Oracle® Adaptive Intelligent Apps for Manufacturing

Data Ingestion User's Guide

Release 20A

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Oracle Adaptive Intelligent Apps for Manufacturing Data Ingestion User's Guide, Release 20A

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Preface

Intended Audience

Welcome to Release 20A of the *Oracle Adaptive Intelligent Apps for Manufacturing Data Ingestion User's Guide.*

This guide is intended for Oracle customers and partners administering Oracle Adaptive Intelligent Apps for Manufacturing. It provides guidance and steps to upload and import data from various manufacturing enterprise systems and machine sensor devices into Oracle Adaptive Intelligent Apps for Manufacturing.

See Related Information Sources on page viii for more Oracle E-Business Suite product information.

Documentation Accessibility

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Structure

1 Overview
2 Getting Started with Data Ingestion
3 Importing Business Entity Data
4 Importing Sensor Devices Data

Related Information Sources

Oracle Big Data Cloud Service [https://docs.oracle.com/en/cloud/paas/big-data-cloud/index.html]

Oracle Cloud Infrastructure Object Storage Documentation [https://docs.us-phoenix-1.oraclecloud.com/Content/Object/Concepts/objectstorageoverview.htm]

Oracle Data Mining Concepts [https://docs.oracle.com/en/database/oracle/oracle-database/18/dmcon/index.html]

Oracle Data Pump [https://docs.oracle.com/en/database/oracle/oracle-database/12.2/sutil/oracle-data-pump.html#GUID-501A9908-BCC5-434C-8853-9A6096766B5A]

Oracle Database Cloud Service [https://docs.oracle.com/en/cloud/paas/database-dbaas-cloud/index.html]

Oracle GoldenGate Cloud Service [http://docs.oracle.com/cloud/latest/goldengate-cloud/index.html]

Do Not Use Database Tools to Modify Oracle E-Business Suite Data

Oracle STRONGLY RECOMMENDS that you never use SQL*Plus, Oracle Data Browser, database triggers, or any other tool to modify Oracle E-Business Suite data unless otherwise instructed.

Oracle provides powerful tools you can use to create, store, change, retrieve, and maintain information in an Oracle database. But if you use Oracle tools such as SQL*Plus to modify Oracle E-Business Suite data, you risk destroying the integrity of your data and you lose the ability to audit changes to your data.

Because Oracle E-Business Suite tables are interrelated, any change you make using an Oracle E-Business Suite form can update many tables at once. But when you modify Oracle E-Business Suite data using anything other than Oracle E-Business Suite, you may change a row in one table without making corresponding changes in related tables. If your tables get out of synchronization with each other, you risk retrieving erroneous information and you risk unpredictable results throughout Oracle E-Business Suite.

When you use Oracle E-Business Suite to modify your data, Oracle E-Business Suite automatically checks that your changes are valid. Oracle E-Business Suite also keeps track of who changes information. If you enter information into database tables using database tools, you may store invalid information. You also lose the ability to track who has changed your information because SQL*Plus and other database tools do not keep a record of changes.

1

Overview

Overview of Oracle Adaptive Intelligent Apps for Manufacturing

Oracle Adaptive Intelligent Apps for Manufacturing (AIAMFG) collects, stores, prepares, and analyzes massive amounts of operational technology data coming from shop floor systems such as equipment, machines, sensors, and test stations and then contextualizes it with information technology data coming from business applications such as Supply Chain Management (SCM), Enterprise Resource Planning (ERP), Human Capital Management (HCM), and Customer Relationship Management (CRM). AIAMFG then analyzes the data by applying machine learning, data mining, and artificial intelligence techniques to discover key patterns and correlations that affect manufacturing efficiencies and provides actionable predictive analytics to maximize yield and minimize defects, scrap, cycle times, costs, and related parameters that impact or improve the manufacturing process. It also provides comprehensive capabilities for backward and forward tracing of products and processes within manufacturing and the supply chain, spanning manpower, machine, material, method and management aspects to facilitate rapid root cause, impact and containment analysis.

AIAMFG provides four modules with advanced analytical capabilities.

- Insights

- Predictions

- Genealogy and Trace

- Factory Command Center
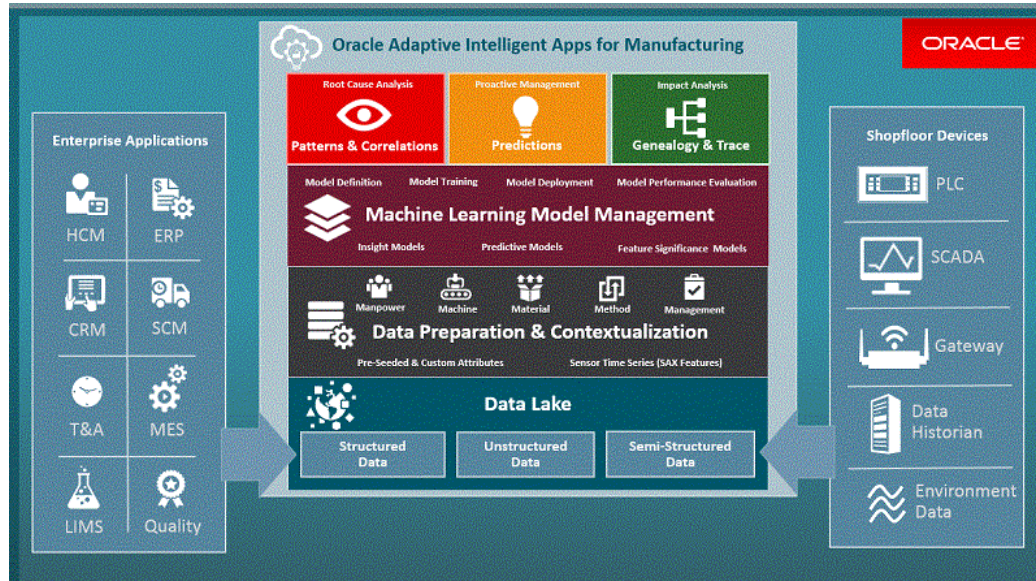
Data ingestion provides users with the ability to upload structured enterprise and semi-structured sensor data into AIAMFG using comma separated values (CSV) file templates. Users can import data from third-party applications, enabling companies using any ERP application to take full advantage of the AIAMFG features. Oracle provides out-of-the-box integrations that use Oracle Data Pump and Oracle GoldenGate for E-Business Suite (EBS) customers who implement AIAMFG.

2

Getting Started with Data Ingestion

Overview of Data Ingestion

To analyze shop floor data, you must first acquire the data from sources such as ERP applications, Manufacturing Execution Systems (MES), and Quality/Laboratory Information Management Systems (LIMS) as well as from shop floor sensor devices mounted on machines. Oracle Adaptive Intelligent Apps for Manufacturing (AIAMFG) provides CSV file-based upload tools to collect data. Users can extract structured data from external source systems and semi structured data from machines and equipment sensor devices and load them into the data lake in Oracle Cloud. Equipment and sensor device data is then contextualized with equipment and work order information and summarized for analysis.

You can use spreadsheet templates and REST web services in AIAMFG to load data from various information technology and operational technology systems. Upload this data for any historical period and for one or more products using periodic and incremental batch uploads. The application also provides out-of-the-box integrations between AIAMFG and Oracle E-Business Suite (EBS), which enable the collection of data from EBS applications.

Structured Data

Import enterprise or business data into AIAMFG using CSV file templates. Two types of data uploads are supported, one for upload of prepared data for quick analysis and the other a detailed upload of entities to take full advantage of all AIAMFG features. Users may choose the upload method that meets their requirement. Oracle partners can help users extract data from external source systems and load the data into the AIAMFG data lake in Oracle Cloud.

Case Record Data

Upload case record data to obtain insights and predictions on historical data and in-progress work orders. Case Record Data CSV files captures data like item number,

reference information like work order number, actual start date, actual end date, operation code, and attributes which can be targets or input features. Use this data, captured in a flattened file format, for data preparation, and then model building. Upload case record data in order to take advantage of AIAMFG features like Insights and Predictions.

Business Entity Data

Upload business entity data to capture the key entities from external source systems, entity by entity. Use this data in AIAMFG for data preparation and subsequent model building, as well as trace analysis. The CSV data files capture data for individual business entities such as items, lots, departments, persons, machines, receiving, work orders, quality, and so on. AIAMFG stitches all of the uploaded data together for analysis by relating the underlying data structures. Upload business entity data in order to take advantage of all AIAMFG features, including Insights, Predictions, Genealogy and Trace, and Factory Command Center.

Semi-structured Data

Import sensor stream and alert data from shop floor sensor devices into AIAMFG using CSV files. The sensor data is contextualized with the business entity data and summarized for analysis. Separate templates are available for sensor stream and alert data.

Sensor Data

Oracle partners can help users to configure machine data acquisition systems, such as Supervisory Control and Data Acquisition (SCADA), Distributed Control Systems (DCS) and other gateway device systems, to extract machine sensor data into the CSV file format. Users can then upload these sensor data files into AIAMFG in batch mode. The application processes the sensor stream data (for example, temperature) and alert data (for example, idle, paused), contextualizes it with equipment and work order information, and then summarizes the contextualized data for analysis.

Understanding Data Ingestion Methods

Users can ingest data into AIAMFG using either CSV files or out-of -the-box integration tools such as Oracle Data Pump and Oracle GoldenGate.

Uploading CSV Files

Users can import both structured and semi-structured data into AIAMFG using CSV files. Oracle partners can help users to configure and map data from external data sources into seeded templates for upload into AIAMFG. The process of extracting, configuring, and mapping the data from an external data source to a CSV file is the same irrespective of the data ingestion method used.

User Interfaces

AIAMFG provides three distinct user interfaces to import case record, business entity, and sensor data. Users can extract the data from external systems, enter the data into seeded templates, and then import the data into the application using these user interfaces.

REST Services

AIAMFG provides three REST services to import Business Entity data into AIAMFG using CSV files. Download a seeded template, enter data as suggested in the template guidelines, and then save the template as a CSV file. You can then import/upload the data file by calling a REST service. See: REST Web Services, *Oracle Adaptive Intelligent Apps for Manufacturing User's Guide*.

Using Oracle Data Pump and Oracle GoldenGate

AIAMFG provides out-of-the-box integration with Oracle E-Business Suite applications using Oracle Data Pump and Oracle GoldenGate. Oracle Data Pump enables high-speed transfer of data and metadata from a source database to the target database. Oracle GoldenGate provides near real time replication of data and real time capture, routing, and delivery of data across databases.

Comparing Data Types and Ingestion Methods

The following table compares the types of data available for ingestion with the various ingestion methods and features you can choose from.

> **Additional Information:** By importing Business Entity work order CSV files, you are able to import work orders that have not started or have partially progressed. By creating appropriate models with these work orders, you can make predictions for yield and quality attributes.

Data Ingestion: A Comparison

	Case Record Data	Business Entity Data	Sensor Device Data
Type of Data			
Characteristics	Structured Data: Prepared flattened records for quick analysis to obtain insights and predictions on historical and in-process work orders.	Structured Data: Separate files for each of the business entities to leverage all AIAMFG features.	Semi Structured Data: Sensor stream and alert data that is contextualized with Business Entity Data and then leveraged in all AIAMFG features.
Source Data System Examples	ERP Systems: JDE, SCM Cloud, etc. Other Shop Floor Systems: MES, LIMS, etc.	ERP Systems: SAP, JDE, SCM Cloud, EBS Other Shop Floor Systems: MES, LIMS, etc.	Sensor Devices: PLC, SCADA, Data Historian, Environment Data.
Data File			
Templates	Separate templates for process and discrete organizations.	A set of common templates and process or discrete organization specific templates.	Separate templates for Sensor Stream and Alerts.
File Examples	Files with flattened records of work orders, batches, or serial numbers.	Individual files for items, BOM, work orders, Receiving, equipment, quality, etc.	Individual files for Sensor Stream and Alerts data.
Ingestion Method			
CSV Files			
Upload through UIs	✓	✓	✓
Upload through REST APIs	✗	✓	✓
Data Pump	✗	✓ EBS Only	✗
Golden Gate	✗	✓ EBS Only	✗
AIAMFG Features (Leveraged)			
Insights	✓	✓	✓
Prediction	✓	✓	✓
Factory Command Center	✗	✓	✓
Genealogy and Trace	✗	✓	✓

Understanding the Data Ingestion Process

The Oracle Adaptive Intelligent Apps for Manufacturing Data Ingestion process consists of the following steps:

1. Copying a template to use as the basis for a CSV file, which matches the requirements of the target application table. Oracle and its partners can help users to configure and map the data.

2. Following an upload process to load the data files from the source system or local machine to storage cloud services.

3. Using data import programs to import data from interface tables in Oracle Storage Cloud Service to the AIAMFG tables in Oracle Database Cloud Service.

Storage Cloud Services

Oracle Storage Cloud Service serves as a storage area for uploaded CSV files and contextualized machine sensor data.. It also stores enterprise data from external ERP systems such as JDE, SAP, SCM Cloud, EBS, or shop floor systems such as MES and LIMS. Both sensor and enterprise data are captured in a CSV file format and stored in the Storage Cloud.

Database Cloud Services

Oracle Database Cloud Service serves as the data lake for AIAMFG by storing data for analysis. The types of data stored in this database include Enterprise Resource Planning (ERP) application data, Manufacturing Execution System (MES) data, Quality/LIMS data, sensor device mapping definitions, and summarized machine sensor data. This

data is used for model building and analysis, lot genealogy, presenting the manufacturing time line, and providing a real-time overview of factory events in the Factory Command Center.

Following Template Guidelines for Data Ingestion

When uploading data files using Data Ingestion templates, follow these guidelines:

- Prepare the Business Entity, Case Record, or Sensor Device CSV data files as shown by the CSV templates.

- Save and upload the data files as CSV files. Other formats are not supported.

- Limit each data file size to less than 5 GB. If a file's size is greater than 5 GB, then split the data into more than one file.

- Verify that the column names in the data file match the column names in the template. The order of the columns in the data file do not have to match the order of the columns in the template, but should you change the order of the columns, you must include all the columns, along with the mandatory columns. Ensure that the same column is not repeated by mistake.

When uploading data files directly into the Storage Cloud, all file names within the same folder must be unique.

Setting Up Data Ingestion

Perform the following setup steps in order to ingest data:

1. Define organizations. See: Defining Organizations, page 2-6.

2. Define users, which includes the following tasks. See: Creating and Managing Users, *Oracle Adaptive Intelligent Apps for Manufacturing User's Guide*.

    1. Add a new user.

    2. Assign the user to an application and a role.

    3. Assign organization access to a user.

3. Define user preferences. See: Defining User Preferences, *Oracle Adaptive Intelligent Apps for Manufacturing User's Guide*.

    > **Important:** In order to upload business entity CSV files, a user must set their user preference to an organization that allows business entity data ingestion only. Similarly, in order to upload case record

CSV files, set your user preferences to an organization that allows case record data ingestion only.

Defining Organizations

When defining organizations, consider the following information:

- A single AIAMFG instance can support multiple organizations of different organization types. An organization's type is based on the type of data ingestion supported by the organization:

  - Business entity data ingestion only.

  - Case record data ingestion only.

  - Replicated business entities from an EBS source.

- Create Case Record and Business Entity organizations manually through the AIAMFG user interface Create Organization page. EBS organizations are automatically created in AIAMFG via Data Pump and GoldenGate synchronization. You can upload sensor data for either a Business Entity or an EBS organization.

- Each organization in AIAMFG, depending on its type, can uniquely ingest data from only one of the following sources:

  - Business Entity CSV files.

  - Case Record CSV files.

  - Oracle Data Pump and GoldenGate synchronization.

- If you intend to ingest data from EBS by using Oracle Data Pump and GoldenGate, you must complete the EBS organization Data Pump load before ingesting data for Business Entity or Case Record organizations.

- You can ingest a limited selection of business entities from non-EBS sources into an EBS organization using Business Entity CSV files. These business entities include:

  - Quality data.

  - Machine time.

  - Operator time.

The following chart summarizes which type of organization to use with each type of data ingestion method.

	EBS Synced Org	Case Record Org	Business Entity Org
Data Pump + Golden Gate Sync	✓	X	X
Case Record CSV Upload	X	✓	X
Business Entity CSV Upload	✓*	X	✓
Machine Data CSV Upload	✓	X	✓
Custom Predictors Rest API	✓	✓**	✓

* Business entity data from non-EBS sources such as quality data, machine time, and operator time can be collected into EBS organizations using Business Entity CSV Upload.
** Only if the context information for the custom predictors has been added previously using Case Record CSV Upload.

To create a Case Record or Business Entity data ingestion organization:

AIAMFG displays analysis data by organization, so data collected from various data sources using different ingestion methods belongs to a unique organization code. Each organization lists the ingestion method under the organization name:

- Case record data ingestion enabled: manually created organization that ingests case record data only.

- Business entity data ingestion enabled: manually created organization that ingests business entity data and sensor device data.

- Business entity data replication enabled: indicates an EBS organization created using GoldenGate synchronization, which also replicates the business entities from EBS. In addition, the organization can ingest business entity data from non-EBS sources such as quality data, equipment time, and operator time, using CSV files.

1. Navigate to the Create Organization page.

   From the Setup page, click **Organization Access**, then **Create Organization**.

2. In the Name field, enter a unique name for the organization.

3. In the Code field, enter a unique organization code.

4. Select one of the following organization Types:

- Discrete Manufacturing

  - Process Manufacturing

5. Select the Data Ingestion organization type:

   - Allow case record data ingestion only

   - Allow business entity data ingestion only

6. Click Create.
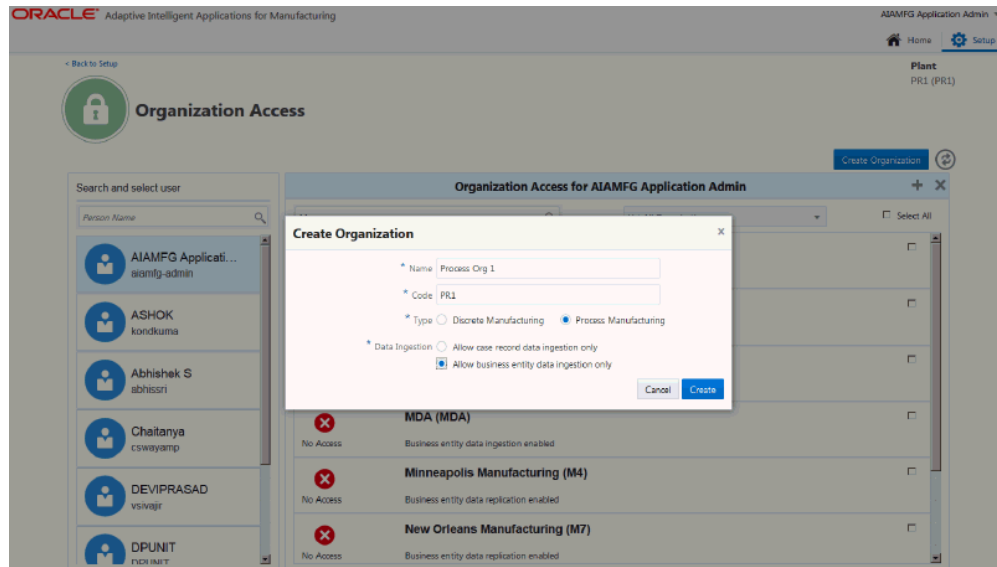
Supported Browsers

AIAMFG is supported on multiple web browser platforms. Support is provided by Oracle on all platforms for which the browser vendor provides support. For mobile device operating systems, Oracle provides support for the most recent browser delivered by the device operating system only.

Platform	Google Chrome	Mozilla Firefox	Microsoft Browsers	Apple Safari
Android	Not Supported	Not Supported	N/A	N/A
iOS	Not Supported	Not Supported	N/A	Supported

Platform	Google Chrome	Mozilla Firefox	Microsoft Browsers	Apple Safari
Mac OS X	Supported	Supported	N/A	Supported
Windows	Supported	Supported	Supported*	N/A

* Internet Explorer 11+ and Microsoft Edge, although the Network Viewer in the Genealogy and Trace page does not display when using Internet Explorer. Support for Microsoft Browsers will follow the same N-1 (the most recent version plus one previous release) support policy that iOS provides.

- Compatibility Mode: For Windows Browsers, only Native mode is supported. View Compatibility mode should be disabled.

- JavaScript: JavaScript support must be enabled.

- Doctype: To use AIAMFG on Microsoft Internet Explorer, a doctype is required.

3

Importing Business Entity Data

Overview of Importing Business Entity Data

Use business entity data templates to upload the following key entities from external source systems into AIAMFG to take full advantage of all AIAMFG features.

- Master data, such as items, categories, resources, resource instances, operations, routings, bills of material, and recipes.

- Reference data, such as work orders or batches, sales orders, purchase orders, and quality test specifications.

- Transactional data, such as work order material and resource transactions, quality data, material move transactions, and work order completions.

- Flex attributes associated with business entities, such as the lot expiry date associated with a lot or the voltage associated with an operation.

AIAMFG can ingest enterprise data from any ERP application, not only Oracle E-Business Suite (EBS) applications. Upload data from ERP systems such as JD Edwards, Oracle Supply Chain Management Cloud, SAP, or shop floor systems such as MES and LIMS, into AIAMFG using CSV data files. Oracle Data Pump and GoldenGate synchronization provide out of the box integration between E-Business Suite and AIAMFG.

When choosing between ingesting Case Record or Business Entity data, choose to ingest Business Entity data when you need:

- Source data organized by business entities.

- AIAMFG to stitch together data across entities and create flattened case records.

- AIAMFG to extract out-of-the-box features for use in Feature Significance, Insights and/or Predictions models.

- Visibility into multi-level manufacturing operations and across organizations through use of the Genealogy feature.

- To drill down into transactional data from high level data transformations.

- Equipment sensor data contextualization within AIAMFG.

- To capture multiple values for quality at an operation.

- To upload reference information once or infrequently.

- To generate predictions using scheduled and in progress work orders.

Data Import Steps
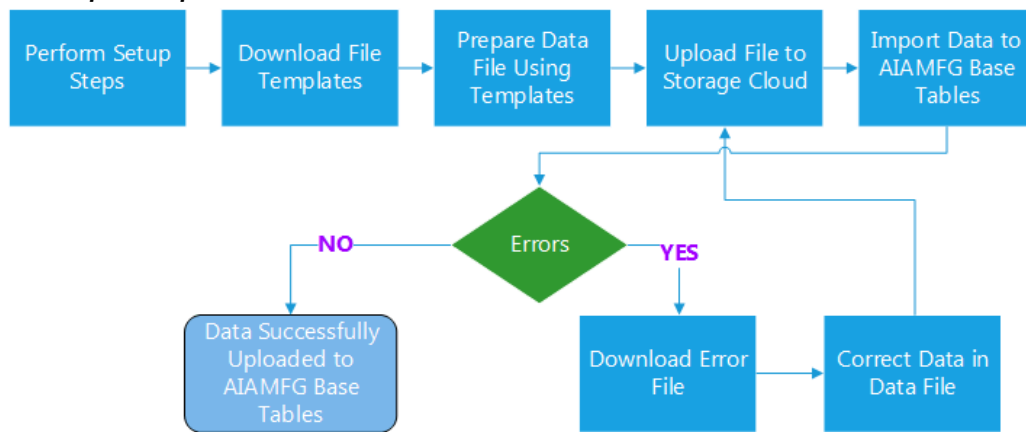
1. Perform the setup steps required to import data.

