Proficy Operations Hub 2022

User Guide

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doc@ge.com

Contents

Chapter 1. Release Notes

Operations Hub Release Notes

This topic provides a list of product changes in Operations Hub for this release.

Version: 2022.4.1

What's New

Table 1. Enhancements and New Features

The following enhancements and new features have been added.

Description	Tracking IDs
Enhancements to the Trend Card *(on page 533)* widget: • Option to show/hide the plot from the chart's legend. • Added trend card properties for inserting a chart title, and labels for y-axis and x-axis. • Ability to browse the data source and set upper, lower, and target specification limits. • Options to maximize the plotting area by minimizing the whitespace. • Support for new delta calculation modes - DELTA, DELTAPOS, DELTANEG.	F64020
Introduced Favorite Organizer *(on page 530)* widget.	F63934
Provision for Auto-login configuration *(on page 131)*.	F64022
Enhancements to SQL queries with multiple result sets. See Use the Relational Database Query in the Designer *(on page 102)*	F64156
New plugins in Operations Hub: Button *(on page 421)*, Check Box *(on page 422)*, Radio Button *(on page 423)*, Slider *(on page 424)*, Text Area *(on page 424)*, Text Box *(on page 424)*, Toggle *(on page 425)*, Chart Line *(on page 426)*Chart Pie *(on page 427)*, Gauge Bar *(on page 496)*, Gauge Circular *(on page 497)*, Gauge Linear *(on page 498)*, Image *(on page 517)*, Simple Indicator *(on page 519)*, List *(on page 520)*, Text *(on page 520)*.	

Known Issues and Limitations

Table 2. Known Issues and Limitations

The following known issues and limitations exist.

Description	Tracking ID
When you save a favorite in a trend chart, if you include a special character in the name, the error message that appears does not specify the issue.	DE123967
In a trend chart, if you add a tag that is identical to the one that is already plotted but the case of the tag name does not match the case of the tag name in Historian, a straight line appears in the trend chart. To resolve this issue, modify the tag name to match the case of the tag name in Historian.	DE123833
During Operations Hub installation, when you provide the tenant user ID, the following conditions apply: • If you are installing Operations Hub for the first time, do not provide StudioAdmin as the tenant user ID because it is used by Operations Hub. • If you want to use a shared Proficy Authentication (UAA) to work with Operations Hub, do not provide the user ID of an existing user of the UAA instance. If you do so, the installation fails. • If you are installing Operations Hub after uninstalling it without purge, do not provide a tenant user ID that matches any previously used user ID (including any previously used tenant ID). This is because after you uninstall Operations Hub without purge, previous Operations Hub users (along with tenant administrators, their groups, and privilege assignments) still exist in the database.	DE123770
When you create a data source, you can provide a certificate only in the base-64-encoded format. A DER-encoded certificate is not supported.	DE116706
Operations Hub uses Kafka, which generates a large number of logs in the following location: `C:\tmp\kafka-logs\`. To avoid consuming too much space for these logs, we recommend that you periodically delete the logs, especially if the system has low disk space.	N/A

Table 2. Known Issues and Limitations

The following known issues and limitations exist.

(continued)

Description	Tracking ID
If you encounter intermittent responsiveness issues with the Operations Hub runtime environment when using the Safari browser on your mobile device, it is recommended that you use the Chrome browser instead.	DE131011
When adding environment variables to Windows System Variables, be aware that environment variables are case-sensitive. If your environment variables in Operations Hub do not match the case of the ones used by the target Historian Server, the data source will fail when tested. Be sure that you use the same case when configuring data sources in Operations Hub. A data source target in Operations Hub should match the case in the environment variables, as the variables are case-sensitive.	DE130896
Historian REST response time increases exponentially when there are over 30 users logged into Operations Hub accessing an End app that utilizes Historian REST queries.	DE134904
When using Safari 13+ on iOS, trend card functionality like adding tags to the trend, favorites, and annotations perform inconsistently. The workaround is to use the Chrome browser on the iPad.	DE136597, DE149433
If a Historian data point being trended transitions to a bad quality (such is the case when a collector goes down or loses communications), the trend card displays a flatline for the last known good value. If you experience one or more flatlines in your trends, and all the various requests from the same source, you should check the communication chain for an issue with Historian, a collector, or a SCADA driver, for instance.	DE138128
There are currently some page printing issues. For instance, if you have iframe that spills over to a second page, that can cause an issue.	DE146462
The `uaa-provisioning.log` file generates in a new folder if the location path provided during Operations Hub installation contains a space in it. For example, `C:\Custom Logs`.	DE148827
As a workaround to address VC++ (x64) failure, follow these steps to install Task Client on Operations Hub 2.1.	DE161643

Table 2. Known Issues and Limitations

The following known issues and limitations exist.

