager (ILOM) to obtain information about the system. Oracle ILOM provides a browser-based interface (BUI) and a command-line interface (CLI) that support assistive technologies for real-time viewing of

system status, indicator interpretation, and system configuration. For details, see [“Oracle ILOM Accessibility” on page 24](#).

Oracle ILOM Accessibility

You can use the Oracle ILOM BUI to monitor and manage the server hardware. The Oracle ILOM BUI does not require a special accessibility mode; rather, its accessibility features are always available. The BUI was developed using standard HTML and JavaScript and its features conform to accessibility guidelines.

To navigate a BUI page and select items or enter commands, use standard keyboard inputs, such as the Tab key to go to a selection, or the up and down arrow keys to scroll through the page. You can use standard keyboard combinations to make menu selections.

For example, using the Oracle ILOM Open Problems BUI page, you can identify faulted memory modules (DIMMs) or processors (CPUs) that would otherwise be identified by a lighted LED indicator on the motherboard. Likewise, you can use the Oracle ILOM BUI to monitor the hardware power states that are also indicated by flashing LED indicators on the hardware.

The Oracle ILOM CLI is an alternative and equivalent way to access the Oracle ILOM BUI features and functionality. Because the operating systems that run on the Oracle server hardware support assistive technologies to read the content of the screen, you can use the CLI as an equivalent means to access the color-based, mouse-based, and other visual-based utilities that are part of the BUI. For example, you can use a keyboard to enter CLI commands to identify faulted hardware components, check system status, and monitor system health.

You can use the Oracle ILOM Remote Console Plus to access both a text-based serial console and a graphics-based video console that enable you to remotely redirect host server system keyboard, video, mouse, and storage devices. Note, however, that the Oracle ILOM Java Remote Console Plus does not support scaling of the video frame within the Java application. You need to use assistive technology to enlarge or reduce the content in the Java Remote Console Plus display.

As an alternative method to using the BIOS Setup Utility to configure BIOS settings, Oracle ILOM provides a set of configurable properties that can help you manage the BIOS configuration parameters on an Oracle x86 server. Using Oracle ILOM, you can do the following:

- Back up a copy of the BIOS configuration parameters to an XML file using the Oracle ILOM BUI.
- Edit the XML file using a standard XML editor. The BIOS XML tags correlate directly to the BIOS screen labels.

- Restore the XML file of the backed up or edited configuration parameters to BIOS.

The BUI and CLI methods for using Oracle ILOM are described in the accessible HTML documentation for Oracle ILOM at <http://www.oracle.com/goto/ilom/docs>.

BIOS Accessibility

When viewing BIOS output from a terminal using the serial console redirection feature, some terminals do not support function key input. However, BIOS supports the mapping of function keys to Control key sequences when serial redirection is enabled. Descriptions of the function key to Control key sequence mappings are provided in the product documentation, typically within the server Service Manual. You can navigate the BIOS Setup Utility by using either a mouse or keyboard commands.

As an alternative method of configuring BIOS settings using the BIOS Setup Utility screens, Oracle ILOM provides a set of configurable properties that can help you manage the BIOS configuration parameters on an Oracle x86 server. For more information, see “[Oracle ILOM Accessibility](#)” on page 24.

BIOS information and its functions are typically documented in the Oracle Storage 12 Gb SAS PCIe HBA, Internal Service Manual or Installation Guide.

Documentation Accessibility

Documentation for Oracle hardware is provided in HTML and PDF formats. The HTML documents are accessible using standard operating system controls and assistive technology. PDF documents are also provided, but are not an accessible format. PDF documents are considered support documents because the PDF content is available in accessible HTML format.

Product documentation provides figures, other types of images, and screenshots that do not rely on color for interpretation. Within the figures, callouts indicate the referenced component information. The callouts are mapped within a table to provide text descriptions of the referenced parts of the figures. In addition, alternative text is provided for all tables and images that provides the context of the information and images.

Note that screen readers might not always correctly read the code examples in the documentation. The conventions for writing code require that closing braces should appear on an otherwise empty line. However, some screen readers might not always read a line of text that consists solely of a bracket or brace.

The documentation might contain links to web sites of other companies and organizations that Oracle does not own or control. Oracle neither evaluates nor makes any representations regarding the accessibility of these web sites.

You can access the accessible HTML documentation for Oracle Storage 12 Gb SAS PCIe HBA, Internal products at http://docs.oracle.com/cd/E88190_01/index.html.

Diversity and Inclusion

Oracle is fully committed to diversity and inclusion. Oracle respects and values having a diverse workforce that increases thought leadership and innovation. As part of our initiative to build a more inclusive culture that positively impacts our employees, customers and partners, we are working to remove insensitive terms from our products and documentation. We are also mindful of the necessity to maintain compatibility with our customers' existing technologies, and the need to ensure continuity of service as Oracle's offerings and industry standards evolve. Because of these technical constraints, our effort to remove insensitive terms is ongoing and will take time and external cooperation.

◆◆◆ **A P P E N D I X A**

HBA Specifications

This appendix contains the specifications for the HBA.

This appendix contains the following topics:

- [“Physical Dimensions” on page 27](#)
- [“Environmental Requirements” on page 27](#)
- [“Fault Tolerance” on page 28](#)

Physical Dimensions

The HBA card size is as follows:

- Height: 94.31mm (2.731 inches)
- Length: 167.64mm (6.6 inches)

Environmental Requirements

[Table 4, “HBA Environmental Requirements,” on page 27](#) lists the HBA environmental requirements.

TABLE 4 HBA Environmental Requirements

Specification	Operating	Non-Operating
Temperature	0° to 55°C, non-condensing	-40°C to 70°C, non-condensing
Humidity	10% to 90% RH, non-condensing, 27°C max wet bulb	93% RH, non-condensing, 38°C max wet bulb
Altitude	3000m	12,000m
Vibration	0.20G in all axes swept for 5-500 Hz sine	1.0G in all axes 5-500-5 Hz sine
Shock	5G, 11 ms half-sine	30G, 11 ms half-sine

Fault Tolerance

The following table lists the fault tolerance features for the HBA.

TABLE 5 Fault Tolerance Features

Specification	HBA Support
Support for SMART	Yes
Drive failure detection	Automatic
Drive rebuild using hot spares	Automatic
Parity generation and checking	Yes

Note - The Self Monitoring Analysis and Reporting Technology (SMART) detects up to 70 percent of all predictable drive failures. In addition, SMART monitors the internal performance of all motors, heads, and drive electronics.