2. Download the file templates for either a process or discrete organization.

3. Prepare or enter the data into the CSV file, following the template guidelines.

4. Submit the file for upload to Oracle Storage Cloud Service.

5. Run the data import program to import data into the target base tables in Oracle Database Cloud Service.

6. If errors occur, download the error file, correct the data, remove the error message columns, save the error file as a new CSV file, and then upload the file again.

> **Important:** In order to ingest business entity data into an organization, the organization must be defined as a business entity data ingestion organization. See: Defining Organizations, page 2-6.

Use one of the following three methods to import business entity data.

- Upload CSV files using the business entity data user interface, page 3-3.

- Upload CSV files using REST web services, page 3-9.

- Use Data Pump and GoldenGate to ingest EBS data, page 3-83.

Uploading CSV Files Using the Business Entity Data User Interface

Import the CSV Business Entity Data files using the Business Entity user interface, which begins at the Business Entity Data page.

To download a template:

1. From the Home page, click **Insights** or **Predictions**, then the **Data Ingestion** tab, then **Business Entity Data**, and then **Download Template**.

    All of the Business Entity templates are zipped together into one file named AIMFG_BusinessEntityDataIngestionTemplates.zip. Download this zip file.

2. Extract the downloaded file AIMFG_BusinessEntityDataIngestionTemplates.zip. In the individual template files, enter your business entity data. For more information about entering data into each template, see:

    - Validating Business Entity Data and Handling Errors, page 3-12

    - Using Business Entity Data Templates, page 3-14

3. Save each template file as type CSV.

To upload business entity data files to Oracle Storage Cloud Service

4. In the Business Entity Data page, click **Upload**. The Upload Business Entity Data page opens.

5. In the File Set Name field, enter a meaningful name. You need to know this name to reference log files or the file set upload status.

6. Add one or more Business Entity Data CSV files to the file set in the Select Files region. After you enter information into the following fields for one CSV file, click the **Add** button (+ icon) to add a row for the next CSV file.

   • File: Click Browse to search for and select a CSV file.

   • Description: Optional. Enter a description of the CSV file selected.

   • Entity: Use the drop-down list to select the CSV file entity type.

7. Click **Upload** to submit the file set for upload to Oracle Storage Cloud Service.

   A File Upload Status page displays with the following information:

   • File upload: Displays the file number currently uploading out of the total number of files in the file set.

   • File upload progress indicator: Provides a visual representation of the upload progress.

   • File uploading in progress: Displays the file name currently uploading.

To import data into the target base tables:

Upon upload completion, the Business Entity Data page appears again, which displays the status of the uploaded file set. File set FS001 shown below contains 1 file, which has been uploaded to Oracle Storage Cloud Service and has a status of PENDING Data

Import.

The File Sets region of the Business Entity Data page displays the following information:

- File Set Name

- Files: The number of CSV files uploaded in the file set.

- Creation Date: Creation date of the file set.

- Created By: User who uploaded the file set.

- Status: Data import status. Statuses include:
    - PENDING: File set upload to Oracle Storage Cloud Service completed successfully. Data import to the target base tables is pending.

    - IN PROGRESS: Data import to the target base tables is in progress.

    - SUCCESS: Data import completed successfully for all files in the file set.

    - ERROR: Data import failed for all or a subset of the files in the file set. To troubleshoot errors, refer to Validating Business Entity Data and Handling Errors, page 3-12. If you suspect the errors are related to Oracle Storage Cloud Service, contact the Oracle Cloud Operations team for support.

- Action icon: Invoke additional actions on the file set using this icon.

1. Click the **Action** icon, next to the Status, to perform additional actions on the file set. A drop-down list with two possible actions displays.

   • Import Data: Processes and imports data from the CSV files in the storage cloud to the target base tables.

   • Add File to File Set: Add additional files to an existing file set containing CSV files already uploaded to Oracle Storage Cloud Service.

      Note: The above actions are only enabled when the status is PENDING..

2. Select the **Add File to a File Set** option.

   Follow the steps to upload business entity data files to Oracle Storage Cloud Service as described above. Note that the files already uploaded display, but are read only. Once files are uploaded, you cannot remove them from the file set.

3. Click **Upload** to resubmit the file set. The newly added files are uploaded to Oracle Storage Cloud Service.

4. Click **Files** to view details of the uploaded files.

Details displayed for each file in the file set include:

- File Name

- Description

- Entity

- Status

- Action icon

5. From the file set **Actions** icon, select **Import Data** to submit a program which imports the CSV files included in the file set to the target base tables.

Once the import data program completes, the Status at both the file set and file level are displayed.

6. Click **Files** again to view the individual files in the imported file set.

7. Click the Action icon for an individual file.
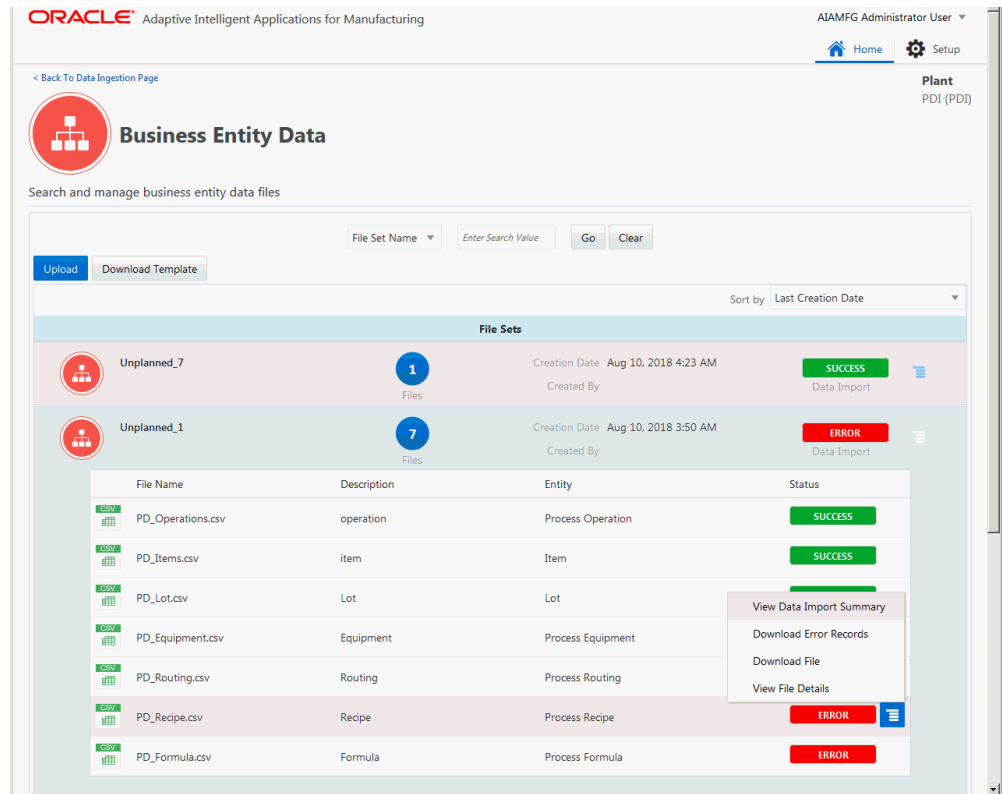
Choose from the following actions on an individual, imported CSV file:

- View Data Import Summary: Provides details about the number of uploaded records, successful imports, and failed imports.

- Download Error Records: Download a file containing the import error records of the CSV file.

- Download File: Download the CSV file uploaded as part of this file set.

- View File Details: View file details such as name, description, creation date, and so on.

Uploading CSV Files Using REST Web Services

Representational State Transfer, or REST web services, provide interoperability between computer systems and the web. REST web services enable requesting systems to access and manipulate resources.

Oracle Adaptive Intelligent Applications for Manufacturing provides three REST services to import data into the applications through CSV data files. The seeded templates must be downloaded, data entered as suggested in the template guidelines, and saved as a CSV file. These data files can then be imported using REST Services.

Business Entity Data Ingestion supports the following REST services:

1. Uploading data files in a file set to Storage Cloud. The file set can contain one or more files.

2. Importing files from Storage Cloud to the Database Cloud. This moves the data from the files in Storage Cloud to the product base tables.

3. Obtaining the status of all the files in a file set that is imported.

To use REST web services, a user must have access to Oracle Identity Cloud Service with either the Identity Domain Administrator or Application Administrator role. The user must first register the AIAMFG Client Application in Oracle Identity Cloud Service, then use a third-party client such as Postman to access REST web services. See: Appendix: REST Web Services, *Oracle Adaptive Intelligent Apps for Manufacturing User's Guide*.

Uploading a file set to Storage Cloud:

You can upload a file set containing one or more business entity data files to the Storage Cloud.

URL:

```
<host:>/aimfgapi/vof/v1/di/pub/entitydata/upload
```

Request Parameters:

Parameter Name	Description	Type	Required
json	A file containing the JSON payload, similar to the example shown below.	File	Yes.
files	List of csv files containing data to import.	File	Yes.

JSON Payload Request Example:

Input:

```
{
    "filesetName" : "fileSet1",
    "files" : [
        {"fileName": "1.csv", "fileDescription" : "file description
here" , "entityName" : "Item"},
        {"fileName": "2.csv", "fileDescription" : "file description
here" , "entityName" : "Bom"}
    ]
}
```

Response Body Example

```
{
  "filesetName" : "fileSet-1",
  "files" : [
      {"fileName": "1.csv","fileDescription" : "file description here" ,
"entityName" : "Item ", "uploadStatus" : "SUCCESS"},
      {"fileName": "2.csv","fileDescription" : "file description here" ,
"entityName" : "Bom", "uploadStatus" : "SUCCESS"}
      ]
 }
```

Importing the data file:

Import a file set containing one or more files from Storage Cloud to the base tables in the Database Cloud.

URL:

```
<host:>/aimfgapi/vof/v1/di/pub/entitydata/process/<filesetName>
```

Request Parameters:

None

Payload Example:

Input:

```
"filesetName" as part of the url path parameter
```

Output:

```
{
    "filesetName": "fileSetName",
    "filesetStatus":"In-Progress"
     //In-Progress if job is submitted successfully. Else an error
message will be displayed in filesetName
}
```

Checking the Status of a File Upload:

Check the upload status of all the files in a file set.

URL:

```
<host:>/aimfgapi/vof/v1/di/pub/status/<filesetName>
```

Request Parameters:

None

Payload Example:

Input:

```
"filesetName" as part of the url path parameter
```

Output:

```
"fileSetName" : "fileSet-1",
  "files": [
      { fileName":"test.csv","entityName":"Items", "totalCount":3,
"uploadCount":3, "importCount":3,    "errorUploadCount":0,
"importStatus":"S", "processStatus":"S">" }
      {  "fileName":"test2.csv", "entityName":"BOM", "totalCount":3,
"uploadCount":3, "importCount":3, "errorUploadCount":0, "importStatus":"
S", "processStatus":"S">" }
      ]
  }
```

Validating Business Entity Data

Oracle Storage Cloud imposes the following validation rules on uploaded CSV files:

1. Oracle Storage Cloud Service requires unique file names in a folder. Each folder in the storage cloud gets its name from an uploaded Business Entity file set. The storage cloud ensures file name uniqueness by ensuring the uniqueness of the file set names.

2. To avoid data dependency issues, follow the file set upload order as described in Template Upload Order, page 3-14.

3. To update an existing record in AIAMFG, create a data file, enter the updated data, and ensure that the primary key columns match the data record you wish to update.

4. A file set cannot exceed 5 GB. If a file set exceeds 5 GB, split the files into multiple file sets, each less than 5 GB.

5. When creating a data file based on a template, ensure that the columns names in the data file match the column names listed in the Column Header row of the template. Verify that the column names have no spaces.

6. The maximum size of any template column value must not exceed the limits listed in the Data Type row of the template's Sample Data tab.

7. Upload the Discrete or Process Work Order template after uploading the upstream entity templates such as Item, Bill of Material, Routing, and Flex Attribute.

Data Model Derived Field Values

Some of the uploaded business entity data is used to derive field values, as shown in the following table.

Template Name	Source Fields from Template	Derived Field in Data Model	Derived Field Values
WorkOrderTemplate.xlsx	ActualStartDate, ActualEndDate	Work Order Status	Pending (If ActualStartDate is null). In Progress (If ActualStartDate is not null and ActualEndDate is null). Completed (If both ActualStartDate and ActualEndDate are not null).
ProcessWorkOrderTemplate.xlsx	ActualStartDate, ActualEndDate	Work Order Status	Pending (If ActualStartDate and ActualEndDate are null). In Progress (If ActualEndDate is null and ActualStartDate is not null). Completed (If both ActualStartDate and ActualEndDate are not null).
ProcessWorkOrderTemplate.xlsx	ScheduleStartDate, ActualStartDate	Batch Creation Date	CreationDate provides the value for Batch Creation Date. If CreationDate is null, then Batch Creation Date is derived from the earliest date of either ScheduleStartDate or ActualStartDate.

Template Name	Source Fields from Template	Derived Field in Data Model	Derived Field Values
ProcessWorkorderTransactionTemplate.xlsx	TransactionType, when the EntityType field value is MaterialTransaction.	Item Type	Ingredient - If the TransactionType field value is IngredientIssue or IngredientReturn. Product - If the TransactionType field value is ProductCompletion or ProductReturn. By-Product - If the TransactionType field value is ByProductCompletion or ByProductReturn.

Using Business Entity Data Templates

AIAMFG provides twenty-one business entity data templates. Download the templates from AIAMFG and then enter the data as recommended into the spreadsheet templates. You can upload multiple files together by creating a file set.

For business entity data templates common for both discrete and process organizations, see Data Used by Both Discrete and Process Organizations (Common), page 3-16.

For business entity data templates for discrete organizations, see Data Used by Discrete Manufacturing Organizations (Discrete), page 3-39.

For business entity data templates for process organizations, see Data Used by Process Manufacturing Organizations (Process), page 3-63.

Template Upload Order

The import program manages data dependencies within a file set. If files have data dependencies across file sets, then you must manually manage the dependencies as described in the table below. The table lists the order in which to upload files. For example, upload setup templates before transaction templates due to data dependencies between the templates. You can upload setup data once and then all dependent entities can use the setup data multiple times. Upload additional setup data and import it into the application when required.

The Dependent Entities column lists for each row those templates that you must upload

before uploading the entity name in the row. For example, before uploading lots, you must upload items.

> **Additional Information:** Dependency on flex attributes exists only when you plan to enter flex fields for an entity.

Seeded Business Entity Data Templates

Entity Execution Order	Entity Name	Template Classification (Process, Discrete, Both)	Entity Type (Setup/Transaction)	Dependent Entities
1	Flex Attribute	Both	Setup	
2	Item	Both	Setup	Flex Attribute
3	Lot	Both	Setup	Item, Flex Attribute
4	Serial	Both	Setup	Item, Flex Attribute
5	Department	Discrete	Setup	
6	Discrete Equipment	Discrete	Setup	Serial, Flex Attribute
7	Process Equipment	Process	Setup	
8	Person	Both	Setup	Flex Attribute
9	Discrete Routing	Discrete	Transaction	Person, Department, Discrete Equipment
10	Bill of Material	Discrete	Transaction	Item, Routing
11	Process Operation	Process	Setup	Process Equipment

Entity Execution Order	Entity Name	Template Classification (Process, Discrete, Both)	Entity Type (Setup/Transaction)	Dependent Entities
12	Process Routing	Process	Setup	Process Operation
13	Process Formula	Process	Setup	Item
14	Process Recipe	Process	Setup	Process Formula, Process Routing
15	Quality Test	Both	Setup	
16	Receipt	Both	Transaction	Item
17	Discrete Work Order	Discrete	Transaction	Item, Routing, Bill of Material, Flex Attribute
18	Process Work Order	Process	Transaction	Process Recipe, Flex Attribute
19	Process Work Order Transaction	Process	Transaction	Process Work Order, Flex Attribute
20	Quality Result	Both	Transaction	Discrete Work Order, Process Work Order
21	Shipment	Both	Transaction	Item

For business entity data templates common for both discrete and process organizations, see Data Used by Both Discrete and Process Organizations (Common), page 3-16.

For business entity data templates for discrete organizations, see Data Used by Discrete Manufacturing Organizations (Discrete), page 3-39.

For business entity data templates for process organizations, see Data Used by Process Manufacturing Organizations (Process), page 3-63.

Data Used by Both Discrete and Process Organizations (Common)

The following are the list of business entity data templates, common to both discrete

and process organizations:

- Flex Attribute (FlexAttributeTemplate.xlsx), page 3-17

- Item (ItemTemplate.xlsx), page 3-20

- Lot (LotAttributesTemplate.xlsx), page 3-22

- Serial (SerialAttributesTemplate.xlsx), page 3-24

- Department (DepartmentTemplate.xlsx), page 3-27

- Person (PersonTemplate.xlsx), page 3-28

- Quality Result (QualityResultsTemplate.xlsx), page 3-30

- Quality Test (QualityTestsTemplate.xlsx), page 3-34

- Receipt (ReceiptTemplate.xlsx), page 3-35

- Shipment (ShipmentTemplate.xlsx), page 3-38

For information on the uploading order for business entity data templates, see Template Upload Order, page 3-14.

For information on business entity data templates for discrete organization, see Data Used by Discrete Manufacturing Organizations (Discrete), page 3-39.

For information on business entity data templates for process organizations, see Data Used by Process Manufacturing Organizations (Process), page 3-63.

Flex Attribute (FlexAttributeTemplate.xlsx)

CSV templates have a set of standard columns used to import data into AIAMFG. In addition to the standard columns, users can also import custom or organization specific attributes into AIAMFG using flex attributes. Use the flex attributes template to define and import the flex context and corresponding attributes before referencing the flex data in other data files.

The Entity column values in the Flex Attribute Template correspond to the following CSV templates:

Entity Value	Business Entity	Record Details
Work Order-Assembly	Discrete Work Order	RecordType = Assembly
Work Order-Operation	Discrete Work Order	RecordType = Operation

Entity Value	Business Entity	Record Details
Work Order-Person	Discrete Work Order	RecordType = Person
Work Order-Equipment	Discrete Work Order	RecordType = Equipment
Work Order-Component	Discrete Work Order	RecordType = Component
Work Order-Exception	Discrete Work Order	RecordType = Exception
Lot	Lot	All
Serial	Serial	All
Equipment	Discrete Equipment	All
Person	Person	All
Item	Item	All
Batch	Process Work Order, Process Work Order Transaction	EntityType = Batch
Batch-Step	Process Work Order, Process Work Order Transaction	EntityType = Step
Batch-Material	Process Work Order, Process Work Order Transaction	EntityType = Material
Batch-Exception	Process Work Order, Process Work Order Transaction	EntityType = Exception

Flex Attribute Template Columns

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
Entity	Y	Char	30	Name of the entity for which the flex attribute context is defined. Valid values are WorkOrder-Assembly, WorkOrder-Operation, WorkOrder-Person, WorkOrder-Equipment, WorkOrder-Component, WorkOrder-Exception, Lot, Serial, Equipment, Person, Item, Batch, Batch-Step, Batch-Material, Batch-Exception. **Note:** Equipment refers to the Discrete Equipment entity.	Lot, Serial, Equipment, Person, Batch-Step

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
FlexAttributesContext	Y	Char	30	An entity can have as much context as required. Each context provides a logical name for a set of attributes.	Lot Attributes, Electrical Parameters
C_FlexAttribute1...15	-	Char	240	Fifteen attributes that can hold character values for the context. Users can choose to use a subset of the attributes or none of the attributes.	Length (mm), Voltage (V)
N_FlexAttribute1...15	Y	Number	240	Fifteen attributes that can hold numeric values for the context. Users can choose to use a subset of the attributes or none of the attributes.	Height (ft), Weight (kg)

For the complete list of business entity data templates common for both discrete and process organizations, see Data Used by Both Discrete and Process Organizations (Common), page 3-16.

Item (ItemTemplate.xlsx)

The Item data file contains definitions for inventory items, engineering items, and purchasing items. You can specify item-related information in fields such as Revision, Lot Control, and Serial Control, for example.

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
SourceSystem		Char	100	Identifies the success or failure records uploaded from a specific source system.	INV
Organization Code	Y	Char	3	Short alphanumeric code of the organization to which the item belongs.	MD5, PD2
ItemName	Y	Char	40	Inventory item name.	G15-Pinion Gear, Strawberry Fruit
ItemDescription	Y	Char	240	Item description.	Helical - 40mm 46T, 8mm Bore
Category		Char	20	Item category.	Inventory
MakeorBuy		Char	1	Make or Buy	M, B
Revision	Y	Char	3	Revision of the item.	A, B, C
LotControl		Char	1	Flag indicating lot control allowed.	Y, N
SerialControl		Char	1	Flag indicating Serial Control allowed.	Y, N

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
UnitOfMeasure	Y	Char	3	Item unit of measure.	Ea
FlexAttributesContext		Char	30	Flex attributes context code.	Item Attributes
C_FlexAttribute1...15		Char	150	Fifteen attributes than can hold character values for the context.	Expiration Date, Purchasable
N_FlexAttribute1...15		Number	240	Fifteen attributes that can hold numeric values for the context.	

For the complete list of business entity data templates common for both discrete and process organizations, see Data Used by Both Discrete and Process Organizations (Common), page 3-16.

Lot (LotAttributesTemplate.xlsx)

A lot can represent a quantity of an item that shares the same specifications, one or more receipts from the same vendor, or characteristics you choose. You can divide each lot into child lots that reflect characteristics you choose for items within the lot. For example, you may divide an item lot from a vendor into child lots to reflect differences in quality specifications. When you allocate stock for production, you can allocate specific lots to a production batch based on the potency, age, or other item characteristics.

This data file contains the definitions for lot controlled items. For items under lot control, you must assign lot numbers to each receipt, and then reference these lots each time you perform material transactions. This enables you to maintain control over lot controlled items in inventory.

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
SourceSystem		Char	100	Identifies the success or failure records uploaded from a specific source system.	INV
Organization Code	Y	Char	3	Short alphanumeric code of the organization.	MD5, PD2
ItemName	Y	Char	40	Name of the item.	G15-Pinion Gear, Sugar
LotNumber	Y	Char	80	Lot number to which the item belongs.	LTG15G01, LTSG0106
ParentLotNumber		Char	80	Parent lot number.	PLTSG001
Description		Char	256	Lot description.	Sugar from Crystals
ExpirationDate		Date		Expiration date. Format: (mm/dd/yyyy hh24:mi:ss)	01/01/2019 14:33:04
GradeCode		Char	150	Lot grade code.	L31

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
OriginationDate		Date		Origination date. Format: (mm/dd/yyyy hh24:mi:ss). Lots created use Origination Date. If no Origination Date is provided, then the Origination Date value defaults to the import date.	01/01/2019 14:33:04
FlexAttributesContext		Char	30	Descriptive flex field context code.	Crystal Size
C_FlexAttribute1...15		Char	150	One of up to 15 flex field attributes.	Large
N_FlexAttribute1...15		Number		One of up to 15 flex field attributes.	

For the complete list of business entity data templates common for both discrete and process organizations, see Data Used by Both Discrete and Process Organizations (Common), page 3-16.

Serial (SerialAttributesTemplate.xlsx)

For items that are under serial number control, you must assign a unique serial number to each individual unit and reference the same serial number each time you perform a transaction on an individual unit. This enables you to have control over every unit of every serial-controlled item in your inventory. This data file contains serial number details for each item.

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
SourceSystem		Char	100	Identifies the success or failure records uploaded from a specific source system.	INV
Organization Code	Y	Char	3	Short alphanumeric code of the organization to which the serial item belongs.	MD5
ItemName	Y	Char	40	Name of the item.	G15-Gearbox
SerialNumber	Y	Char	30	Item serial number.	SNG15000001
Revision		Char	3	Revision of the item.	A
Description		Char	240	Description.	
LotNumber		Char	80	Lot number.	FGLT0001

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
OriginationD ate		Date	Y	Origination date. Format: (mm/dd/yyyy hh24:mi:ss). Serial units created use Origination Date. If no Origination Date is provided, then the Origination Date value defaults to the import date.	01/01/2019 14: 33:04
Status		Char	80	Status. Valid values are Defined, InStores, Issued, Intransit, Receiving, WIP.	Defined
FlexAttribute sContext		Char	30	Descriptive flex field context code.	GearRatio Torque
C_FlexAttrib ute1...15		Char	150	One of up to 15 flex field attributes.	5 to 1
N_FlexAttrib ute1...15		Number		One of up to 15 flex field attributes.	

For the complete list of business entity data templates common for both discrete and process organizations, see Data Used by Both Discrete and Process Organizations (Common), page 3-16.

Department (DepartmentTemplate.xlsx)

A department consists of one or more people, machines, or suppliers within your organization where you want to collect costs, apply overhead, and compare load to capacity. Assign a department to each operation in a routing and then assign resources available for that department.

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
SourceSystem		Char	100	Identifies the success or failure records uploaded from a specific source system.	WIP
Organization Code	Y	Char	3	Short alphanumeric code of the organization to which the item belongs.	DI1
DepartmentC ode **Note:** This is an optional field for process organizati ons.	Y	Char	10	Short alphanumeric code of the Department to which the employee belongs.	Assembly
Description		Char	240	Description of the department.	Assembly Department

For the complete list of business entity data templates common for both discrete and process organizations, see Data Used by Both Discrete and Process Organizations (Common), page 3-16.

Person (PersonTemplate.xlsx)

This data file contains employee details of people working in the manufacturing process.

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
SourceSystem		Char	100	Identifies the success or failure records uploaded from a specific source system.	WIP
RecordType	Y	Char	150	Identifies employee information or shift-in and shift-out information. The only accepted values are Person and Attendance. Use the value Person for employee information. Use the value Attendance for shift-in and shift-out information.	Person Attendance
Organization Code	Y	Char	3	Short alphanumeric code of the organization to which the person belongs.	MD5

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
DepartmentCode **Note:** This is an optional field for process organizations.		Char	10	Short alphanumeric code of the Department to which the employee belongs.	Assembly
PersonResourceCode	Y	Char	10	Short alphanumeric code of the person.	ASSEMBLER
PersonFullName	Y	Char	240	Employee's full name.	Hammond John
EmployeeNumber	Y	Char	30	Employee number. You can not delete an employee number once it is defined.	2725
StartDate	Y	Date		Employee start date. Format: (mm/dd/yyyy hh24:mi:ss). StartDate must be earlier than EndDate.	01/01/2019 14: 33:04
EndDate		Date		Employee end date. Format: (mm/dd/yyyy hh24:mi:ss)	01/01/2019 14: 33:04

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
Email		Char	240	Email ID of the person.	John. Hammond@abc.com
FlexAttributesContext		Char	30	Descriptive flex field context code.	Employee Attributes
C_FlexAttribute1...15		Char	150	One of up to 15 flex field attributes.	Operator Shop Floor
N_FlexAttribute1...15		Number		One of up to 15 flex field attributes.	

For the complete list of business entity data templates common for both discrete and process organizations, see Data Used by Both Discrete and Process Organizations (Common), page 3-16.

Quality Result (QualityResultsTemplate.xlsx)

The quality results data file contains definitions for inspection quality test results. Along with the test results, the template also contains information about the item, operation, serial number, test date, and so on. For items under serial number control, you must assign a unique serial number to each individual item and reference the same serial number each time you perform a transaction on an individual item. This enables you to have control over every serial numbered item in your inventory. This data file contains serial number details for each item.

> **Tip:** Delete quality results for a work order using work order purge.

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
SourceSystem		Char	100	Identifies the success or failure records uploaded from a specific source system.	EBSOPM
Source System Result ID		Number		Stores reference information that links quality results in AIAMFG to the quality source system.	96117
Organization Code	Y	Char	3	Short alphanumeric code of the organization to which the quality result for an item belongs.	PD2
Sample		Char	240	Sample name. Sample is applicable to process quality data. For discrete quality data, the value is null.	SAMPLE230531-1600039
ItemName	Y	Char	240	Name of the item.	Strawberry Fruit
LotNumber		Char	80	Lot number of the item.	LI-230167-1600039-1

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
WorkOrder		Char	240	Work order number. Value is null for a process organization. Value is mandatory for an Assembly or Product WIP ItemName.	WO-PG-7812
SerialNumber		Char	30	Item serial number. Value is null for a process organization. Value is mandatory for an Assembly or Product WIP ItemName.	SNG16000607
Operation		Number		Operation sequence. Value is null for a process organization. Value is mandatory for an Assembly or Product WIP ItemName.	10
SampleDataDrawn		Date		Sample date drawn (mm/dd/yyyy hh24:mi:ss)	01/01/2018 08:00:00
Tester		Char	240	Name of the tester.	

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
TestName	Y	Char	240	Quality test name.	Soluble Solids%
TestResultValue	Y	Char	240	Quality test result value. Existing quality test result records cannot be updated.	67
TestResultDate	Y	Date		Quality test result date (mm/dd/yyyy hh24:mi:ss). The most recent TestResultDate determines the latest quality test result to use.	11/16/2017 08:00:00
SpecMinValue		Number		Test specification minimum value.	65
SpecTargetValue		Number		Test specification target value.	68
SpecMaxValue		Number		Test specification maximum value.	70
InspectionResult		Char	240	Results of the inspection.	Accept, Reject
Disposition		Char	240	Disposition	Accept with Variance

For the complete list of business entity data templates common for both discrete and

process organizations, see Data Used by Both Discrete and Process Organizations (Common), page 3-16.

Quality Test (QualityTestsTemplate.xlsx)

The quality test data file contains the definition of each test, including information such as test name and test method.

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
SourceSystem		Char	100	Identifies the success or failure records uploaded from a specific source system.	LIMS
SourceType	Y	Char	30	Identifies the source as either a discrete or process manufacturing organization. Valid values are Discrete and Process.	Discrete, Process
TestName	Y	Char	240	Quality test name.	Noise level
TestDataType	Y	Char	15	Identifies the test results as either alphanumerical or numerical. Valid values are Numerical and Categorical.	Numerical

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
TestDescription		Char	240	Quality test description.	Noise Level
TestType		Char	30	The type of quality parameter tested.	ATTRIBUTE
TestMethod		Char	30	Quality test method	FLAME PHOTOMETRY
UnitOfMeasure		Char	5	Quality parameter unit of measure.	mg%

For the complete list of business entity data templates common for both discrete and process organizations, see Data Used by Both Discrete and Process Organizations (Common), page 3-16.

Receipt (ReceiptTemplate.xlsx)

A receipt provides information about the items received, such as the supplier, purchase order, item, lot, serial number, quantity, and more.

This data file contains the receipt information for each purchase order line number, as well as the lot and serial number range, if applicable.

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
SourceSystem		Char	100	Identifies the success or failure records uploaded from a specific source system.	PROC

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
TransactionType	Y	Char	10	Type of transaction. Valid values are Receipt, Return.	Receipt
ReceivingType	Y	Char	10	Type of receipt. Valid values are External, Internal.	External
Supplier	Y	Char	240	Supplier name.	ABC Suppliers
SupplierSite		Char	15	Supplier site.	Site_132197
SupplierContact		Char	32	Supplier contact name. The format is <Firstname, Lastname>, with 15 characters for the first name, 15 for the last name, and 2 characters for the ', ' separator.	Steve Johnson
PONumber	Y	Char	20	Purchase order number.	PO-6058
LineNumber		Number		Purchase order line number.	1

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
SourceOrganizationCode	Y	Char	3	Source organization code for an internal transfer purchase order.	MD5
DestinationOrganizationCode	Y	Char	3	Organization code for the receiving organization.	M1
ItemName	Y	Char	40	Item name.	Strawberry Fruit
Revision		Char	3	Item revision.	A
LotNumber		Char	80	Item lot number.	LTG15MM01
SerialNumberFrom		Char	30	Start of a serial number range.	SL-G15GB-0012
SerialNumberTo		Char	30	End of a serial number range.	SL-G15GB-0014
TransactionDate		Date		Transaction date (mm/dd/yyyy hh24:mi:ss).	04/13/2020 15:45:10
TransactionQuantity	Y	Number		Transaction quantity	10

For the complete list of business entity data templates common for both discrete and process organizations, see Data Used by Both Discrete and Process Organizations (Common), page 3-16.

Shipment (ShipmentTemplate.xlsx)

This data file contains shipping transaction details.

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
SourceSystem		Char	100	Identifies the success or failure records uploaded from a specific source system.	OM
TransactionType	Y	Char	10	Transaction type.	Return, Ship
Customer	Y	Char	240	Customer name.	Bigmart
CustomerContact		Char	15 for first name, 15 for last name.	Customer contact name entered in the format of FirstName, LastName.	David, Cooper
OrderNumber	Y	Number		Order number.	153150
LineNumber		Number		Order line number.	1
OrganizationCode	Y	Char	3	Short alphanumeric code of the organization to which the sales order belongs.	PD2
ItemName	Y	Char	40	Name of the item.	SB Jam Case

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
Revision		Char	3	Revision of the item.	A
LotNumber		Char	80	Lot number.	LTP-2233162-1
SerialNumberFrom		Char	30	Serial number at the beginning of the item range.	SL-G15GB-0012
SerialNumberTo		Char	30	Serial number at the end of the item range.	SL-G15GB-0015
TransactionDate	Y	Date		Transaction date (mm/dd/yyyy hh24:mi:ss).	01/01/2018
TransactionQuantity	Y	Number		Transaction Quantity	1

For the complete list of business entity data templates common for both discrete and process organizations, see Data Used by Both Discrete and Process Organizations (Common), page 3-16.

Data Used by Discrete Manufacturing Organizations (Discrete)

The following are the list of business entity data templates for discrete organizations:

- Discrete Equipment (DiscreteEquipmentTemplate.xlsx), page 3-40

- Bill of Material (BOMTemplate.xlsx), page 3-41

- Discrete Routing (DiscreteRoutingTemplate.xlsx), page 3-44

- Discrete Work Order (WorkOrderTemplate.xlsx), page 3-48

For information on the uploading order for business entity data templates, see Template Upload Order, page 3-14.

For information on common business entity data templates for discrete and process organization, see Data Used by Both Discrete and Process Organizations (Common), page 3-16.

Discrete Equipment (DiscreteEquipmentTemplate.xlsx)

The Discrete Equipment entity provides information about equipment instances used in the manufacturing process.

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
SourceSystem		Char	100	Identifies the success or failure records uploaded from a specific source system.	WIP
Organization Code	Y	Char	3	Short alphanumeric code of the organization to which the Equipment belongs.	DI1
DepartmentC ode	Y	Char	10	Department code.	DI_DEPT
Equipment	Y	Char	10	Equipment name.	MCH_RSRC
EquipmentIn stance	Y	Char	40	Equipment instance. You can not delete an EquipmentIn stance once it is defined.	DRILL_1
EquipmentSe rialNumber	Y	Char	30	Equipment serial number.	SER_001

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
FlexAttribute sContext		Char	30	Flex attributes context.	Physical Attributes
C_FlexAttrib ute1...15		Char	150	Up to 15 character-based flex attributes.	10
N_FlexAttrib ute1...15		Number		Up to 15 number-based flex attributes.	

For the complete list of business entity data templates for discrete organizations, see Data Used by Discrete Manufacturing Organizations (Discrete), page 3-39.

Bill of Material (BOMTemplate.xlsx)

A bill of material identifies the list of components and assemblies and the quantity of each needed to manufacture an end part. This data file provides the information necessary to create new and update existing bills of material.

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
SourceSystem		Char	100	Identifies the success or failure records uploaded from a specific source system.	MES
Organization Code	Y	Char	3	Short alphanumeric code of the organization to which the BOM belongs.	DI1

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
Assembly	Y	Char	40	Assembly name.	ASSEMBLY_1
Revision	Y	Char	3	Assembly revision.	A
Alternate		Char	10		
Operation	Y	Number	-	BOM routing operation number. If the same Component is provided more than once in the same Operation with a different effective date, the duplicate Components display in the Insights, Predictions, Genealogy and Trace, and Factory Command Center pages.	10

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
Component	Y	Char	40	Component name. You can not remove a Component from a BOM once it is defined. If the same Component is provided more than once in the same BOM routing operation (Operation) with a different effective date, the duplicate Components display in the in the Insights, Predictions, Genealogy and Trace, and Factory Command Center pages.	COMPONENT_1
SubstituteComponent		Char	40	Name of the substitute component.	
Quantity	Y	Number		Component quantity used in the assembly.	100

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
EffectiveDate	Y	Date		Date the BOM became effective (mm/dd/yyyy hh24:mi:ss). EffectiveDate must be earlier than DisableDate.	01/01/2001 10:00:00
DisableDate		Date		Date to disable the BOM (mm/dd/yyyy hh24:mi:ss).	01/01/2020 10:00:00

For the complete list of business entity data templates for discrete organizations, see Data Used by Discrete Manufacturing Organizations (Discrete), page 3-39.

Discrete Routing (DiscreteRoutingTemplate.xlsx)

A Routing consists of the operations and resources used to assemble an item. This data file provides the information necessary to create new routings.

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
SourceSystem		Char	100	Identifies the success or failure records uploaded from a specific source system.	INV
Organization Code	Y	Char	3	Short alphanumeric code of the organization to which the routing belongs.	MD5

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
Assembly	Y	Char	240	Assembly name.	G15-Gearbox
Revision	Y	Char	3	Assembly revision.	A
AlternateRouting		Char	10	Alternate routing name.	
Operation	Y	Number		Operation number.	10
StandardOperationCode	Y	Char	4	Standard operation code.	SAY
OperationDescription		Char	240	Operation description.	Sub assembly

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
EffectiveDate	Y	Date		Date the routing became effective. EffectiveDate must be earlier than DisableDate. EffectiveDate values should not overlap for the same operation code. If the EffectiveDate overlaps, multiple operation names display in the Insights, Predictions, Genealogy and Trace, and Factory Command Center pages.	01/01/2015 12:00:00
DisableDate		Date		Date the routing is disabled (mm/dd/yyyy hh24:mi:ss).	01/01/2020 12:00:00
Department	Y	Char	10	Department name.	Assembly

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
SerializationStartOperation		Number		The operation when serialization begins. For a serialized assembly, enter the SerializationStartOperation in all records of the routing definition.	10
ResourceType		Char	10	Type of resource. Valid values are Equipment, Person.	Person
ResourceCode		Char	10	Primary resource. You can not update a ResourceCode and its Alternate in the routing operation if the primary and alternate resource combination already exists.	ASSEMBLER

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
Usage	Y	Number		Resource usage (in hours). The Usage value remains the same for both the ResourceCode and Alternate.	2
Alternate		Char	10	Alternate resource code. You can only define an Alternate if a ResourceCode exists in the routing definition.	

For the complete list of business entity data templates for discrete organizations, see Data Used by Discrete Manufacturing Organizations (Discrete), page 3-39.

Discrete Work Order (WorkOrderTemplate.xlsx)

The Work Order entity encapsulates the manufacturing process on the shop floor by tracking the item, quantity manufactured, routing steps, material consumption, equipment, operators, scrap generated, and exceptions reported in the manufacturing process.

You can create a work order transaction with one of the following six record types:

- Assembly - Work order transactions like definition, release, completion, or purge.

- Operation - Operation transactions like scrap, start, or completion of an operation.

- Component - Components consumed in an operation like issue or return.

- Equipment - Equipment usage transactions in terms of charge or reversal of equipment being used in the operations.

- Person - Person usage transactions in terms of charge or reversal of persons working in the operations.

- Exception - Exceptions in shop floor operations related to equipment, person, quality, or component.

Each transaction must contain a record type and one of the transaction types mentioned in the tables given below. A combination of a record and transaction type determines the transaction data that must be entered in the dependent columns of the work order data sheet for import into AIAMFG Applications. The required columns and the allowed values in the data sheet vary based on the record and transaction type combination.

Detail Transaction Type:

Use this transaction type to capture in progress transactions that are currently being processed in the shop floor and historical transactions that use serial or lot manufacturing. You can upload multiple records with the same record type and detail transaction type in which case the records will be processed and consolidated.

Using detail transaction types allows you to:

- View the Genealogy and Trace dashboard with serial and lot timelines, show the granular transactions like component issue, equipment charge, and so on, which is not possible using summary transaction type.

- Access accurate contextualization of sensor data with the work order, operation and serial based on the granular information collected for equipment usage and operations.

- Synchronize work orders with individual transaction details earlier than the lead time that is required to complete the manufacturing of a product.

- Synchronize work orders with transactions related to charge or release of a person, equipment, or component. These details cannot be captured using summary transaction type.

Assembly:

You can use the Assembly record type to create or update the work orders and track the work orders in the sequence. It supports creating or updating work orders in unreleased, released, or completed statues. You can also put the work order on hold or cancel it.

Record Type	Transaction Type	Purpose

Assembly	Definition	Creates or updates a work order definition. This is a superset transaction type which can be cumulative transaction of other detail transaction types. Transaction date and transaction quantity is not required.
		The status of work order is derived based on the following:
		• If the actual start date is blank, the job status is Unreleased.
		• If the actual start date is entered, the job status is Released.
		• If both the actual start date and actual completion date are entered, the job status is Completed.
Assembly	Release	Releases a work order to the shop floor. This updates the status of work order as Released.
Assembly	OhHold	Places a work order on hold. This updates the status of work order as OnHold
Assembly	Cancel	Cancels a work order. This updates the status of work order as Canceled.

Assembly	Completion	Completes transactions related to completion of individual products of a work order. For example, a work order that produces two gearboxes can be updated with two completion transaction showing individual gearbox completions. This transaction does not complete a work order. This transaction requires transaction date and transaction quantity.
Assembly	Return	Reverses completion transactions. These transactions reduces the completion quantity Return transactions may fail if the return quantity exceeds the completion quantity.
Assembly	Complete	Updates the status of work order as complete. This transaction will not require a transaction date or transaction quantity. The transaction date and quantity details are captured using completion transactions.
Assembly	Purge	Deletes the work order record as well as associated transactions, operations, equipment, person, exceptions, and quality records. A purge transaction is only allowed on existing work orders.

Note: The Definition record type should be processed at the end of other detail transactions to ensure work order is updated with accurate details such as dates, quantities, yield and so on. For a work order, you can use the transaction type Completion when assemblies are completing with exact quantities, and the Return transaction type when

returning assemblies with exact quantities and then finally update the work order with the Definition transaction type. For example:

1. Date1 - Create WO1 for 10 Qty with the Release transaction type.

2. Date2 - Complete WO1 with 2 completed qty with the Completion transaction type.

3. Date3 - Complete WO1 with 2 completed qty with the Completion transaction type.

4. Date4 - Return WO1 with 1 qty returned with the Return transaction type.

5. You can then use the Definition transaction type to sync the completed quantity as 3.

Operation:

You can use the Operation record type to create or update operations in a work order and track the operations. This record type supports creating or updating operations, starting the operation, completion, and so on.

Record Type	Transaction Type	Purpose
Operation	Definition	Creates or updates an operation in a work order. This creates the operation in the Pending status. Transaction date and transaction quantity is not required.
Operation	Start	Starts the operation.
Operation	Completion	Completes the operation.
Operation	Scrap	Scraps the transactions in operation.
Operation	Return	Returns the completed assemblies in the operation for rework.

Operation	ScrapReturn	Returns the scrap assemblies in the operation for rework.

Component:

You can use Component record type to create or update components consumed in work order operations and track the consumption in manufacturing process such as component issue and return.

Record Type	Transaction Type	Purpose
Component	Definition	Creates or updates components consumed in a work order. Transaction date and transaction quantity is not required.
Component	Issue	Issues components to the work order.
Component	Return	Returns components to the inventory.

Equipment:

You can use Equipment record type to create or update equipment used in work order operations and track the equipment usage such as equipment charge and charge reversals.

Record Type	Transaction Type	Purpose
Equipment	Definition	Creates or updates equipment used in the work order. Transaction date and transaction quantity is not required.

Equipment	Charge	Charge for equipments used in the process. You can enter the usage using either start and end dates or usage quantity. Usage quantity by default is measured in hours. It is mandatory to enter equipment transaction to contextualize sensor data with work order information.
Equipment	Reverse	Reverses equipment charged against a work order.

Person:

You can use Person record type to create or update persons used in work order operations and track the person assigned such as person charge and charge reversals.

Record Type	Transaction Type	Purpose
Person	Definition	Creates or updates information on persons assigned to a work order. Transaction date and transaction quantity is not required.
Person	Charge	Assigns a person to the work order. You can enter the usage using either start and end dates or usage quantity. Usage quantity by default is measured in hours.
Person	Reverse	Reverses charges for a person charged for a work order.

Exception:

You can use Exception record type to create or update exceptions captured during work order operations such as equipment, person, quality, or component. Note the following:

• You can enter multiple exception records for the same exception number to show the movement from open to close.

- An exception with only the start date is considered open.

- An exception with both start and end date is considered closed.

Record Type	Transaction Type	Purpose
Exception	Equipment	Creates or updates work order exception related to equipment.
Exception	Person	Creates or updates work order exception related to person.
Exception	Quality	Creates or updates work order exception related to quality elements.
Exception	Component	Creates or updates work order exception related to components.

Summary Transaction Type:

You can use Summary transaction type to collect assembly, operation, components, equipment, and person information used in non-serial or non-lot controlled manufacturing. Note that you cannot enter any detailed transaction type along with the summary transaction type.

Record Type	Transaction Type	Purpose
Assembly	Summary	Creates or updates a work order. One summary record is allowed for a work order with the Assembly record type. The last summary record overwrites the previous summary record.

Operation	Summary	Creates or updates one or more operations of the work order. One summary record is allowed per operation used in the work order. The last summary record overwrites the previous summary record
Component	Summary	Creates or updates components consumed in the work order. One summary record is allowed for each component consumed in the work order. The last summary record overwrites the previous summary record
Equipment	Summary	Creates or updates equipment used in the work order. One summary record is allowed for each equipment used in the work order. The last summary record overwrites the previous summary record.
Person	Summary	Creates or updates person used in the work order. One summary record is allowed for each person used in the work order. The last summary record overwrites the previous summary record.
Exception	Summary	Not Supported.

Template Column Value Validations

- Once a Summary Transaction Type is processed for a record type, no additional transaction types can be processed for the same record type.

- In discrete serialized manufacturing:

  - Serial number is mandatory.

  - Valid values for Yield and ReworkedQuantity are 0 or 1.

  - Serial numbers completed by one work order cannot be completed by another

work order unless returned by the first one.

- Serial numbers associated with one work order cannot be associated with another work order.

- TransactionQuantity must equal 1.

- SerialNumberFrom and SerialNumberTo: Both fields must be the same character length.

- In discrete manufacturing:
  - Serial number must be blank.

  - Yield value must be between 0 and 100.

  - Uploading transaction records multiple times creates duplicate transactions.

  - All quantity fields like PlanQuantity, ActualQuantity, ScrapQuantity, ReworkedQuantity, and TransactionQuantity must be positive.ActualQuantity, ScrapQuantity, ReworkedQuantity can be zero.

  - ScheduledCompletionDate must be later than ScheduledStartDate.

  - ActualCompletionDate must be later than ActualStartDate.

- For transaction type:
  - A value of Purge deletes the work order record as well as associated transactions, operations, equipment, person, exceptions, and quality records in other tables.

  - A value of Purge is only allowed for existing work orders.

  - Use the Definition value to create or update a work order.

  - If multiple Summary transactions are uploaded, the latest Summary transactions overwrite previous Summary transactions.

Discrete Work Order Template

Field Name	Required	Data Type	Length (Max)	Description	Sample Data

SourceSystem	-	Char	199	Identifies the success or failure records uploaded from a specific source system.	MES
RecordType	Y	Char	30	Transaction record type = Assembly.	Assembly
TransactionType	Y	Char	20	When RecordType = Assembly, valid transaction type values are Summary, Definition, Completion, Return, Release, OnHold, Cancel, Complete, Purge. **Caution**: The transaction type REJECT is not supported, which impacts model building for serial items.	Summary
TransactionDate	-	Date	-	Transaction date, mm/dd/yyyy hh24:mi:ss.	09/14/2018 13: 10:12

Organization Code	Y	Char	3	Short alphanumeric code of the organization to which the work order belongs.	MD5
AssemblySerialNumber	Y	Char	30	Serial Number for the assembly.	SNG15000608
WorkOrder	Y	Char	240	Work order number. One of the fields, AssemblySerialNumber or WorkOrder, is mandatory. If only AssemblySerialNumber is given, the data ingestion process creates a work order internally.	WO-GB-8605
Operation	Y	Char	-	Operation This field is not required for the Assembly record type. **Note:** See the Required Columns for Record Types, page 3-62 table.	

EntityName	Y	Number	40	Name of the assembly item.	G15-Gearbox
Revision	-	Char	3	Item revision	A
EntityDescription	-	Char	240	Description of entity value associated with the transaction record type.	Gearbox Job
ExceptionNumber	-	Number	-	Exception Number	
EntityDetail	-	Char	71	Description of the work order.	
PlanQuantity	Y	Number	-	Planned quantity.	1
ActualQuantity	-	Number	-	Quantity completed for the work order.	1
ScrapQuantity	-	Number	-	Quantity scrapped.	0
ReworkedQuantity	-	Number	-	Quantity reworked	
Yield	-	Number	-	Yield	

TransactionQuantity	-	Number	-	Transaction quantity. When SerialNumberFrom and SerialNumberTo are given, the TransactionQuantity must match the number of serials provided.	
ScheduledStartDate	Y	Date	-	Scheduled work order start date (mm/dd/yyyy hh24:mi:ss).	07/20/2017 13:00:00
ScheduledCompletionDate	-	Date	-	Scheduled work order completion date (mm/dd/yyyy hh24:mi:ss).	07/20/2017 17:00:0
ActualStartDate	-	Date	-	Actual work order start date (mm/dd/yyyy hh24:mi:ss).	07/20/2017 13:00:00
ActualCompletionDate	-	Date	-	Actual work order completion date (mm/dd/yyyy hh24:mi:ss).	07/20/2017 17:00:00
LotNumber	-	Char	80	Assembly lot number	

SerialNumbe rFrom	-		Char	30		Starting serial number in a series. When SerialNumbe rFrom and SerialNumbe rTo are given, both numbers must have the same length and prefix.		
SerialNumbe rTo	-		Char	80		Ending serial number in a series.		
FlexAttribute sContext	-		Char	30				
C_FlexAttrib ute1...15	-		Char	150				
N_FlexAttrib ute16...30	-		Number	-				

Required Columns for Record Types:

The following table gives the required columns for each record type:

Record Type	Operati on	Entity Name	Entity Detail	Revisio n	Plan Quantit y	Schedul ed Start	Actual Start	Excepti on Numbe r
Assemb ly	Blank	Assemb ly	BOM/ Routing	BOM/R ourting Rev	Require d	Require d		Blank
Operati on	Operati on Code	Operati on	Depart ment	Blank	Require d	Require d		Blank
Compo nent	Operati on Code	Compo nent	Blank	Blank	Require d	Blank		Blank

Equipment	Operation Code	Resource Name	Equipment Instance	Blank	Required	Required	Required	Blank
Person	Operation Code	Resource Name	Person Instance	Blank	Required	Required	Required	Blank
Exception	Operation Code	Exception Entity Name: • Equipment • Person • Quality • Component	Equipment Instance or Person Instance	Blank			Required (Exception Reported Date)	Required

> **Note:** Organization Code and Work Order Number are mandatory columns for all rows.
>
> Assembly Serial Number is mandatory for all rows in case of serial unit transaction data.

For the complete list of business entity data templates for discrete organizations, see Data Used by Discrete Manufacturing Organizations (Discrete), page 3-39.

Data Used by Process Manufacturing Organizations (Process)

The following are the list of business entity data templates for process organizations:

- Process Equipment (ProcessEquipmentTemplate.xlsx), page 3-64

- Process Operation (ProcessOperationTemplate.xlsx), page 3-66

- Process Formula (FormulaTemplate.xlsx), page 3-68

- Process Routing (ProcessRoutingTemplate.xlsx), page 3-69

- Process Recipe (RecipeTemplate.xlsx), page 3-71

- Process Work Order (ProcessWorkOrderTemplate.xlsx), page 3-74

- Process Work Order Transaction (ProcessWorkorderTransactionTemplate.xlsx), page 3-79

For information on the uploading order for business entity data templates, see Template Upload Order, page 3-14.

For information on common business entity data templates for discrete and process organization, see Data Used by Both Discrete and Process Organizations (Common), page 3-16.

Process Equipment (ProcessEquipmentTemplate.xlsx)

Process Equipment includes the assets used to produce batches. This data file provides the details of each equipment instance, such as equipment name, instance number, serial number, minimum and maximum capacity, capacity UOM, and parameter details.

Field Name	Required?	Data Type	Length (Max)	Description	Sample Data
SourceSystem	N	Char	100	The source system identifier for Equipment upload. Used to identify the success or failure records uploaded from a specific source system.	MES

Field Name	Required?	Data Type	Length (Max)	Description	Sample Data
Organization Code	Y	Char	3	Short alphanumeric code of the organization/ plant to which the equipment belongs.	PD1
Equipment	Y	Char	16	Name of the equipment.	2-PACKLINE
EquipmentUsageUOM	Y	Char	3	Unit of measure for equipment usage.	HR
EquipmentInstance	N	Number	38	Equipment instance number.	1
EquipmentSerialNumber	N	Char	30	Equipment serial number.	2-PACKLINE-001
MinCapacity	N	Number	38	Minimum equipment capacity.	0
MaxCapacity	N	Number	38	Maximum equipment capacity.	4000
IdealCapacity	N	Number	38	Ideal equipment capacity.	4000
CapacityUOM	N	Char	4	Unit of measure for capacity.	BTL
PlanningCost	N	Number	38	Nominal cost.	55

Field Name	Required?	Data Type	Length (Max)	Description	Sample Data
ParameterName	N	Char	40	Process parameter name.	FEEDER SPEED
ParameterType	N	Char	3	Type of parameter. (N= Numeric; L= List of Values)	N
TargetValue	N	Char	16	Target value for equipment parameter.	10
MinValue	N	Number	38	Minimum value.	5
MaxValue	N	Number	38	Maximum value.	10
ParameterUOM	N	Char	25	Unit of measure for the parameter.	MM
EquipmentItem	N	Char	240	Item name of the equipment. If EquipmentItem is provided, EquipmentSerialNumber cannot be null.	Strawberry Jam

For the complete list of business entity data templates for process organizations, see Data Used by Process Manufacturing Organizations (Process), page 3-63.

Process Operation (ProcessOperationTemplate.xlsx)

An operation combines one or more activities performed in a production batch and the resources used to perform those activities. This data file contains operation details, such

as operation name, version, unit of measure, and activity.

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
SourceSystem	N	Char	100	The source system identifier for Operation upload. Used to identify the success or failure records uploaded from a specific source system.	MES
Organization Code	Y	Char	3	Short alphanumeric code of the organization to which the operation belongs.	PD1
Operation	Y	Char	16	Name of the operation.	BLEND
OperationVersion	Y	Number	5	Version of the operation.	1
UOM	Y	Char	4	Unit of measure for the process quantity.	KGM
Activity	Y	Char	16	Name of the activity associated to the operation.	MIX

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
Equipment	Y	Char	16	Name of the equipment associated with the activity of the operation.	1-BLENDER

For the complete list of business entity data templates for process organizations, see Data Used by Process Manufacturing Organizations (Process), page 3-63.

Process Formula (FormulaTemplate.xlsx)

This data file contains item details that explain each item's contribution to the formula yield as ingredients or as a product.

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
SourceSystem	N	Char	100	The source system identifier for Formula upload. Used to identify the success or failure records uploaded from a specific source system.	MES
Organization Code	Y	Char	3	Short alphanumeric code of the organization to which the formula belongs.	PD1

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
Formula	Y	Char	32	Name of the formula.	PDI-1-Formula-3
FormulaVersion	Y	Number	5	Version of the formula.	1
FormulaItemType	Y	Char	10	Type of formula line item. Valid values are: Ingredient, Product, Co-Product, By-Product.	Ingredient
ItemName	Y	Char	240	Item name for the formula line item.	PDI-1-Item-1
ContributeToYield	N	Char	1	Indicates if the item contributes to yield. If the item is a packaging item, then the item cannot contribute to yield and the value is N, for No. Valid values are Y or N.	Y

For the complete list of business entity data templates for process organizations, see Data Used by Process Manufacturing Organizations (Process), page 3-63.

Process Routing (ProcessRoutingTemplate.xlsx)

A routing defines the step-by-step operations you perform to manufacture a product. Each routing can have any number of operations, and provides the relationship between operations.

Additional Information: The **Required?** column refers to whether the field is required for a step and/or a step dependency. The **Sample Data** column provides sample data for a step, step dependency, or both.

Field Name	Required?	Data Type	Length (Max)	Description	Sample Data
SourceSystem	No for both.	Char	100	Used to identify the success or failure records uploaded from a specific source system.	MES
Organization Code	Yes for both.	Char	3	Short alphanumeric code of the organization to which the routing belongs.	PD1
Routing	Yes for both.	Char	32	Name of the routing.	PDI-UTN-Routing-001
RoutingVersion	Yes for both.	Number	5	Version of the routing.	1
EntityType	Yes for both.	Char	14	Valid entity types include: Step, StepDependency.	Step, StepDependency
Step	Yes for both.	Number	5	Step number.	10
Operation	Yes for step, No for step dependency.	Char	16	Operation code.	PDI-D-Oprn-1

Field Name	Required?	Data Type	Length (Max)	Description	Sample Data
OperationVersion	Yes for step, No for step dependency.	Number	5	Version of the operation.	1
StepQuantity	Yes for step, No for step dependency.	Number	5	Quantity processed during the step.	100
PreviousStep	No for step, Yes for step dependency.	Number	5	Previous step number.	10
DependencyType	No for step, Yes for step dependency.	Char	240	Type of dependency. Valid values are Finish-to-Start and Start-to-Start.	Start-to-Start
StandardDelay	No for both.	Number		Standard delay for a step dependency.	0
MaxDelay	No for both.	Number		Maximum delay for a step dependency.	100

For the complete list of business entity data templates for process organizations, see Data Used by Process Manufacturing Organizations (Process), page 3-63.

Process Recipe (RecipeTemplate.xlsx)

Recipes standardize the structure of all information that describes production of one or more products. Recipes have:

1. Formulas that define the relationship of material resources, including products, ingredients, and byproducts.

2. Routings that define the relationship of non material resources, including equipment operations with activities and associated resources. Routings are optional.

Additional Information: The **Required?** column refers to whether the field is required for a recipe and/or a step material association. The **Sample Data** column provides sample data for a recipe, step material association, or both.

Field Name	Required?	Data Type	Length (Max)	Description	Sample Data
SourceSystem	No for both.	Char	100	The source system identifier for Recipe upload. Use to identify the success or failure records uploaded from a specific source system.	OPM
Organization Code	Yes for both.	Char	3	Short alphanumeric code of the organization to which the recipe belongs.	PD1
Entity Type	Yes for both.	Char	30	Valid entity types include: Recipe, StepMaterial Association.	Recipe, StepMaterial Association
Recipe	Yes for both.	Char	32	Name of the recipe.	7470Recipe
RecipeVersion	Yes for both.	Number	5	Version of the recipe.	1

Field Name	Required?	Data Type	Length (Max)	Description	Sample Data
Formula	Yes for recipe, No for SMA.	Char	32	Name of the formula used in the recipe.	7470Formula
FormulaVersion	Yes for recipe, No for SMA.	Number	5	Version of the formula used in the recipe.	1
Routing	Yes for recipe, No for SMA.	Char	32	Name of the routing used in the recipe.	LWCF01
RoutingVersion	Yes for recipe, No for SMA.	Number	5	Version of the routing used in the recipe.	1
RoutingStep	No for recipe, Yes for SMA.	Number	5	Routing step associated with the formula item.	10
FormulaItem	No for recipe, Yes for SMA.	Char	240	Formula item associated with the routing step.	7470
FormulaItem Type	No for recipe, Yes for SMA.	Char	10	Line type of the formula item associated with the routing step. Valid values include: Ingredient, Product, Co-Product, By-Product.	Product
Product	Yes for recipe, No for SMA.	Char	240	Product for which to make the validity rule.	7470

For the complete list of business entity data templates for process organizations, see Data Used by Process Manufacturing Organizations (Process), page 3-63.

Process Work Order (ProcessWorkOrderTemplate.xlsx)

This data file contains the list of work orders (batches) submitted. It contains details such as the recipe, operations, activities, equipment, items, quantity produced, and scheduled and actual dates.

> **Additional Information:** In the **Required?** column, the following entity type acronyms indicate that the field is required for the entity type.

- B = Batch

- BOH = Batch on Hold

- S = Step

- A = Activity

- E = Equipment

- M = Material

- SD = Step Dependency

- P = Parameter

Field Name	Required?	Data Type	Length (Max)	Description	Sample Data
SourceSystem	N (for all entities)	Char	100	The source system identifier for Batch upload. Identifies the success or failure records uploaded from a specific source system.	MES

Field Name	Required?	Data Type	Length (Max)	Description	Sample Data
Organization Code	Y (for all entities)	Char	3	Short alphanumeric code of the organization to which the formula belongs.	PD1
Recipe	B	Char	32	Recipe name. Along with Recipe version, part of the Alternate Key for the recipe.	STRAWBERR Y JAM
RecipeVersio n	B	Number	5	Recipe version. Along with Recipe name, part of the Alternate Key for the recipe.	1
EntityType	Y (for all entities)	Char	20	Valid Entity Types: Batch, Batch on Hold, Step, Activity, Equipment, Material, Step Dependency, Parameter.	Batch
Batch	Y (for all entities)	Char	32	Batch name.	WO-SBJ-230167
Step	S, A, E, M, SD, P	Number	38	Step number.	10
OperationCo de	S	Char	16	Operation code.	STEAM

Field Name	Required?	Data Type	Length (Max)	Description	Sample Data
OperationVersion	S	Number	5	Version of the operation.	1
Activity	A, E, P	Char	16	Activity.	RUN-TIME
Equipment	E, P	Char	16	Name of the equipment.	OVEN
ParameterName	P	Char	40	Parameter name.	Temperature
LineType	M	Char	10	Valid line types: Ingredient, Product, By-Product.	Ingredient
ItemName	M	Char	40	Name of the item.	Purified Water
CreationDate	N (for all entities)			Batch creation date (mm/dd/yyyy hh24:mi:ss). If CreationDate is null, then the Batch Creation Date field value in the data model is derived from the earliest date of either ScheduleStart Date or ActualStartD ate	01/22/2018 04: 00:00

Field Name	Required?	Data Type	Length (Max)	Description	Sample Data
ScheduleStart Date	B, S, A, E, M	Date		Batch/Step/Ac tivity/Equipm ent/Material scheduled start date (mm/dd/yyyy hh24:mi:ss).	01/22/2018 04: 00:00
ScheduleEnd Date	B, S, A, E, M	Date		Batch/Step/Ac tivity/Equipm ent/Material scheduled end date (mm/dd/yyyy hh24:mi:ss).	01/25/2018 04: 00:00
ActualStartD ate	N (for all entities)	Date		Batch/Step/Ac tivity/Equipm ent actual start date (mm/dd/yyyy hh24:mi:ss).	01/22/2018 04: 00:00
ActualEndDa te	N (for all entities)	Date		Batch/Step/Ac tivity/Equipm ent actual end date (mm/dd/yyyy hh24:mi:ss).	01/25/2018 04: 00:00
CloseDate	N (for all entities)	Date		Batch/Step/Ac tivity/Equipm ent close date (mm/dd/yyyy hh24:mi:ss).	01/25/2018 04: 00:00
PlannedQuan tity	S, M	Number		Step/resource planned quantity.	550
ActualQuanti ty	N (for all entities)	Number		Step/resource actual quantity.	548

Field Name	Required?	Data Type	Length (Max)	Description	Sample Data
PlannedActivityFactor	A	Number		Planned activity factor.	1
ActualActivityFactor	N (for all entities)	Number		Actual activity factor.	1
EquipmentType	E	Char	10	Resource type for the activity. Valid values are: Primary, Secondary, Aux.	Primary
PlannedUsage	N (for all entities)	Number		Resource planned usage.	0.083333333
Yield	N (for all entities)	Number		Batch/step yield.	100
TerminateFlag	N (for all entities)	Char	1	Batch terminate flag. Possible values are Y, N or null (no value provided).	Y
PreviousStep	SD	Number		Previous step number for step dependency.	10
DependencyType	SD	Char	15	Step dependency types: start-to-start, finish-to-start.	FINISH-TO-START
ActualValue	P	Number		Parameter actual value.	35

Field Name	Required?	Data Type	Length (Max)	Description	Sample Data
TargetValue	P	Number		Parameter target value.	35
MinValue	P	Number		Parameter minimum value.	50
MaxValue	P	Number		Parameter maximum value.	150
Flex Attributes Context	B, S, M, P	Char	30	Character type attribute.	
Flex Attribute 1-30	B, S, M, P	Char	150	Character type attribute.	

For the complete list of business entity data templates for process organizations, see Data Used by Process Manufacturing Organizations (Process), page 3-63.

Process Work Order Transaction (ProcessWorkorderTransactionTemplate.xlsx)

This data file contains the list of material and equipment transactions related to the work order (batch).

> **Additional Information:** In the **Required?** column, the following entity type acronyms indicate that the field is required for the entity type.
>
> - MT = Material Transaction
>
> - ET = Equipment Transaction
>
> - E= Exception
>
> When the entity type = Material Transaction, then the data model uses the value in the TransactionType column to determine the Item Type field value for a record.
>
> - Item Type = Ingredient if the TransactionType field value is IngredientIssue or IngredientReturn.
>
> - Item Type = Product if the TransactionType field value is

ProductCompletion or ProductReturn.

- Item Type = By-Product if the TransactionType field value is ByProductCompletion or ByProductReturn.

Field Name	Required?	Data Type	Length (Max)	Description	Sample Data
SourceSystem	N (for all entities)	Char	100	The source system identifier for Batch transaction upload. Use to identify the success or failure records uploaded from a specific source system.	MES
Organization Code	MT, ET, E	Char	3	Short alphanumeric code of the organization to which the formula belongs.	PD1
EntityType	MT, ET, E	Char	25	Valid entity types: MaterialTransaction, EquipmentTransaction, Exception.	MaterialTransaction
EntityName	MT, ET, E	Char	10	Name of an ingredient or product.	Strawberry Fruit

Field Name	Required?	Data Type	Length (Max)	Description	Sample Data
TransactionType	MT, ET, E	Char	20	Valid values for material transactions: IngredientIssue, IngredientReturn, ProductCompletion, ProductReturn, ByProductCompletion, ByProductReturn Valid values for equipment transactions: PlannedTransaction, ActualTransaction Valid values for exceptions: Other, Quality, Equipment, Product, Ingredient	IngredientIssue
Batch	MT, ET, E	Char	32	Batch number.	WO-SBJ-230167
Step	MT, ET, E	Number	38	Batch step.	10
Activity	ET	Char	16	Activity	RUN-TIME
EquipmentInstance	ET	Number		Equipment instance number.	1

Field Name	Required?	Data Type	Length (Max)	Description	Sample Data
TransactionQuantity	MT, ET	Number		Either batch transaction quantity or equipment usage (mm/dd/yyyy hh24:mi:ss).	500
StartDate	MT, ET, E	Date		Either batch transaction date, equipment start time, or reported date (mm/dd/yyyy hh24:mi:ss).	06/01/2017 04:00:00
EndDate	N (for all entities)	Date		Either batch end date, equipment end time, or resolved date (mm/dd/yyyy hh24:mi:ss).	06/03/2017 04:00:00
LotNumber	MT	Char	80	Lot number.	LI-230167-1600039-1
ExceptionEntityName	E	Char	240	Exception entity name.	-
ExceptionEntityDetail	E	Char	240	Exception entity details.	-
Exception Reason	E	Char	80	Exception reason.	-
Flex Attributes Context	E	Char	30	Flex attributes context.	-
Flex Attribute 1-30	E	Char	150	Character type attribute.	-

For the complete list of business entity data templates for process organizations, see Data Used by Process Manufacturing Organizations (Process), page 3-63.

Using Data Pump and GoldenGate to Ingest EBS Data

An out of the box integration is provided between Oracle E-Business Suite and Oracle Adaptive Intelligent Apps for Manufacturing through Oracle Data Pump and GoldenGate Synchronization. You can also choose to import E-Business Suite data through Business Entity Data files, but Oracle recommends using the built-in integrations.

Oracle Data Pump performs the initial load of data from E-Business Suite to Adaptive Intelligent Apps for Manufacturing, after which the GoldenGate solution synchronizes data from E-Business Suite to Adaptive Intelligent Apps for Manufacturing in near real time. Oracle GoldenGate is a replication software that provides real time capture, routing, and delivery of data across heterogeneous databases.

Performing Initial Data Load with Oracle Data Pump:

1. Export:

    Data Pump Export is a utility for unloading data and metadata into a set of operating system files called a dump file set.

    The dump file set is made up of one or more disk files that contain table data, database object metadata, and control information. The files are written in a proprietary, binary format.

    Oracle Adaptive Intelligent Apps for Manufacturing uses Oracle Data Pump Export utility to extract data for the initial load from the source database to the target database. You will need to run the automated script and upload dump files to Oracle Cloud by working with Oracle Cloud Operations.

2. Import:

    Data Pump Import is a utility for loading an export dump file set into a target system. During an import operation, the Data Pump Import utility uses these dump files to locate each database object in the dump file set. Oracle Cloud Operations takes the data pump file set provided by the customer and uploads it to the Oracle Adaptive Intelligent Applications for Manufacturing.

Synchronizing Data with Oracle GoldenGate:

1. Export:

    The Extract process runs on the source system and is the extraction (capture) mechanism of Oracle GoldenGate .

    Extract captures the Data Manipulation Language(DML) and Data Definition Language(DDL) operations that are performed on objects in the source E-Business

Database. Extract stores these operations until it receives commit records or rollbacks for the transactions that contain them. When a rollback is received, Extract discards the operations for that transaction. When a commit is received, Extract persists the transaction to disks in a series of files called a trail, where it is queued for propagation to the target system. All the operations in each transaction are written to the trail as a sequentially organized transaction unit.

2. Data Pump:

    Data pump reads the trail created in the Extract and sends them over the network to a remote trail on the target, in this case Adaptive Intelligent Apps for Manufacturing. The data pump adds storage flexibility and serves to isolate the primary Extract process from TCP/IP activity.

3. Replicat:

    The Replicat process runs on the target system, reads the trail on that system, and then reconstructs the DML or DDL operations and applies them to the target database.

Enabling Data Pump and GoldenGate:

1. Begin by logging a service request with Oracle Cloud Operations team to enable Data Pump and GoldenGate from your Source E-Business Suite Database to Oracle Adaptive Intelligent Apps for Manufacturing Cloud Service.

2. The Oracle Cloud Operations team will then provide a set of instructions and scripts to:

    •   Create Data Pump Files.

    •   Steps to upload them in Oracle Cloud.

    •   Steps to deploy GoldenGate Source Database artifacts.

4

Importing Sensor Devices Data

Overview of Importing Sensor Devices Data

The two types of sensor data collected from shop floor devices are:

- Stream Data

- Alert/Event Data

Stream Data includes values for parameters such as temperature, pressure, vibration, cutting speed, spindle RPM, and so on.

Alert/Event Data includes the following alert type information:

- Machine Status, such as up, down, idle, or in-use.

- Job Status, such as started, paused, resumed or completed.

- Pattern Match.

- Threshold Violations.

- Door State, such as open or closed.

- Power State, such as up or down.

You can use specific templates provided by the application to capture stream data and alert data which you can then upload for data contextualization.

Oracle partners can help users to configure machine data acquisition systems, such as Supervisory Control and Data Acquisition (SCADA), Distributed Control Systems (DCS) and other gateway device systems, to extract machine sensor data in the CSV file format. Users can then upload these sensor data files into Oracle Adaptive Intelligent Apps for Manufacturing in batch mode. The application processes the sensor stream data and alert data, contextualizes this data with equipment and work order

information, and then summarizes the contextualized data for analysis.

Sensor Devices Data Import Steps
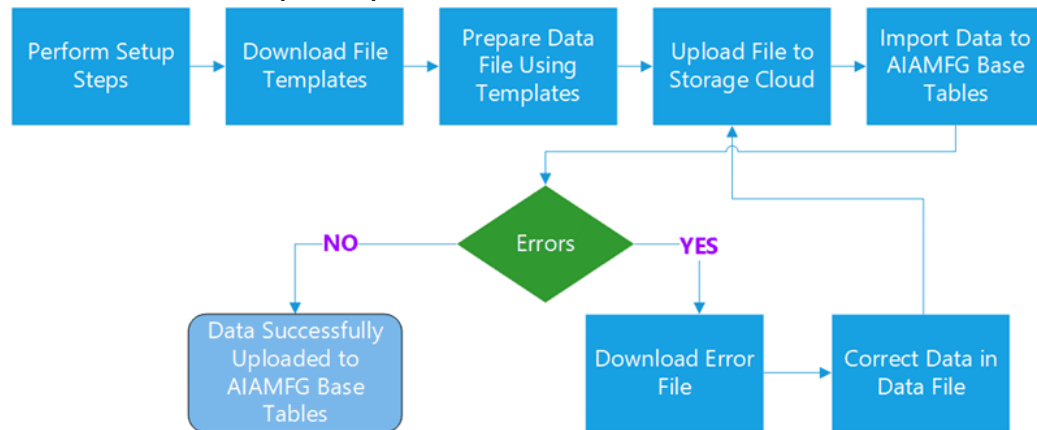
1. Define setups. For example: define sensor device mappings.

2. Download the sensor devices data file template, either for alert or stream data.

3. Prepare or enter the data into the CSV file following the template guidelines.

4. Submit the file for upload to Oracle Storage Cloud Service.

5. Run the data import program to import data into the target base tables.

6. If errors occur, download the error file, correct the data, remove the error message columns, save the error file as a new CSV file, and then upload the file again.

7. After a successful import, the summarized data/features are imported into the AIAMFG base tables.

> **Additional Information:** Alternatively, you can perform steps 4 - 7 using REST web services, which are provided with Oracle Adaptive Intelligent Applications for Manufacturing, instead of the user interface. See: Uploading Sensor Device CSV Files Using REST Web Services, page 4-23

In addition to completing the setup steps described in Setting Up Data Ingestion, you must also create and map sensor devices.

To map sensor devices using the user interface see: Setting Up Sensor Device Data Mappings, page 4-3.

To import mappings using spreadsheet templates see: Uploading CSV Files Using the Sensor Devices Data User Interface, page 4-17.

Setting Up Sensor Devices Mappings

Before acquiring sensor data, you must define the sensor devices in the application. Skip this step if the sensor device mapping is already defined for the sensor devices in the application.

Define sensor devices by entering the sensor device IDs and sensor attributes, such as manufacturer, model number, and serial number. Next, map the sensor devices to the ERP equipment and equipment instance.

The data collected from the sensor devices is contextualized with the Enterprise Resource Planning (ERP) data. You can set the contextualization rules and priority for equipment and work context (and serial context for discrete serialized manufacturing organizations). You can also enter stream parameter names derived from IoT systems and select the corresponding equipment parameters from ERP systems for process manufacturing organizations, or enter equipment parameters for discrete manufacturing organizations along with the parameter units of measure. The pages in the application display the equipment parameter names.

When you map a sensor device, you can select a time series feature set you have defined for either production analysis usage or machine event analysis usage. When the data set request runs, the program extracts features from the time series data based on the feature set selected for production analysis usage. You can also use the sample interval for processing event data. You can enter the stream sample interval value or leave the field blank, allowing the application to derive the sample interval from the sensor data. The time series data is split using the stream sample interval and event identification processing is applied based on the feature set selected for machine event analysis usage.

Oracle Adaptive Intelligent Apps for Manufacturing provides a user interface to map sensor devices, as well as specific templates for capturing stream data and alert data, to which you can then add sensor data information and then upload the files.

Creating and Mapping Sensor Device Data:

Use the Setup tab in the Sensor Devices page to:

- View existing sensor device mappings.

- Create a new sensor device mapping.

- Update an existing sensor device mapping.

- Duplicate an existing sensor device mapping.

- Download the Sensor Device mapping template.

- Import sensor device mapping definitions using CSV files.

- Export existing sensor device mappings in CSV files.

To view a sensor device mapping

1. Navigate to the Sensor Devices page.

   From the Home Page, click **Insights** or **Predictions**, then click the **Configuration** link, and then **Sensor Devices**. Alternatively, from the Home page, click **Setup** and then **Sensor Devices**.
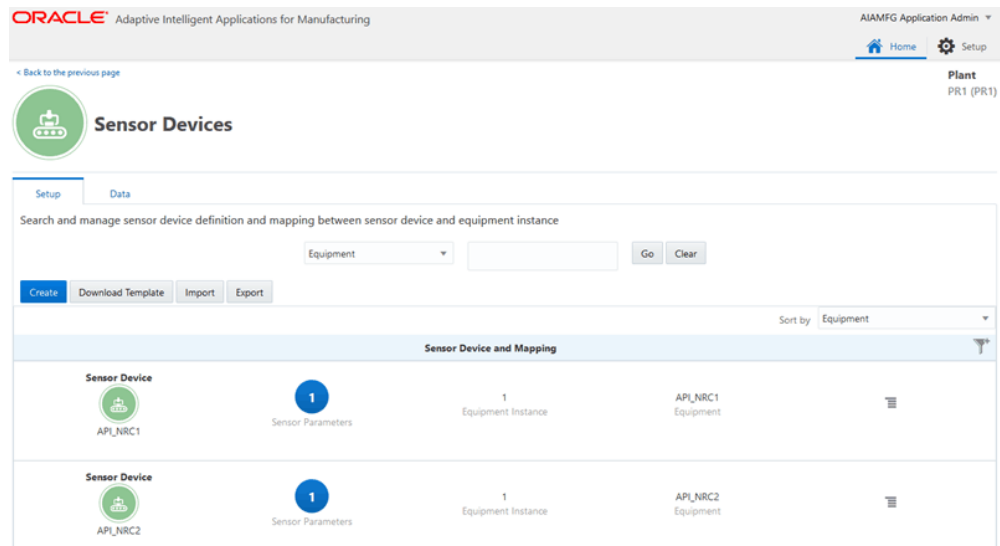
2. Use the Setup tab in the Sensor Devices page to view details such as the sensor device name and the number of sensor parameters for process manufacturing or discrete manufacturing, depending on the organization selected. You can search for and view sensor device definitions and mappings using the following criteria:

   - Equipment

   - Equipment Instance

   - Sensor Device ID

   - Equipment Parameter

   Select a search criteria and click **Go**.

3. From the Sensor Device and Mapping table, select a sensor device mapping and click **Sensor Parameters** to view names of stream parameters and the equipment parameter names mapped to them.

   For process manufacturing organizations you can view equipment instance and equipment.
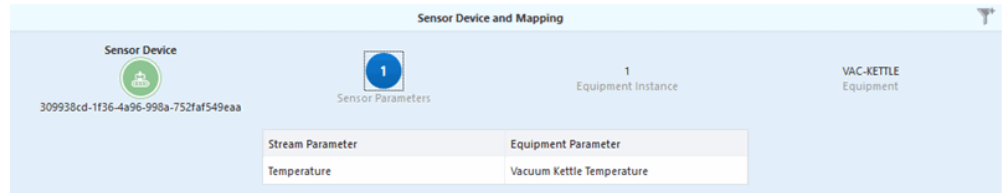
For discrete manufacturing organizations you can view equipment instance, equipment and department.
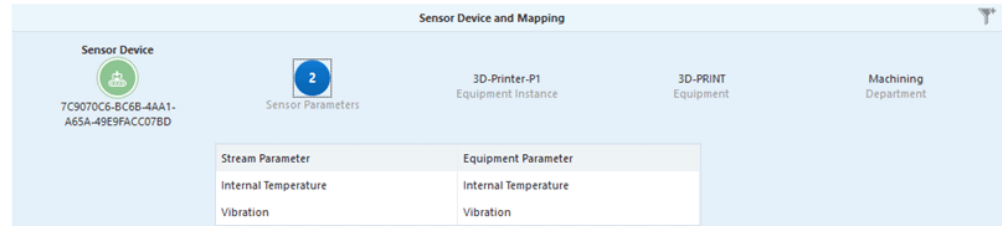
To create a sensor device mapping

1. Navigate to the Create Sensor Device Mapping page.

    Use the Setup tab in the Sensor Devices page to create a sensor mapping.

    Click **Create**.
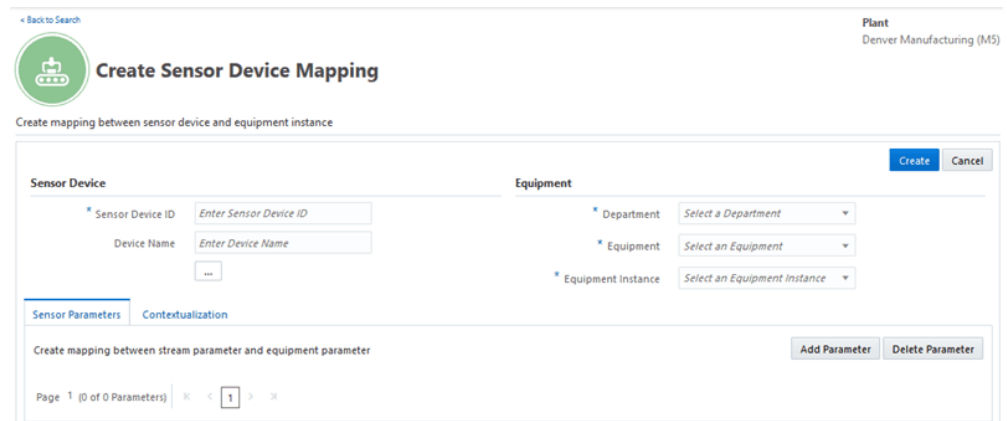
Map Sensor Device ID

2. In the Create Sensor Device Mapping page, enter values in the following fields:

    • **Sensor Device ID**

    • **Device Name**

3. Click the ellipsis points (...) under Sensor Device.

Enter information for the following Sensor Device Attributes fields:

- **Manufacturer**

- **Model Number**

- **Serial Number**

4. Map the sensor device you have entered to its ERP equipment and equipment instance:

For process manufacturing organizations:

Select **Equipment** and **Equipment Instance**.

> **Note:** For process manufacturing users, all the equipment parameters have to be defined in ERP before setting up the parameter mapping.

For discrete manufacturing organizations:

Select **Department**, **Equipment**, and **Equipment Instance**.

Note that you can update the mapping of a sensor device to the equipment and equipment instance, till you upload and process sensor data for the mapped sensor device. You cannot update the mapping once you have uploaded and processed sensor data for a mapped sensor device.

Process Stream Data

5. Use the Sensor Parameters tab to create mappings between a stream parameter and the equipment parameter. You can map multiple parameters with the sensor device.

> **Note:** Not all sensor devices will send sensor stream data. In case of sensors that only send alert data, there is no requirement to map parameters.

6. Click **Add Parameter** to add stream parameters you will map to the equipment parameters in the ERP.

7. Enter the **Stream Parameter**.

8. In the **Equipment Parameter** field specify the equipment parameter in the ERP.

    For process manufacturing organizations:

    Select the **Equipment Parameter** from the list of values. The parameter UOM is displayed depending on equipment parameter you select.

    For discrete manufacturing organizations:

    Enter the **Equipment Parameter** and the **Parameter UOM**.

    Note that you can add new stream parameters and update an existing stream parameter in the sensor device mapping. When you use the sensor device mapping template to import additional parameters, you can either add new parameters or update existing stream parameters.

9. Click **Delete Parameter** to delete a parameter.

Process Event Identification

10. The stream sample interval is used when a time series feature set has been selected in the Machine Event Analysis field. The actual sample interval is derived from sensor data for event detection. Optionally, you can enter a value.

    In Stream Sample Interval, use the **Interval** field to:

    - Allow the sample interval value to be derived from the sensor data by the application automatically and generate events based on the actual interval value.

    - Enter the same frequency at which the machine sensor sends the data in milliseconds. If you enter a value, events are generated based on the sample interval value you have entered, even if the actual interval is different.
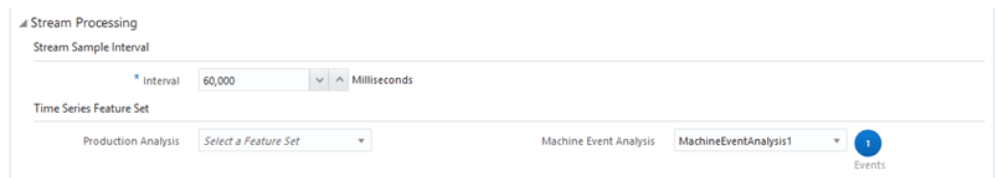
    The **Interval** field is used to ensure that sensor stream data is streaming correctly and to calculate and generate events based on the intervals from the sensor data.

    For example, if a parameter is set to stream at an interval of 100 milliseconds, and in case there is a gap in the data set readings, the machine will gauge this gap and split the data for processing event identifications.

    See: Processing Event Identification and Summarization

11. In the Time Series Feature Set region, select a feature set in the **Machine Event Analysis** field. Alert messages are usually received directly from the sensors, but machine alerts can also be indirectly derived from a time series sensor stream data. When a time series features set is selected in this field, it enables event identification based on the time series feature set.
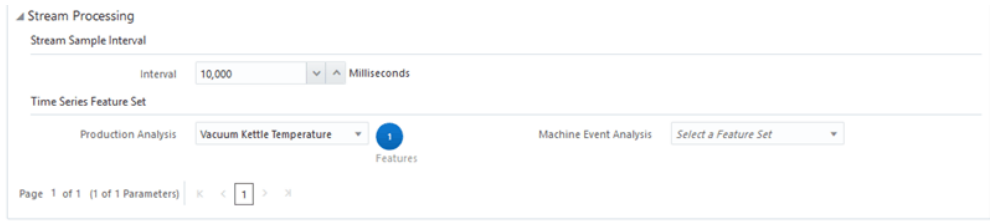
    See: Setting Up Times Series Features Sets, *Oracle Adaptive Intelligent Apps for Manufacturing User's Guide*

12. In the Time Series Feature Set region select a feature set in the **Production Analysis**

field. When a time series features set is selected in this field, based on the definition of the time series features set, it will generate features that will be used in model building and analysis.
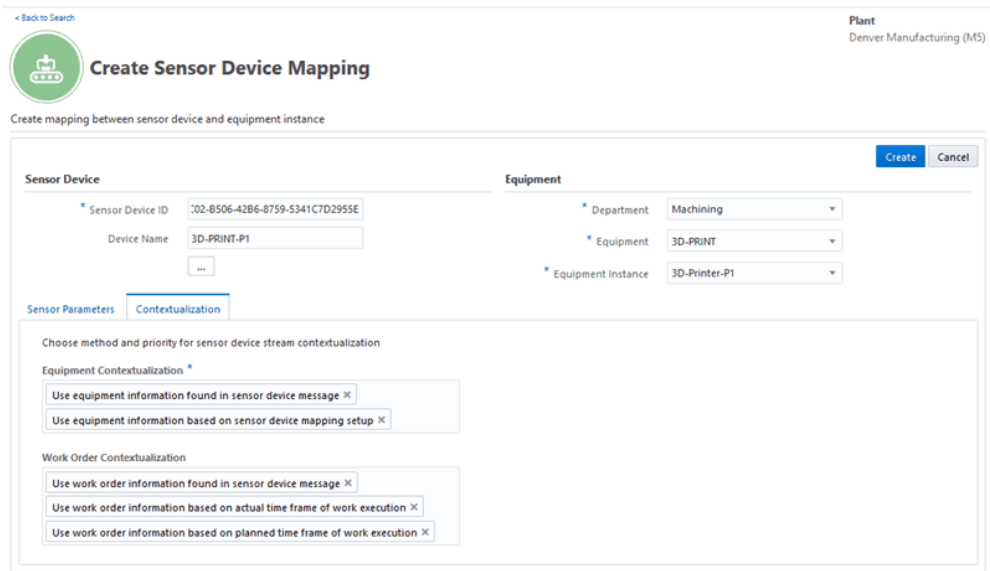
See: Setting Up Time Series Features Sets, *Oracle Adaptive Intelligent Apps for Manufacturing User's Guide*

Contextualize Data

13. Select the Contextualization tab to select a priority sequence of the context source for both equipment and work order contextualization.

See: Processing Data Contextualization

14. **Equipment Contextualization**

In the mandatory **Equipment Contextualization**, select the priority sequence of the context source. You can select to:

- Use equipment information found in sensor device message

- Use equipment information found in sensor device mapping setup

You must select at least one of the options in this field.

The default first option for the priority sequence is using equipment information found in sensor device message and the second is using equipment information found in sensor device mapping setup. For example, if the first default option is selected, this ensures that the context values from the sensor device is first sourced.

If the context information from the first option is not available and not valid, the context value from the sensor machine will be sourced from the second priority option which is essentially the mapping you created between the sensor device and the equipment instance.

15. **Work Order Contextualization**

Optionally, in **Work Order Contextualization**, select the priority sequence of the context source. You can select to:

- Use work order information found in sensor device message

- Use work order information based on actual time frame of work execution

- Use work order information based on planned time frame of work execution

> **Note:** You can disable the work order contextualization for sensor records for an equipment by removing all the three values. In this case, the contextualization is completed without work order/ serial context.

The default first option for the priority sequence is Use work order information found in sensor device message, followed by Use work order information based on actual time frame of work execution as the second option, and Use work order information based on planned time frame of work execution as the third option. You can choose to have only one of the above, or a combination of two of the options.

For example, if the first option is selected as Use work order information found in sensor device message, the context values from the sensor machine is first sourced from the sensor message.

If context values from the first option is not available and not valid, the context value from the sensor machine is sourced from the second priority option which is Use work order information based on actual time frame of work execution. If valid context information cannot be derived from the sensor device tag, or from actuals, the context values is derived from the third option which is Use work order information based on planned time frame of work execution.

> **Note:** You cannot prioritize to use work order information based on planned time frame of work execution before work order information based on actual time frame of work execution. You can

however select to use work order information based on planned
time frame of work execution as the only source for context values.

16. Click **Create** to complete the sensor device mapping.

To update a sensor device mapping

1. Select the existing sensor device mapping you would like to update. From the
   Actions link, click **Update Sensor Device Mapping**.
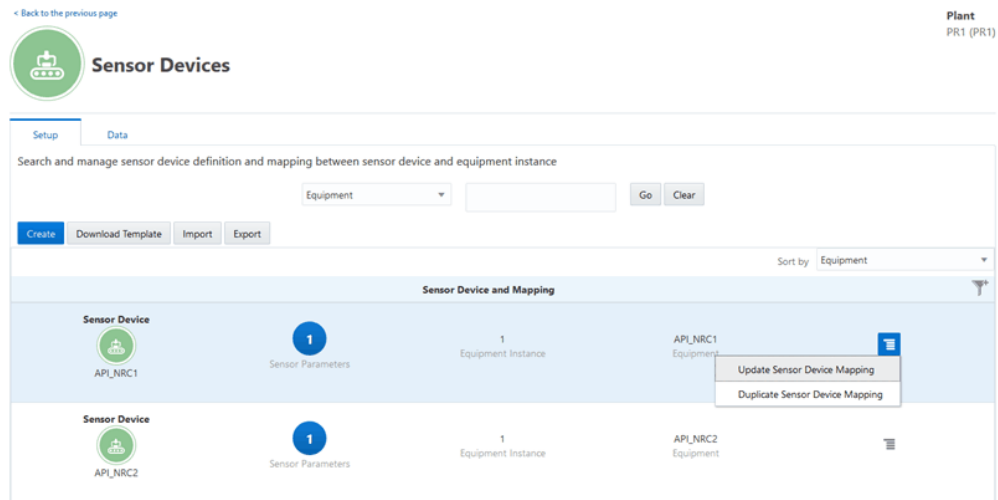
The Update Sensor Device Mapping page appears.

2. Note that you cannot update the Sensor Device ID, Equipment and Equipment Instance fields for process organizations, and Sensor Device ID, Department, Equipment and Equipment Instance fields for discrete manufacturing organizations, once you have uploaded and processed sensor data for a mapped sensor device.

   You can update the following:

   - Device Name.

   - Sensor Device Attributes.

   - Stream Parameter.

   - Equipment Parameter.

   - Stream Sample Interval information.

   - Time Series Feature Sets Information.

   - Contexualization information

3. Click **Update** to save and update the sensor device mapping.

To duplicate a sensor device mapping

1. Select the existing sensor device mapping you would like to duplicate. From the Actions link, click **Duplicate Sensor Device Mapping**. The Create Sensor Device Mapping page appears.

2. Enter information for:

   • **Sensor Device ID**

   • **Device Name**

3. Note that the following information is duplicated from the existing sensor device mapping your selected:

   • Equipment.

   • Equipment Instance

   • Department (for discrete manufacturing organizations).

   • Stream Parameter.

   • Equipment Parameter.

   • Stream Sample Interval information.

   • Time Series Feature Sets Information.

   • Contexualization information

   You can choose to retain or update the duplicated information.

4. Click **Create** to create the sensor device mapping.

To import a sensor device mapping

You can choose to enter sensor data in a mapping sheet, save it as a CSV file and import the sensor device mapping definitions.

1. Begin by downloading the SensorDeviceMappingTemplate.xlsx. In the Sensor Devices page, click **Download Template** to download the sensor device mapping template.
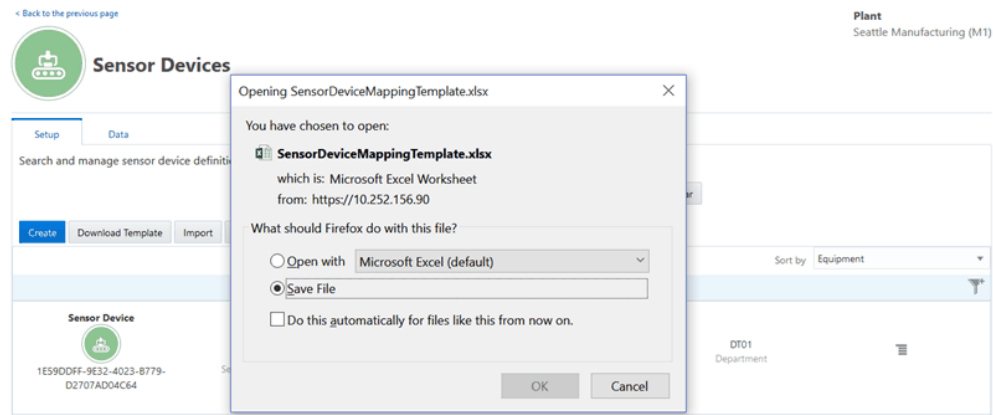
   Use the given instructions in the template to enter the mandatory components of the parent header information, and equipment contextualization. Optionally, enter child paramenter information and work order contexualization. Before saving the file, make sure you are in the Mapping sheet and save the file in the CSV format.

2. Navigate to the Import Mapping page.

   In the Setup tab of the Sensor Devices page, click Import

3. In the Import Mapping page, click Choose File, in the Import Mapping page to browse and select your saved file.
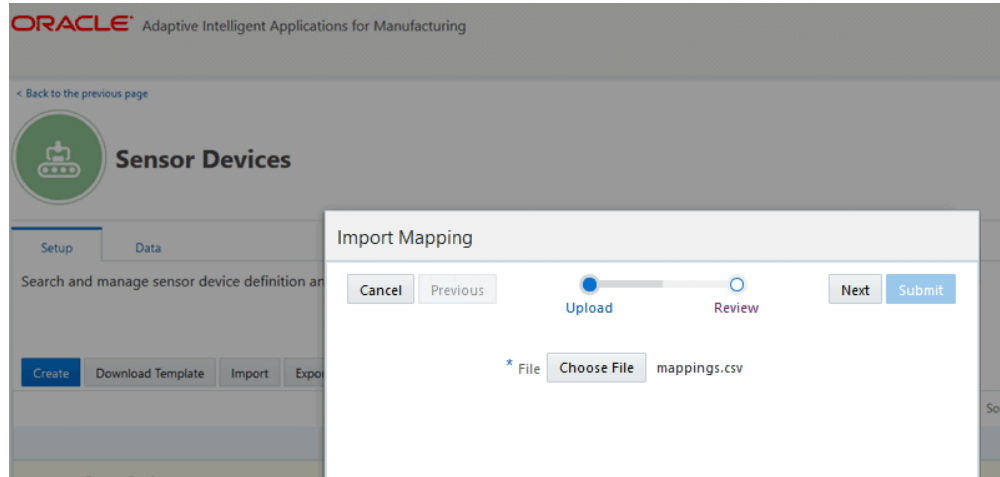
4. Click Next. Review the following information:

- Total number of mappings validated

- Number of mappings already existing

- Number of mappings successfully validated

- Number of mappings failed validation.
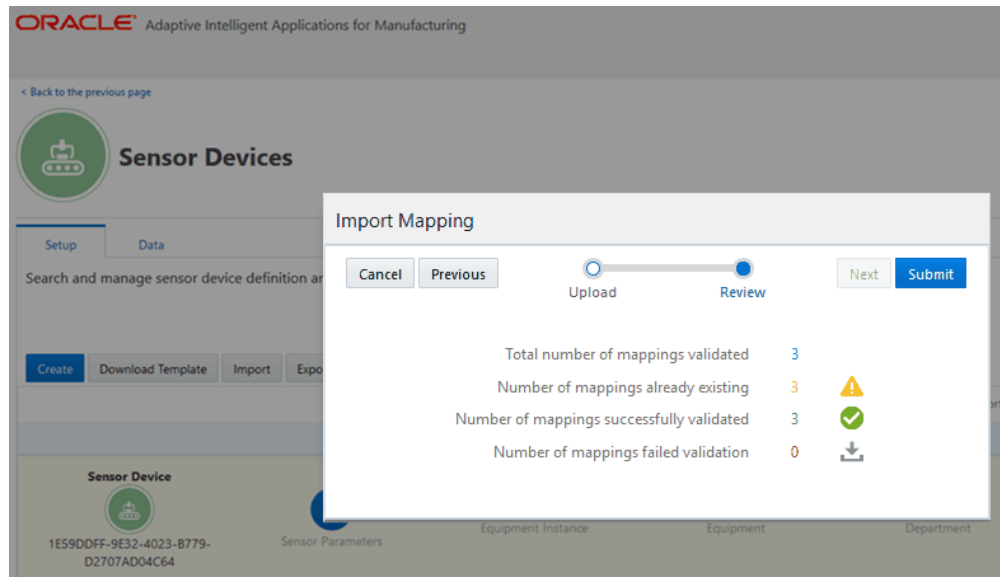
5. To complete the import, click Submit.

To export sensor device mappings

1. The Export functionality exports all mappings for the selected organization that appear in the Sensor Devices page. To reduce the number of mappings you want to export, use the search criteria to select specific mappings. Click **Export**.
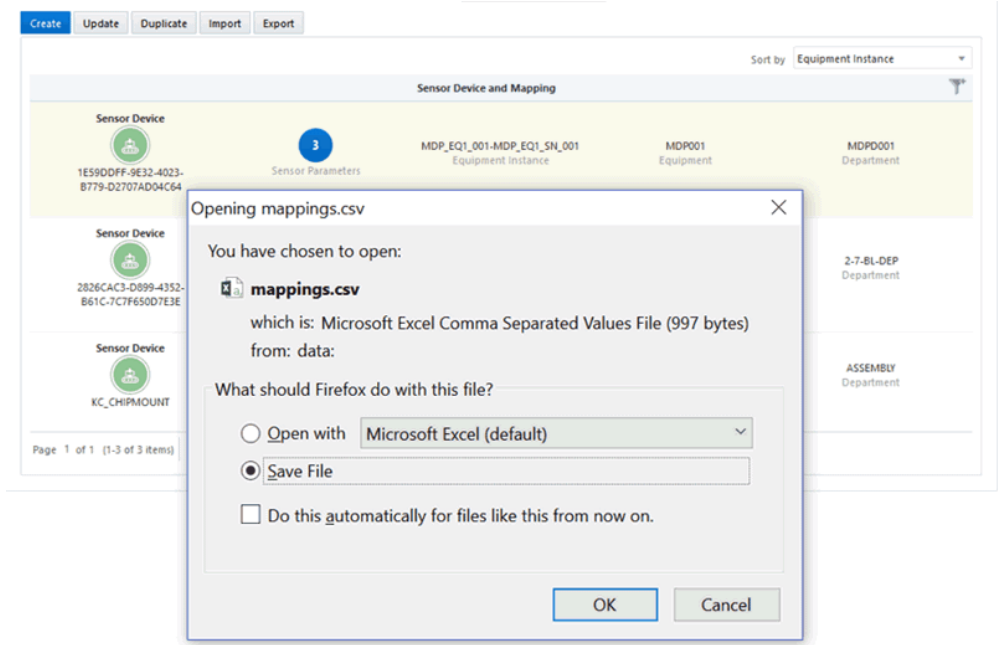
2. The sensor device mapping definition you selected is exported to a CSV file. Use the browser's dialogue box to save the exported sensor device mapping in the CSV format.

Uploading CSV Files Using the Sensor Devices Data User Interface

Oracle Adaptive Intelligent Apps for Manufacturing provides specific templates which you can download and use to add sensor device data information. You can then upload the CSV format files using the Sensor Devices Data user interface.

Uploading CSV Files Using the User Interface:

Use the Data tab of the Sensor Devices Page to import sensor device data by downloading and using the Stream data and Alert data templates which are provided.

To use the Data tab

1. From the Home Page, click **Insights** or **Predictions**, then **Data Ingestion** link, then **Sensor Devices Data**, and then the **Data** tab. Alternatively, from the Home page, click **Setup**, then **Sensor Devices**, and then the **Data** tab.

To download file templates

You can download the file template for either stream data or alert data in xlsx format. Use the same file template for both discrete and process manufacturing organizations. Follow the instructions provided in the templates to ensure you enter the required fields in the specified data formats.

1. From the Download Template drop-down list, select one of the following templates:

   • Stream Data Template

   • Alert Data Template

Review the Read Me instructions in the template, add information in the mandatory columns, and save the file in the required CSV format to your preferred location in your local drive.

To upload sensor data files

1. In the **Data** tab, Click **Upload**. The Upload File page appears. Use the Upload File page to upload a CSV file.

2. Choose one of the following options:

   • Select File to upload a file from your local drive.

   • Enter File Location in Storage Cloud to specify the file location where you have already uploaded the file in Oracle Storage Cloud.
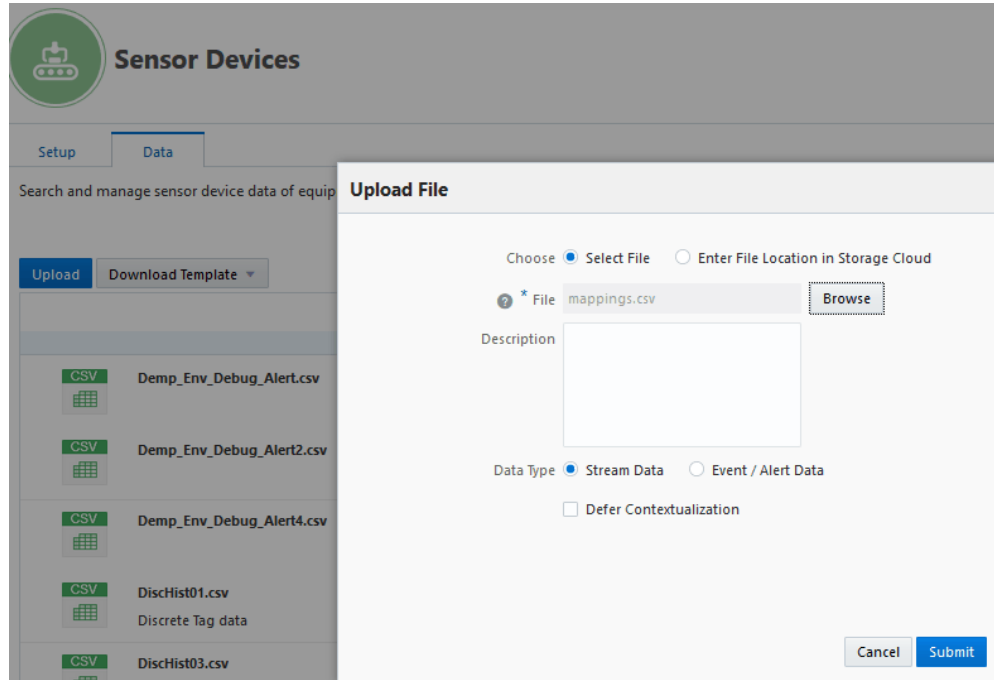
3. When selecting the file from the local machine, click **Browse** or enter the file path in the **File** field.

    When selecting the file from the Storage Cloud, provide the location of the file in Storage Cloud. The URL format should be similar to Container/subfolders/filename. csv.

    For example: NTAIAMFG1825DEV1BDCSCE/aimfg/custom/Machine_Data_With_Tags_Pre_Upl oaded.csv. Note that this example of the file path depicts the case where Oracle Data Transfer Service was used to import sensor data to Storage Cloud. In this case, the URL or container name must be obtained from Oracle Data Transfer Service.

    > **Additional Information:** Oracle Data Transfer Service offers a convenient way to quickly transfer terabyte up to petabyte-scale datasets to Oracle Cloud Infrastructure. For more information, refer to Oracle Cloud Storage Features [https://cloud.oracle. com/en_US/storage/data-transfer/features].

4. Optionally, enter information in the **Description** field.

5. Depending on the data you are uploading, select one of the following **Data Types**:

    *   Stream Data

- Event/Alert Data

6. Optionally, select **Defer Contextualization** to only upload the file and defer contextualization processing of the sensor data.

7. Click **Cancel** if you do not want to upload the file. Click **Submit** to upload the file.

   If you selected **Defer Contextualization**, select Run Contextualization from the Action icon to start contextualization processing of sensor data, after the file is successfully uploaded.

   If you did not select **Defer Contextualization**, contextualization processing of sensor data starts after successful upload of the file.

   > **Note:** Contextualization processing can run on one file at a time. Select Run Contextualization from the Action icon after successfully uploading the file. When you upload multiple files, the application processes the data contextualization of one file after another file in the file upload sequence. For example, the data contexualization of the second file you upload, will run once the data contextualization of the file you uploaded before it is complete.

8. When you click **Submit**, the file appears in the List page, along with the file details, status, and possible actions.

   View the status of the file upload that displays in the Sensor Data page, which can appear as In Progress, Success, or Error. After successfully uploading the file and completing contextualization processing, the status of the contextualization displays as Pending, In Progress, Success, Warning, or Error.

9. Click the **Action** icon for a file, then perform one of the following actions:

   - Run Contextualization

   - Download Contextualization Error Records

   - View Contextualization Status

   - View File Details

   - Download File
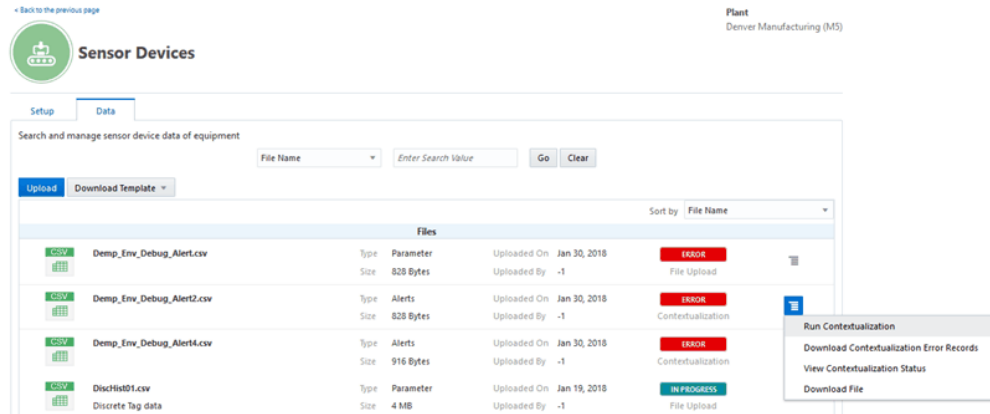
Note that the options in the **Action** icon are enabled or disabled based on the status of file upload or contextualization processing.

Upload Status	Processing Status	Run Contextua lization	Download Contextua lization Error Records	View Contextua lization Status	Download File	File Details
File Upload	SUCCESS	Enabled	Disabled	Disabled	Enabled	Enabled
File Upload	ERROR	Disabled	Disabled	Disabled	Disabled	Enabled
Contextual ization	SUCCESS	Enabled	Disabled	Enabled	Enabled	Enabled
Contextual ization	ERROR	Enabled	Enabled	Enabled	Enabled	Enabled
Contextual ization	WARNIN G	Enabled	Enabled	Enabled	Enabled	Enabled

Downloading Files:

• You can downloaded a file only when it is successfully uploaded to Storage Cloud.

• You can download the CSV file in GZ zipped format.

Downloading Contextualization Error Records:

- When contextualization fails, a CSV file with records of the errors is generated, listing the error code and error message for each error record.

- You can fix the errors in a generated error file and upload it as a new file. You must remove the error code and error message columns from the file.

Viewing Contextualization Status:

- You can view the number of data points uploaded which have been contextualized successfully, or have errors.

- You can view the summary of contextualization by organization, department, equipment, sensor, work order, operation, and processing information.

File Details:

The file you download has the following details:

- File Name: Name of the data file.

- Description: Description of the file.

- Type: Data file type, whether it contains Stream or Alert data.

- Size: Data file size.

- Uploaded On: File upload date.

- Stage: Step completed in the upload process, such as File Upload or Contextualization.

- Status: Status of the file upload, such as ERROR, WARNING, or SUCCESS.

- Error Message: High-level summary of the upload error message. This message only appears when the import status is ERROR.

Uploading and Processing Sensor Device CSV Files Using REST Web Services

Oracle Adaptive Intelligent Applications for Manufacturing provides four REST services to import and process sensor device data using CSV data files. The seeded templates must be downloaded, data entered as suggested in the template guidelines, and saved as a CSV file.

Sensor Device Data Ingestion supports the following REST services:

1. Uploading sensor device data files to Storage Cloud. For general information about uploading sensor device data files, see: Uploading CSV Files Using the Sensor

Devices Data User Interface, page 4-17.

2. Starting contextualization processing of sensor device data files in Storage Cloud. For general information about contextualization processing, see: Processing Sensor Devices Data and Contextualization, page 4-28.

3. Retrieving the contextualization status details of the uploaded file.

4. Downloading the error records or the contextualization summary report file.

To use REST web services, a user must have access to Oracle Identity Cloud Service with either the Identity Domain Administrator or Application Administrator role. The user must first register the AIAMFG Client Application in Oracle Identity Cloud Service, then use a third-party client such as Postman to access REST web services. See: Appendix: REST Web Services, *Oracle Adaptive Intelligent Apps for Manufacturing User's Guide*.

Uploading sensor device files to Storage Cloud:

You can upload sensor device data files to the Storage Cloud.

URL:

```
<host:>/vof/v1/mdap/pub/devicedata/upload
```

Request Parameters:

Parameter Name	Description	Type	Required
json	A file containing the JSON payload, similar to the example shown below.	File	Yes.
files	CSV files containing data to import.	File	Yes.

JSON Payload Request Example:

Input:

```
{
  "files" : [
            {
        "fileName": "1.csv",
        "fileDescription" : "file description here",
        "fileType" : "parameter/alerts",
        "organizationCode":"<code>",
        "deferContextualization":"Y or N. N is default",
        "storageCsPath":"optionally refer to a file in cloud storage to
create metadata for contextualization"
        },
            {
        "fileName": "2.csv",
        "fileDescription" : "file description here" ,
        "fileType" : "parameter/alerts",
        "organizationCode":"<code>",
        "deferContextualization":"Y or N. N is default",
        "storageCsPath":"optionally refer to a file in cloud storage to
create metadata for contextualization"
        },
        ]
}
```

Response Body Example

```
{
  "files" : [
            {
        "fileName": "1.csv",
        "fileDescription" : "file description here" ,
        "fileType" : "parameter/alerts",
        "organizationCode":"<code>",
        "deferContextualization":"Y or N. N is default",
        "storageCsPath":"optionally refer to a file in cloud storage to
create metadata for contextualization",
        "contextualizationStatus":"Pending or Error, shown only if
deferContextualization is not set or is set to N",
        "uploadStatus":"Success or Error", "failureReason": "display an
appropriate message string if error occurs"},
            {
        "fileName": "2.csv",
        "fileDescription" : "file description here" ,
        "fileType" : "parameter/alerts",
        "organizationCode":"<code>",
        "deferContextualization":"Y or N. N is default",
        "storageCsPath":"optionally refer to a file in cloud storage to
create metadata for contextualization",
        "contextualizationStatus":"Pending or Error, shown only if
deferContextualization is not set or is set to N",
        "uploadStatus":"Success or Error", "failureReason": "display an
appropriate message string if error occurs"
        },
        ]
  }
```

Starting contextualization processing of the sensor device data files in Storage Cloud:

Start contextualization processing of the sensor device data upon successful completion of the file upload to Storage Cloud. Contextualization processing runs on one file at a time.

URL:

```
<host:>/vof/v1/mdap/pub/devicedata/contextualize/<filename>
```

Request Parameter:

filename

Response Payload:

Input:

```
"fileName" as part of the url path parameter
```

Output:

```
{
    "fileName": "fileName",
    "contextualizationStatus": "Submitted" or "Error"
    //If the contextualization job fails to submit, then a failureReason
property is added to the payload
}
```

Retrieving the contextualization status details of the uploaded file:

This service retrieves the number of data points uploaded which have been contextualized successfully, or have errors.

URL:

```
<host:>/vof/v1/mdap/pub/devicedata/summary/<fileName>
```

Request Parameter:

filename

Response Payload:

Input:

```
"fileName" as part of the url path parameter
```

Output:

```
 {
    "fileName":<fileName>
  "fileType":"Parameter" or "Alerts",
    "fileDescription":<optional file description>,
    "uploadStatus" : "Success" or "Error",
    "contextualizationStatus" : "Success", "Error", "Pending", or
"In_Progress",
    "dataPointsContextualizatedWithEquip":<number of data points>,
    "dataPointsContextualizatedWithWorkOrder":<number of data points,>
    "dataPointsContextualizatedWithSerial":<number of data points>,
    "failedDataPoints:<number of data points failed>,
    "totalDataPoints":<total number of data points>,

    //If one or more data points fails while executing this REST web
service, then a failureReason property is added to the payload.

```

Example output if a file is not submitted for contextualization:

```
{
    "fileName": "SampleData02.csv",
    "fileType" : "Alerts"
    "uploadStatus": "ERROR",
    "failureReason": "File column names or values do not match with the
template."
}
```

Example output if a file is submitted for contextualization, but has errors:

```
{
    "fileName": "SampleData02.csv",
    "fileType" : "Parameter",
    "uploadStatus": "Success",
    "contextualizationStatus": "ERROR",
    "dataPointsContextualizatedWithEquip": 0,
    "dataPointsContextualizatedWithSerial": 0,
    "dataPointsContextualizatedWithWorkOrder": 0,
    "failedDataPoints": 36000,
    "totalDataPoints": 36000,
    "failureReason": "Contextualization has failed for all records in
the file. You can download the contextualization error records and check
the issue."
}
```

Downloading the error records or contextualization summary report file:

When contextualization fails, a CSV file with records of the errors is generated, listing the error code and error message for each error record. This REST web service downloads this error file. Optionally, you can fix the errors in the generated error file and upload it as a new file after removing the error code and error message columns from the file.

Alternatively, this REST web service downloads a report file that summarizes contextualization by organization, department, equipment, sensor, work order, operation and the processing information.

URL

`<host:>/vof/v1/mdap/pub/devicedata/download/<fileName>/<fileType>`

Request Parameters:

Parameter Name	Description	Type	Required
fileName	The full file name with extension (such as SampleData1.csv).	String	Yes.
fileType	Use the value "summary" to download a summary report file. Use "error" to download the error records file.	String	Yes.

- The fileName and fileType parameters are case sensitive.

- When downloading a file using a REST client, such as Postman, or a command line tool, such as cURL, specify a target file name with a *.gz extension, if necessary. For example, <fileType>_<fileName>.gz or summary_SampleData1.csv.gz. If downloading a file using a browser, a target file name is unnecessary.

Response Payload

- Response type: application/zip

- Content Type: attachment

- File Name: <fileType>_<fileName_with_extension>.gz

> **Warning:** If the download fails, the API returns the file name "fail_<fileName>.csv", which contains an explanation of the download failure.

Processing Sensor Devices Data and Contextualization

Once the sensor data is uploaded to Oracle Storage Cloud, the stream and event/alert data is processed for contextualization, event identification and summarization.

> **Note:** The application checks sensor data for any duplicate data and does not save it in the contextualized data repository. Duplicate records, such as sensor data with the same sensor device ID, parameter name, and reading date within an uploaded file are not saved. Similarly, when data already exists in the repository for equipment, sensor device ID, parameter name, and period, the newly uploaded file data is not saved.

Processing Sensor Data

The following topics describe how the two types of sensor device data, Stream data and Alert data, are processed:

Processing Stream Data

1. The Data Contextualization Processor applies equipment context information to the stream data.

2. The Data Contextualization Processor then applies the work order context to the stream data that has already been contextualized with the equipment information.

3. The Event Identification Processor identifies events and applies the selected time series feature sets. The derived alerts for machine event analysis are seen in the Factory Command Center and Genealogy and Trace Timeline Viewer.

Processing Alert Data

1. The Data Contextualization Processor applies equipment and work context information to the alert data, which then appears in the Factory Command Center.

2. The Alert Summarization Processor merges the continual occurrent alert data points to one record with the start and end time. This information appears in the Genealogy and Trace Timeline Viewer.

Processing Data Contextualization

Data contextualization enriches stream data and alert data from sensor devices with equipment and work order context attributes so that the machine data can be associated to the entities defined in the EBS instance.

Contextualizing data includes setting up contextualization for deriving equipment and work order information:

- Equipment Contextualization: Equipment context includes information about the organization code, department code, equipment code, and equipment instance code.

- Work Order Contextualization: Depending on whether it is a process or discrete manufacturing organization, work order context includes information about the work order number operation or step, activity, and serial number.

The three available seeded context types provided are:

- Equipment context type only (Context Type = 1) : The contextualized data includes only information on organization code, department code, equipment code, and equipment instance code.

- Work order context type only (Context Type = 2): The contextualized data includes information on work order number operation or step, activity, and serial number.

- Equipment and work order context type (Context Type = 3): The contextualized data includes both equipment and work order contexts.

The following table details the context values derived from the selected seeded context type:

Context Value	Context Type = 1	Context Type = 2	Context Type = 3
OrganizationCode	Organization Code	-	Organization Code
DepartmentCode	Department Code	-	Department Code
EquipmentCode	Equipment Code	-	Equipment Code
EquipmentInstanceCode	Equipment Instance Code	-	Equipment Instance Code
WorkOrderNumber	-	Work Order Number	Work Order Number
OperationSequence	-	Operation or Step	Operation or Step
Activity	-	Activity	Activity
SerialNumber	-	Serial Number	Serial Number

Equipment contextualization helps to obtain equipment information found either in sensor device messages or sensor device mapping setup.

Work and Serial contextualization helps to obtain work order information from the sensor device messages or from ERP based on the actual or planned time frame of work execution. For machine alerts, equipment contextualization is sufficient to show the data in the Factory Command Center and Genealogy and Trace pages.

You can specify equipment contextualization and work order contextualization when setting up sensor device mappings.

See: Setting Up Sensor Device Mappings, page 4-3.

Equipment Contextualization

The equipment contextualization processes sensor device data and associates each sensor message data with equipment information. The mandatory equipment contextualization processor contextualizes machine stream raw data and alerts with equipment information. It stamps each message with equipment instance, equipment, department (in the case of discrete manufacturing) and organization to the sensor readings data.

Following are the two types of equipment contextualization, shown in order of priority:

1. Use equipment information found in sensor device message.

2. Use equipment information based on sensor device mapping setup.

When the contextualization is based on the sensor device message, the sensor sends the readings with the equipment context information. The processor picks context information from the sensor readings and validates the codes in the ERP instance. If the context information is valid, the contextualization is successful. If it is not valid, the record is marked as an error.

The following table shows the placeholders for context attributes for equipment contextualization only:

Context Value	Context Type = 1
OrganizationCode	Organization Code
DepartmentCode	Department Code
EquipmentCode	Equipment Code
EquipmentInstanceCode	Equipment Instance Code

The following table describes equipment contextualization status:

Status	Description
Success	Equipment information is derived from sensor device messages or the sensor device mapping setup and the equipment contextualization is complete. These records are available for the Factory Command Center and the Timeline Viewer and are ready for further processing for work order and serial unit contextualization.
Error	Equipment contextualization fails if the equipment information in sensor device messages is invalid or the sensor device mapping setup is not available. These records are not stored in the repository. The contextualization also fails when the record is duplicated in the file or the record exists in the repository.

Work Order Contextualization

Once the equipment contextualization is complete, the work order contextualization

process begins.

Work order and serial (for discrete serialized manufacturing) contextualization contextualizes machine stream data and alert data with work order (and serial if serialized manufacturing) information. It stamps work order, operation, step, and serial (in case of discrete serialized manufacturing) on the sensor readings.

It is not mandatory to choose a work and serial contextualization method as in some cases the need is to only monitor the stream data and alert data and not use it for model building purposes.

Following are the three types of work order contextualization, shown in order of priority:

1. Use work order information found in sensor device message.

2. Use work order information based on actual time frame of work execution.

3. Use work order information based on planned time frame of work execution.

Work order contextualization is processed according to the priority sequence chosen in the sensor device mapping setup. Based on the preference, it picks the context from either the sensor device message,, work order actuals, or work order planned and validates context for work order, operation/step, activity and serial number (in case of discrete serialized manufacturing).

In case of contextualization using work order information found in the sensor device message, the work order information is validated with work orders whose plan schedule falls within the range of 30 days before and after the sensor device message reading date.

> **Note:** You can choose to change the order or remove all the methods if work and serial contextualization is not required. This is applicable in cases where the need is to only monitor the parameters or alerts but not use them for a model building process. You cannot select the priority of work order planned over work order actuals as the work order actuals takes preference in majority of use cases.

The following table shows the placeholders for context attributes for work order contextualization only as well as both equipment and work order contextualization:

Context Value	Context Type = 2	Context Type = 3
OrganizationCode	-	Organization Code
DepartmentCode	-	Department Code

EquipmentCode	-	Equipment Code
EquipmentInstanceCode	-	Equipment Instance Code
WorkOrderNumber	Work Order Number	Work Order Number
OperationSequence	Operation or Step	Operation or Step
Activity	Activity	Activity
SerialNumber	Serial Number	Serial Number

The following table describes work order contextualization status:

Status	Description
Success	Work order information context is derived from the sensor device message, actual work order, or plan work order and the contextualization is complete. These records are available for downstream applications. In case of serialized manufacturing, the serial unit information is derived from sensor device message.
Error	Work order contextualization fails as the work order information in sensor device message is invalid or actual/plan work order is not available. These records are not available for analysis.

You can view the status of contextualization processing for successfully uploaded sensor data file in the Data tab of the Sensor Devices page. The status of the contextualization is shown as Pending, In Progress, Success, Warning, or Error.

See: Uploading CSV Files Using the Sensor Devices Data User Interface

Processing Event Identification and Alert Data Summarization

Event identification processing is run on contextualized stream data and generates machine alerts. The event identification processor is run in batch mode on the stream data and derive alerts. You can process event identification by selecting the feature set for machine event analysis usage when setting up sensor device mappings. Both the derived alerts from the stream data using event identification processing and the direct

alerts from the equipment is summarized and stored for analysis.

Event Identification in Stream Data

The Stream Sample Interval feature enables the calculation and generation of events based on intervals from the stream data.

The event identification processor uses stream sample interval defined for the parameter in the sensor device mapping setup to identify if there is any break in the stream data. If a break is identified in the stream data, the records are split as separate time series data, and event identification processing is applied on each block of data.

> **Note:** In case the stream sample interval value is different from the stream data readings interval, the stream data is split into multiple blocks and event identification processing is applied. However, when the split exceeed 10 blocks, the event identification processing is stopped for this stream data in order to detect events correctly. Event identificaiton processing will continue for other stream data which is coming at right interval and matching with steam sample interval.

It is important that users specify the stream sample interval same as the actual time interval of sensor readings. If the sample interval is different, then the event identification processing may fail due to performance issues.

Summarization of Alert Data

Machine events can be indirectly derived from a time series sensor stream data. Time series feature sets defined for Machine Event Analysis usage help derive such events. These time series features set can be used for machine event analysis to enable event identification based on the simple functions you select like Above Threshold Alert or the advanced SAX Pattern Alert when creating a time series feature set.

Event identification processing allows the following time segment and function options to choose when defining a time segment feature set for Machine Event Analysis usage:

- Time Segment: Full is the only time segment available as the streaming data will be analyzed for any events in the duration of the work order and operation.The time segment step is retained in the page for consistency in the navigation.

- Simple Functions: Only the following threshold violation rules are allowed:

  - Above threshold alert

  - Below threshold alert

  - Within range alert

  - Outside range alert

- Advanced Functions: Only SAX pattern alert is allowed.

> **Note:** In the case of Event functions, you can specify the value aggregation function like minimum, maximum or average for generating the value of the event. You can specify after an event is matched whether to skip to the last data point or skip to the next data point for checking next matching pattern.

> **Above Threshold Alert example:**

> You can specify, after an event is matched, to skip to the last data point or skip to the next data point for the following temperature readings:

Time	T1	T2	T3	T4	T5	T6	T7	T8
Temperature Reading	10	25	23	34	11	12	10	11

> If you have defined the Above Threshold value as 20 and selected the Value Aggregation function as Maximum, based on the temperature readings given above, the events are generated based on the option you choose for After Match.

> If the After Match is Skip to Next, the following three events are generated:

> - Event E1 - Start Time: T2, End Time: T2, Value: 25
>
> - Event E2 - Start Time: T3, End Time: T3, Value: 23
>
> - Event E3 - Start Time: T4, End Time: T4, Value: 34

> If the After Match is Skip to Last, one event is generated:

> - Event E1 - Start Time: T2, End Time: T4, Value: 34

See the following topics in *Oracle Adaptive Intelligent Apps for Manufacturing User's Guide* :

- Using Time Series Feature Sets

- Setting Up Time Series Feature Sets

Using Sensor Devices Data Templates

AIAMFG provides sensor device data templates for stream data and alert data which can be used by process manufacturing and discrete manufacturing organizations. Download the templates from AIAMFG and then enter the data as recommended into the spreadsheet templates. The following data templates are available for sensor device data:

Alert Data (EventAlertDataTemplate.xlsx)

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
Reading Date	Y	Number		Reading Date field should be in Epoch milliseconds format (number of milliseconds elapsed since Unix epoch) or the normal date and time format.	1494403200000 (Epoch format) 2017-02-11T07:40:00.013+0800
Sensor Device ID	Y	Char		Unique ID for the sensor device	7CCBC4D9-FD52-4919-8212-219DBFCF0B2E
Alert Type	Y	String		See Alert Type Values table for more details.	MachineStatus
Alert Value	Y	Char		See Alert Type Values table for more details.	UP

Context Type	Number		1 - If only equipment context information is available. 2 - If only work order context information is available 3 - If both equipment and work order context information is available	General Electrics
Organization Code	Char	4	Short alphanumeric code of the organization to which the item belongs. Required for equipment contextualization	M5
Department Code	Char		Required for Discrete Manufacturing	Machining
Equipment Code	Char		Required for equipment contextualization	3D-PRINT
Equipment Code Instance	Char		Required for equipment contextualization	

Work Order Number	Char	Required for work order contextualization	7320
Operation Sequence	Number	Required for work order contextualization	10
Activity	Char	Process - Required for work order contextualization. Discrete - Not applicable	ACT
Serial Number	Char	Process - Not applicable	S000000
Additional Attributes	Char	See Additional Attributes Values table for more details.	{"current_quantity":10," overall_quantity":100}

Stream Data (StreamDataTemplate.xlsx)

Field Name	Required	Data Type	Length (Max)	Description	Sample Data

Reading Date	Y	Number		Reading Date field can be in Epoch milliseconds format (number of milliseconds elapsed since Unix epoch) or the normal date and time format.	1494403200000 (Epoch format) 2017-02-11T07:40:00.013+0800
Sensor Device ID	Y	Char		Unique ID for the sensor device	7CCBC4D9-FD52-4919-8212-219DBFCF0B2E
Parameter Name	Y	Char		Sensor Parameter Name defined in the device setup.	Internal Temperature
Parameter Value	Y	Char		Parameter Value	119
Organization Code		Char	4	Short alphanumeric code of the organization to which the item belongs. Required for equipment contextualization	M1
Department Code		Char		Required for Discrete Manufacturing	Machining

Equipment Code	Char	Required for equipment contextualization	3D-PRINT
Equipment Code Instance	Char	Required for equipment contextualization	
Work Order Number	Char	Required for work order contextualization	7320
Operation Sequence	Number	Required for work order contextualization	10
Activity	Char	Process - Required for work order contextualization. Discrete - Not applicable	ACT
Serial Number	Char	Process - Not applicable	S000000

Context Type	Number	1 - If only equipment context information is available.	2
		2 - If only work order context information is available	
		3 - If both equipment and work order context information is available	

Alert Type Values

Alert Types	Values	Meanings

MachineStatus	OFF, UP, DOWN, IDLE, IN-USE, FAULTED	UP: State of the machine when it is warming up, when just turned on.
		DOWN: State of the machine when it is down. Additional Attribute: resourceDownCode
		IDLE: Optional, state of the machine when it is powered on but is not working. If the sensor device is unable to provide the status of the machine, machine status will be determined based of the ERP context information and set to a status of UP.
		IN-USE: Optional, state of the machine when it is running. If the sensor device is unable to provide the status of the machine, machine status will be determined based of the ERP context information and set to a status of UP.
JobStatus	STARTED, PAUSED, RESUMED, COMPLETED	STARTED: Job has started and is in-progress (Additional attributes 'current_quantity' and 'overall_quantity' are applicable)
		PAUSED: Job has paused (Additional attribute 'current_quantity' and 'overall_quantity' is applicable)
		RESUMED: Job has resumed (Additional attribute 'quantity' is applicable)
		COMPLETED: Job has been completed (Additional attribute 'quantity' is applicable)

PatternMatch	<<Stream Parameter Name>>
	Additional Attributes:
	• Max
	• Min
	• Average
	• ERP_PARAMETER_NAME
	• UOM
	• PatternType – SAX_PATTERN
	Note that amMessage can send attribute values for more than 1 parameter
Threshold Violations	<<Stream Parameter Name>>
	Additional Attributes:
	• Max
	• Min
	• Average
	• ERP_PARAMETER_NAME
DoorState	OPEN, CLOSE
PowerState	UP, DOWN

5

Importing Case Record Data

Overview of Importing Case Record Data

Case Record Data upload may be used when data is mined and prepared in an external system and imported into Oracle Adaptive Intelligence for Manufacturing for quick analysis to obtain insights and predictions on historical data and in-progress work orders. Case Record Data files captures the work order data in a flattened file format. Each row in the spreadsheet corresponds to one work order and contains all related entities data like items, operation, routing, and so on, in the same row. Work order records with an actual end date are considered as completed work orders and the records are used for insights analysis. Work order records with no actual end date are considered current in-progress work orders and the records are used for predictions analysis.

> **Note:** While you can bring in historical work orders, or in progress work orders using the case record data ingestion method, note that pending work orders, or operations that are pending are not included.

The data file contains context data which includes information on item, BOM, operation, transactions, and so on. It also includes details of input predictors and target test results. This ingested data can be analyzed to identify key patterns and correlations that affect manufacturing efficiencies. The data ingested through this template, can be used in the Insights and the Predictions module.

If you only plan to use the Insights and Predictions features, consider using the Case Record Data upload. Other key features like Genealogy and Trace, and Factory Command Center cannot be used with data imported through Case Record Data files.

The Case Record Data file uploads data for the following entities:

1. Creates setups required for the business context such as Item, Recipe, Routing, and so on.

2. Uploads transaction records such as work order, serial transactions, and so on.

3. Uploads attributes which could be targets or input features.

4. Enables quick creation of a data set using the uploaded data.

Select to use Case Record Data:

- When flattened records are already available.

- For the flexibility of stitching data outside AIAMFG.

- For the flexibility of creating features outside AIAMFG.

- For simpler ingestion of data into AIAMFG using the single CSV template that is provided.

- When a quick track analysis is required.

- For initial proof of concept validation.

> **Note:** Select to first use case records data for insights before using business entity data.

Case Record Data Import Steps
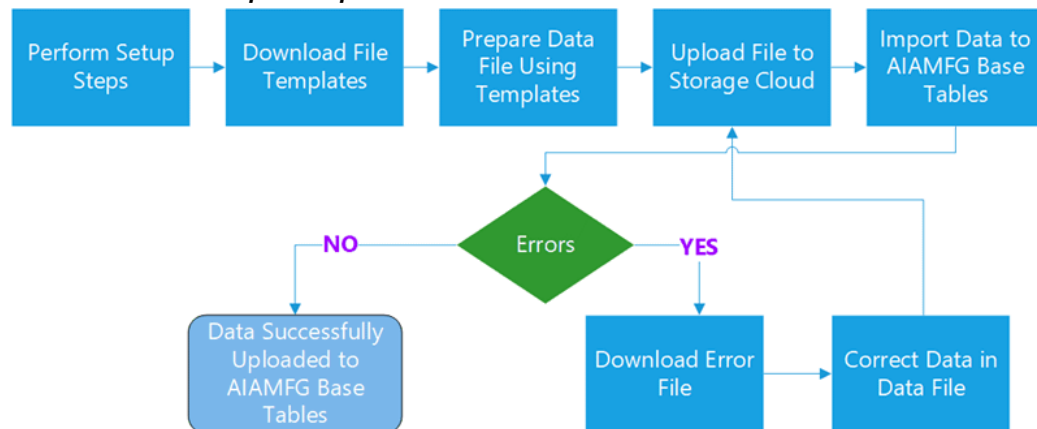
1. Perform the setup steps required to import data.

2. Download the file templates for either a process or discrete organization.

3. Prepare or enter the data into CSV files following the template guidelines.

4. Submit the file for upload to Oracle Storage Cloud Service.

5. Run the data import program to import data into the target base tables.

6. If errors occur, download the error file, correct the data, remove the error message columns, save the error file as a new CSV file, and then upload the file again.

Uploading CSV Files Using the Case Record Data User Interface

Oracle Adaptive Intelligent Apps for Manufacturing provides specific templates which you can download and use to add case record data information. You can use the Case Record Data user interface to download the provided data and metadata templates, add data to these templates, and save the files in the CSV format. You can then upload the saved files, and create a dataset for further analysis.

To use the Case Record Data page:

1. Navigate to the Data Ingestion Page.

   From the Home Page, click **Insights** or **Predictions**, then click the **Data Ingestion** link, and then **Case Record Data**.

   Click Download Template to download the Case Record Data template. Click Upload to upload a case record data file in the CSV format.

To download file templates

2. In the Case Record Data page, click **Download Template.**
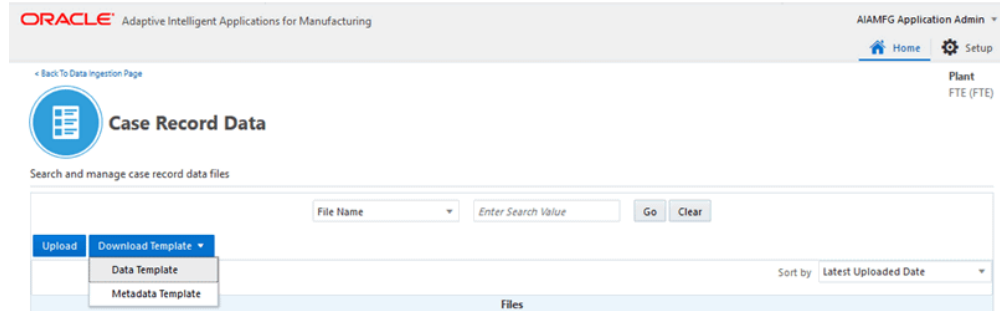
You can download the following Case Record Data templates:

- Data Template - Use the DataTemplate.xlsx that is downloaded in your local system to enter mandatory context information like item number and operation code, reference information like work order number and actual start date, and the attributes.

  > **Note:** Enter the actual end date for completed work order records to ensure the records are used for insights analysis.
  >
  > Leave the actual end date blank for in-progress work orders to ensure the records are used for predictions analysis.

- Metadata Template - Use the MetaDataTemplate.xlsx that is downloaded in your local system to enter optional attribute metadata information like attribute name, category, data type, unit of measure, and so on.

Based on the organization type of the context organization, either a discrete manufacturing or a process manufacturing template is downloaded.

Use the instructions in the ReadMe and Field Information sections of the template to enter the required information.

3. On completion of Case Record Data entry in the data and metadata spreadsheest, save the file in a CSV format. It is required that the data be entered in the same format as defined in the template for processing to be completed successfully.

To upload Case Record Data file templates

4. In the Case Record Data page, click the Upload Button to upload the Case Record Data file you have saved

To upload a Case Record Data file you will complete the following steps:

- Browse and select the data file to be uploaded.

- Optionally, browse and select the metadata file to be uploaded.

- Review the context and attributes derived from the uploaded data and make changes if required.

- Upload the file for processing.

5. In the Select File region use the following fields:

- **Data File** to select the data file you want to upload. Click Browse and then choose the CSV spreadsheet from the local system. This is a mandatory step.

- **Description** to enter a meaningful description to represent the data upload.
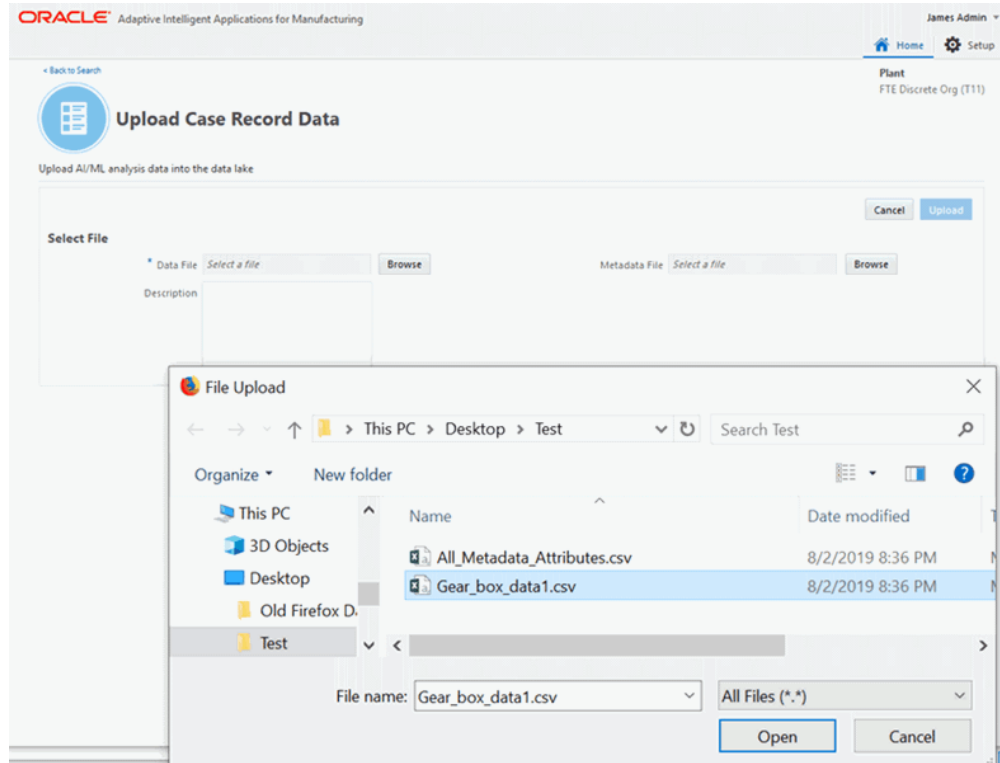
6. In the Context region, review the data context information that displays.

The data context is extracted from the data uploaded in the spreadsheet. The data context information is part of the standard mandatory columns. Enter the first row to provide the context information. Any additional rows with context information is ignored. Note that you will upload one file for a single context information.

The context information that displays for your review consists of the following fields:

- For discrete manufacturing organizations:

    - Item Number

    - Operation Code

    - Item Description

    - BOM Type

    - BOM Revision

    - Routing Type

    - Routing Revision

- Operation Sequence Number

- For process manufacturing organization:

    - Item Number

    - Operation Code

    - Item Description

    - Item Category

    - Item Revision

    - Recipe Number

    - Recipe Revision

    - Step Number

7. In the Attributes region, you can search for attributes, and review the information in the All tab which shows information of all attributes derived from the data file you uploaded.

Also, in the Attributes region, the Missing Metadata or Errors tab shows the attributes that have not passed validation. You can view the following attributes for missing information, or invalid value or format, or an incorrect value:

- Attribute Name - This is mandatory. Ensure that the name of the attribute matches the column name in the case record data template.

- Attribute Display Name - The display name of the attribute. If the display name is not provided, the value defaults to the attribute name.

- Data Type - Values can be numerical or categorical. If no value is provided in the metadata file, the data type of the attribute is derived from first 100 records in the data file. If there are no values for the first 100 records for an attribute in the data file, the data type displays as Unknown. You can then use the Metadata file to provide the data type.

- Category - The value can be any of the 5Ms: Manpower, Machine, Method, Material, or Management. If a category is not provided, the value defaults to Unspecified.

- Subcategory - If a subcategory is not provided, the value defaults as Unspecified.

- Unit of Measure - The specified unit of measure for the attribute.

- Tags - Key value pair format separated by '::' are supported. For example, Department::Manufacturing::Operation::10.

8. You can optionally upload metadata information. Click **Browse** to select and choose a metadata file in the **Metadata File** field.
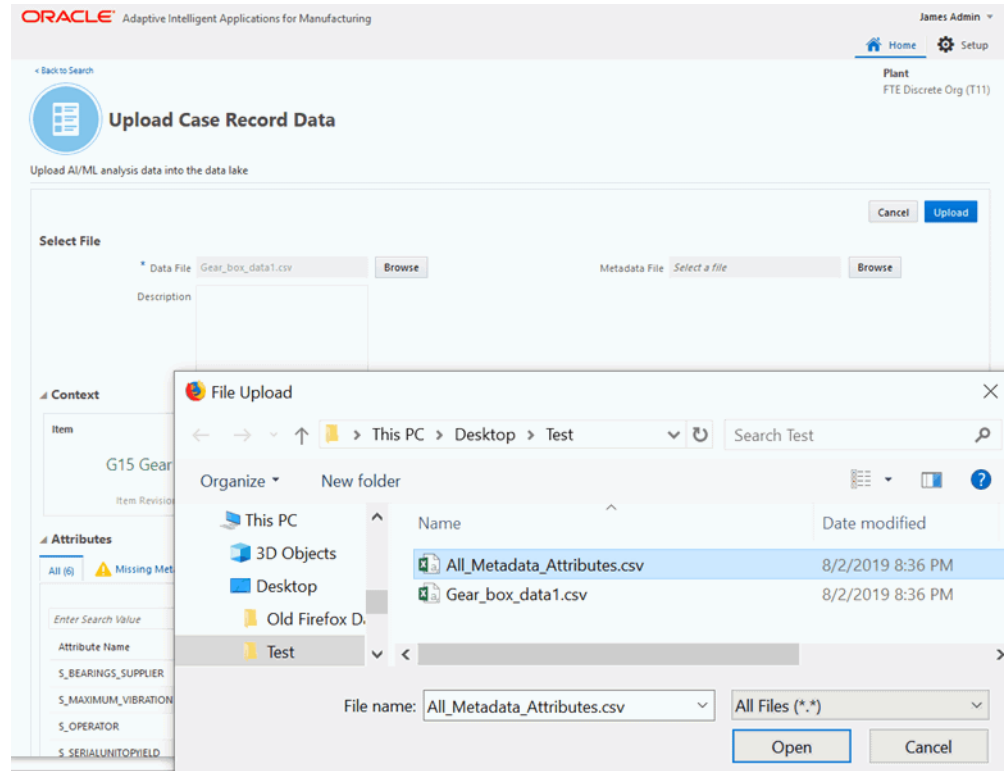

9. Click **Upload**.

> **Note:** The Upload button is only enabled after the data file is uploaded and the metadata definition for all attributes is correct.

Once you click to upload the files, the Upload Case Record Data Status shows that file is under processing.
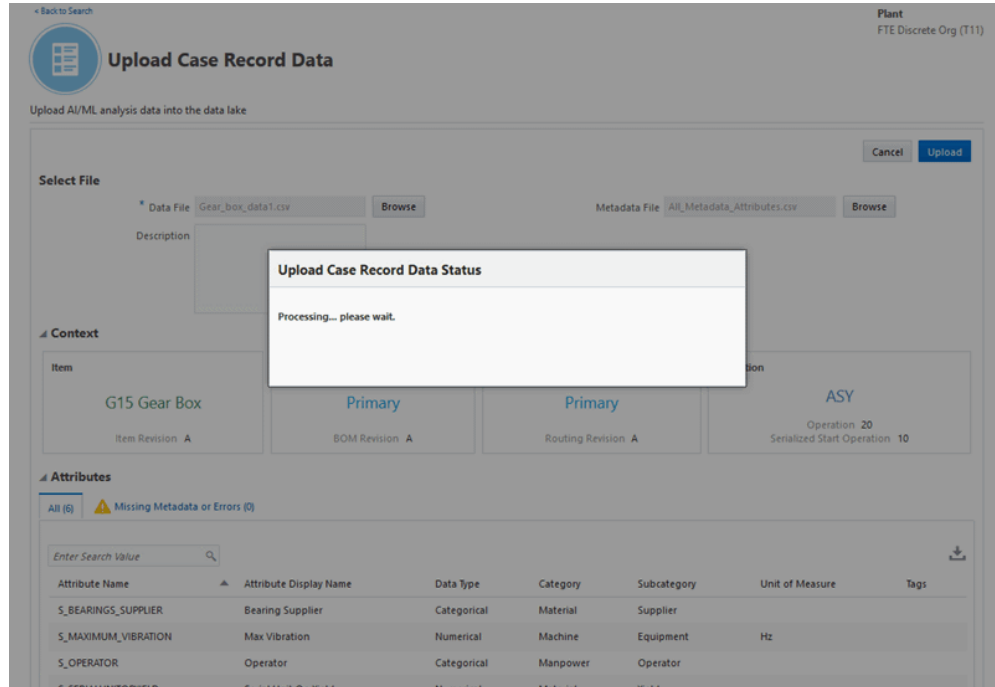
10. Once the case record data files are processed, you will be returned to the Case Record Data page where you can monitor the progress of data import.
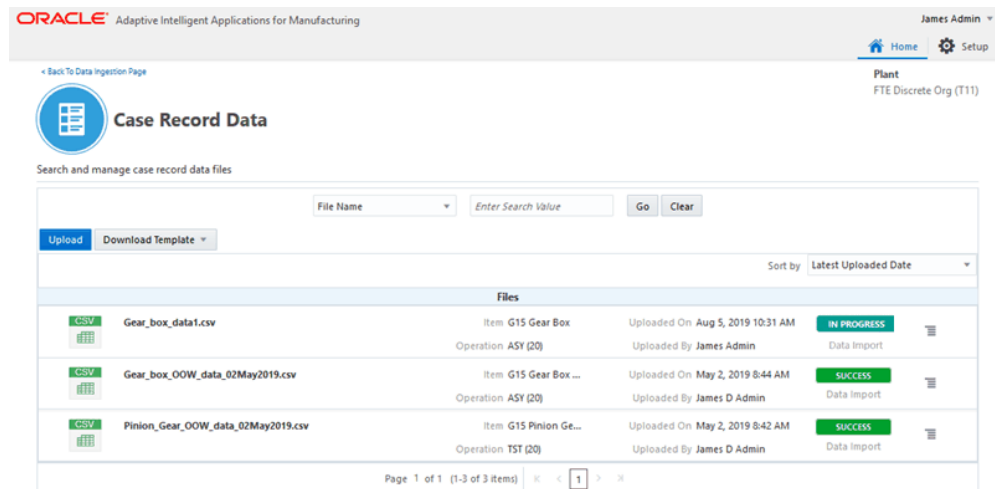
The file appears in the list of uploads in the Case Record Data page, along with the details of file, the status, and actions that can be performed.

The following information displays for the uploaded file:

- File Name

- Description

- Data Context Information:

    - Item

    - Operation

- Uploaded On

- Uploaded By

- Status of the Upload:

    - IN PROGRESS: This indicates that the file has been submitted and the background processing is in progress.

    - SUCCESS: This indicates that all case records data in the spreadsheet has been imported successfully.

    - ERROR: This indicates that the import of some or all of the case records data has failed due to errors.

- Action link

    To view the status of the background process, you can navigate to the Background Process page. See: Running Background Processes, *Oracle Adaptive Intelligent Apps for Manufacturing User's Guide*.

11. Click the Action link, next to the upload status that displays for an upload. Depending on the enabled actions available for you to perform, you can select from the following actions on the upload:

    - View Data Import Summary

    - Download Error Records

    - Download Data File
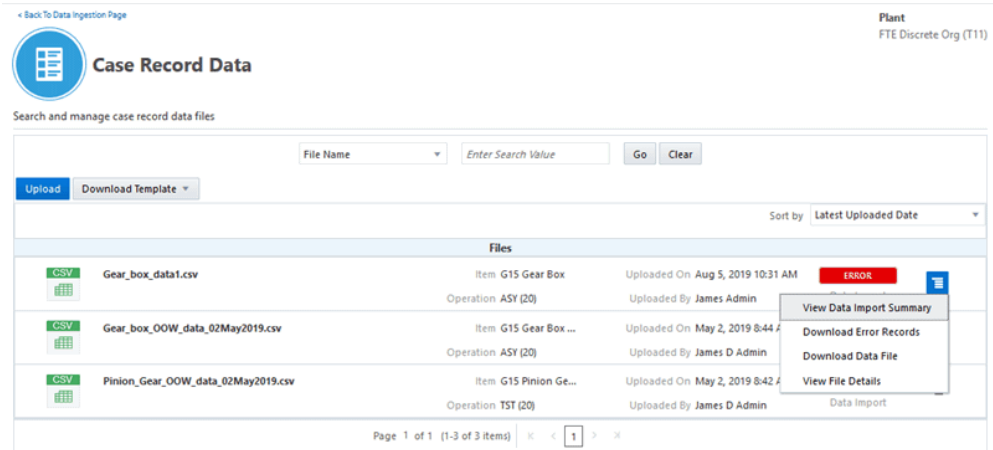
    - View File Details

These actions are enabled or disabled, based on the status of the data import, as given in the following table:

Import Status	View Data Import Summary	Download Error Records	Download Data file	View File Details
IN PROGRESS	Disabled	Disabled	Disabled	Enabled
SUCCESS	Enabled	Disabled	Enabled	Enabled
ERROR	Enabled	Enabled	Enabled	Enabled

12. Click the View Data Import Summary action. You can view details like total number of records, successfully imported records, failed imports, and the number of analysis attributes.The Data Import Summary displays the following:

- Total number of records in the file

- Number of records successfully imported

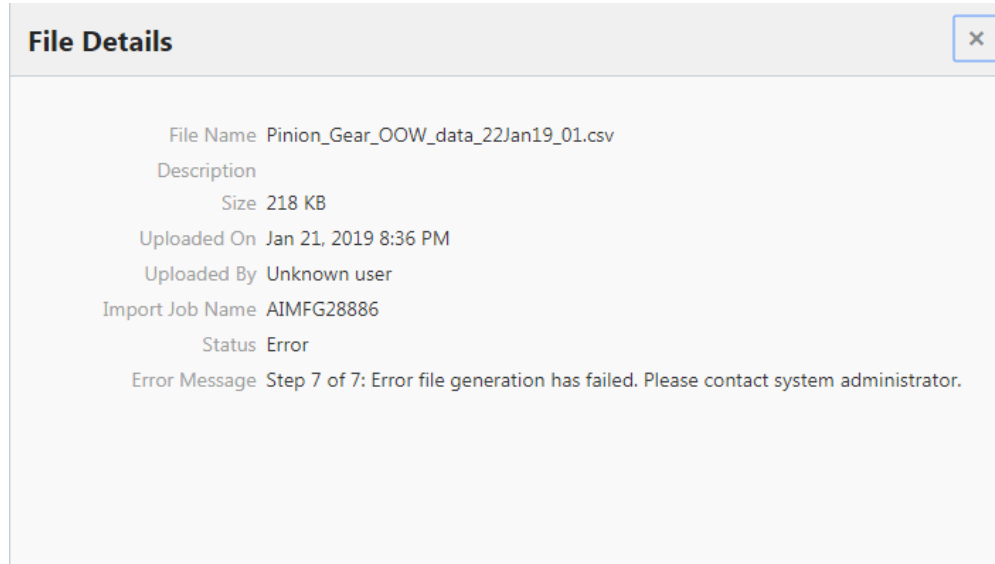- Number of records failed importing

- Number of analysis attributes
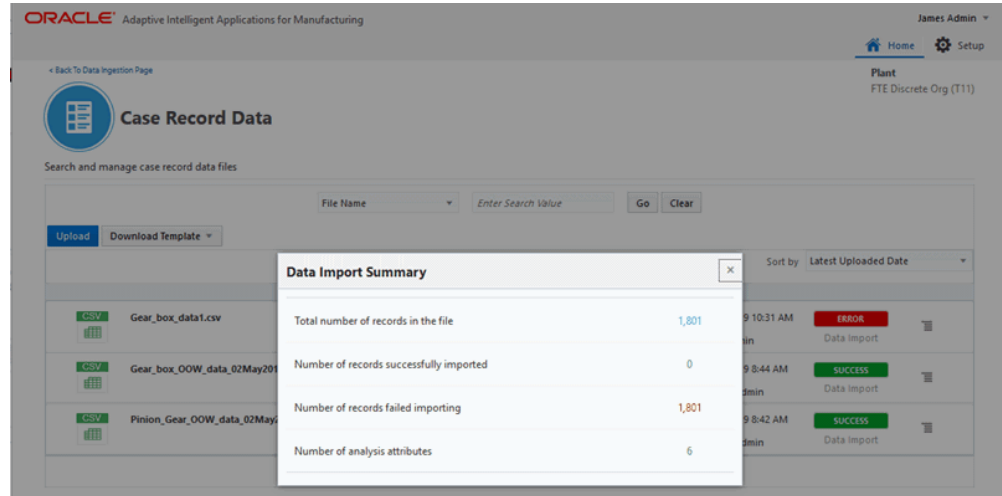
13. Click the Download Error Records action to download the CSV file containing all the errors records with error details to your local machine.

14. Click the Download Data file action to download the data file to your local machine.

15. Click the View File Details action, to review the file name, description, size, upload details, import job name, and status for the upload.

    Note that the file is processed in the following seven steps, sequentially:

    1. Scanning of the file.

    2. Creating context for the file.

    3. Copying the file to Storage Cloud.

    4. Launching the background job.

    5. Reading data from the file.

    6. Importing data to the target tables.

    7. Generating the error file.

    If there is an error during any of the seven file processing steps, the error message will specify at which step the file failed processing.

File Details

File Name	Pinion_Gear_OOW_data_22Jan19_01.csv
Description	
Size	218 KB
Uploaded On	Jan 21, 2019 8:36 PM
Uploaded By	Unknown user
Import Job Name	AIMFG28886
Status	Error
Error Message	Step 7 of 7: Error file generation has failed. Please contact system administrator.

16. To prepare data you have uploaded for analysis, see Preparing Data, *Oracle Adaptive Intelligent Apps for Manufacturing User's Guide*.

Using Case Record Data Templates

AIAMFG provides data and metadata templates for process manufacturing and discrete manufacturing organizations to enter and then upload case record data for analysis.

Case Record Data Template

Use the data template to enter:

• Context information: Provide context information in the first row. Note that the upload process will only pick the the first row for setting the context information and ignores any additional rows you may enter.

• Case Record Identifier: Provide case record identifier as work orders for work order level analysis and work order/serial units combination for discrete serial level analysis.

• Attributes: Provide input features and target attributes which can be selected as targets or features in a dataset.

Note that in the Case Record Data user interface, the data templates you can download are based on the organization type of the context organization. For example, the discrete manufacturing case record data template downloads when logged in as a discrete manufacturing user. Following are the details of the data templates for discrete manufacturing and process manufacturing organizations:

Discrete Manufacturing Data Template

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
ItemCategory		Char	40	Item Category, if not provided, defaults to Case Record Data.	Product
ItemNumber	Y	Char	40	Item Number	G15 Pinion Gear
ItemDescription		Char	240	Item Description, if not provided, defaults to item number.	Pinion Gear Assembly
BOMType		Char	10	BOM Type, if not provided, defaults to Primary.	Primary
BOMRevision		Char	3	BOM Revision, if not provided, defaults to A.	A
RoutingType		Char	10	Routing Type, if not provided, defaults to Primary.	Primary
Routing Revision		Char	3	Routing Revision, if not provided, defaults to A.	A

OperationSequenceNumber		Number		Operation Sequence Number, if not provided, defaults to 10.	10
SerializedStartOperation	Y (for production unit analysis)	Number		Required for production unit analysis and optional for work order level analysis.	10
OperationCode	Y	Char	3	Operation Code	OP1
WorkOrderNumber	Y	Char	240	Work Order Number	WO-PG-1001
SerialNumber	Y (for production unit analysis)	Char	30	Required for production unit analysis and should be left null for work order level analysis	SN00000100
Actual Start Date	Y	Date			01/01/2015 10:00:00
Actual End Date	Y (for completed work orders only)	Date			01/02/2015 10:00:00 A blank AcutalEndDate field indicates the work order is in progress and will be used for predictions analysis.

Attribute1, Attribute2, Attribute3...		Character or Number	240	MainMtlSupplier MaterialGrade Column Name can be a max of 30 Characters.	John Smith High

> **Note:** The following maximum numbers of attributes are supported:

- 450 categorical data type attributes

- 450 numeric data types

> > **Note:** Ensure that the attribute names do not contain any special characters. Only underscores are allowed.

Process Manufacturing Data Template

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
ItemCategory		Char	40	Item Category, if not provided, defaults as Case Record Data	Product
ItemNumber	Y	Char	40	Item Number	Strawberry Jam
ItemDescription		Char	240	Item Description, if not provided, defaults as the item number	Bulk Processed Strawberry Jam

ItemRevision		Char	3	Item Revision, if not provided, defaults as A	A
RecipeNumber	Y	Char	32	Recipe Number	Strawberry Jam
RecipeVersion		Number		Recipe Version, if not provided, defaults to 0	1
StepNumber		Number		Step Number, if not provided, defaults to 10	10
OperationCode	Y	Char	16	Operation Code	FILLING
WorkOrderNumber	Y	Char	32	Work Order Number	WO-PG-1001
ActualStartDate	Y	Date			01/01/2015 10:00:00
ActualEndDate	Y (for completed work orders only)	Date			01/02/2015 10:00:00 A blank AcutalEndDate field indicates the work order is in progress and will be used for predictions analysis.

Attribute1, Attribute2, Attribute3...		Char or Number	240	MainMtlSupplier MaterialGrade Column Name can be a max of 30 Characters.	John Smith High

Note: The following maximum numbers of attributes are supported:

- 450 categorical data type attributes

- 450 numeric data types

> **Note:** Ensure that the attribute names do not contain any special characters. Only underscores are allowed.

Case Record Metadata Template

Following are the details of the case record metadata templates:

MetadataTemplate

Field Name	Required	Data Type	Length (Max)	Description	Sample Data
AttributeName	Y	Char	30	Attribute Name	EM1_MAX
AttributeDisplayName		Char	250	Attribute Display Name defaults as the Attribute name if not provided.	EM1_MAX

Data Type		Char	12	Data Type values can be a numerical or categorical, and if values are not provided, the data type will default from sample records in the data file. **Note:** You cannot change the data type, if the data is already loaded for this attribute.	Numerical or Categorical
Category	Y	Char	10	Category should be one of the 5 Ms: Manpower, Material, Management, Machine, Method	Machine **Note:** The value can be any of the 5Ms. It defaults to Unspecified if no value is given.
Subcategory		Char	30	Subcategory will default to Unspecified if not provided	Sensor Summary
UOM		Char	3	UOM	

Tags	Char	500	Tags support key value pair format separated by ::	Department:: Manufacturing::Operation:: 10

Validating Case Record Data

Case Record Data Validations:

The following are the validations for Case Record Data:

- Storage Cloud requires file names to be unique across a folder. To satisfy this requirement, case record data file names must be unique.

- Case record data in the template must match with the context organization. Context Organization is the organization that you select to access all AIMFG features and invoke the Data Ingestion user interfaces.

- Ensure you enter one row for data context information. Only the first row is taken for validation for data context information and all additional rows provided are ignored.

- For Date format fields, the time zone must be the same as the application server time zone and the data format must be MM/DD/YYYY HH24:MI:SS.

- When multiple sets of data are imported for the same item or business context, the items are created the first time the import is submitted. Future import runs for the same item will reuse the existing item.

- When users upload a new case record data set that reuses an existing item, the program:

  - Creates new transactions. If there are existing transaction records, they will be updated.

  - Creates new attributes or updates attribute data for existing transactions.

- A case record data row can upload the following data elements:

  - Work order number.

  - Serial number (for serialized analysis).

- Actual start date and actual end date.

- Attributes that can be input features or target attributes.

- Attributes

  - Attributes can be input features or target attributes.

  - The spreadsheet can support a maximum of 450 numerical and 450 categorical data type attributes.

  - Provide meaningful names for the attributes as this information will be provided as a default value in all related user interfaces.

  - Attribute names must be alphanumeric and supports underscore only.

- For installations that use both Golden Gate synchronization and Case Record Data upload, it is required to create a new organization for case record data upload. The same organization cannot be used for both features. A separate organization must be created.

- As each import runs on MERGE mode, the transactions are always updated if they exist and inserted if they do not exist. Note that you may have an existing dataset, and if you update the data, the existing dataset will not change or reflect the modified data.

- When the upload program errors out due to setup or context data, the user must fix the data before submitting the case record upload again.

- When the upload program errors out due to transactional data, the background processor will import transactions that were successfully validated and only error our incorrect transactions. You can download the file with the error transactions, fix the data, and upload the transactions in a new data file again.

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