(continued)

Description	Tracking ID
1. Uninstall the VC++ 2015-2019 Redistributable (x64) version installed with Operations Hub 2.1. 2. Open the Workflow install media, navigate to the `\Installers\Resources\Microsoft\2015_2019` folder, and run the `vc_redist.x64.exe`. 3. Open the Services console dialog and restart these services: ◦ GE Operations IQP PostgreSQL Database ◦ GE Proficy Authentication PostgreSQL Database 4. Install Workflow Task Client. 5. Install the VC++ 2015-2019 Redistributable (x64) version that got installed with Operations Hub 2.1.	
If the Data Distributor service started at a time when the datasource was offline, reload the end application.	DE158762
For REST connection, if you enter an IP address instead of the hostname in the **Auth URL** field, it results in a 404 error. You must add the IP address to the list of supported subdomains/zones. To do this: 1. Browse to the location directory on the machine where Operations Hub is installed: `..\ProgramData\GE\Operations Hub\uaa-config` 2. Open the `uaa.yml` file in a text editor. 3. Search for `hostnames` in the file, and enter the IP address. 4. Save and close the file. 5. Restart Proficy Authentication for the changes to take effect.	DE153631
When importing a model containing a second CIMPLICITY namespace table, it overwrites the values in the first namespace table. Workaround: Combine the server and namespace information from the two namespace tables into one namespace table, and then import the model again.	DE47669
The inline mimic write operations performed in Operations Hub are indicated as successful even if the entries did not meet the criteria of these CIMPLICITY attributes.	DE156030

Table 2. Known Issues and Limitations

The following known issues and limitations exist.

(continued)

Description	Tracking ID
• WARNING_LOW_N • WARNING_HIGH_N • ALARM_LOW_N • ALARM_HIGH_N The values do not get updated to the CIMPLICITY point control panel.	
Error message does not appear when you perform a write operation on a CIMPLICITY tag value that is outside of a given range.	DE157698
If you select **Acknowledge All** in Operations Hub to acknowledge 5000 iFIX alarms, an internal error occurs in the iFIX application.	DE161742
Only a single instance of the CIMPLICITY HMI Webspace widget per app is supported. If using multiple instances of webspace widgets across multiple pages, you may encounter access error messages when navigating between pages that contain webspace instances. After confirming the message, the widget loads as expected.	
The `typeName` parameter in the custom widget's `manifest.json` file does not support special characters.	DE162893
For Operations Hub 2022 release, Proficy Authentication server validation fails while installing Workflow Task Client. As a workaround to fix this issue, please refer to Resolving Proficy Authentication Issue During Workflow Task Client Install *(on page 615)*.	DE174960
In Operations Hub 2022.4.1, line chart legend is not updating based on the updated parameters for the chart. The line chart always shows only the initially fetched data for a query.	

Fixed Defects

Table 3. Fixed Defects

The following fixed defects have been addressed with this version of Operations Hub.

Description	Tracking ID
Previously, the output returned by the Dropdown *(on page 527)* integration widget was incorrect if the query had two similar **Select output field** values. This issue has been resolved.	SF00991349
Previously in the end app, the size of the Dropdown *(on page 339)* native widget appeared larger than the other widgets (for example, Input) set to the same size. This issue has been resolved.	SF00993323
Previously, the dropdown selection did not revert to default when switching between pages in an end app. This issue has been resolved.	SF00986712
Previously, `Dropdown` label name appeared for a dropdown in the end app even when no label was given. By default, the dropdown integration widget populates a label if the **Label** property is empty. This issue is fixed by setting the default label value to a blank value.	SF01000424
Previously in the end app, images were not appearing in the size set in the Datagrid widget. This issue is fixed by providing an option to set an image/icon size for datagrid **Rows** property.	SF00991337
Previously, if an administrator renamed a favorite created by a non-admin user, the favorite was inaccessible to the non-admin user. This issue has been resolved.	SF00991863
Previously, output variables lost their global status if the entity was renamed. This issue has been resolved.	SF00996685
Previously, the Trend widget appeared with missing text if the browser language was set to Dutch. This issue has been resolved.	SF00997200
Previously on the Trend chart, values with decimals appeared as whole numbers on the y-axis scale if the option **AUTOFETCH LIMITS** was disabled. This issue has been resolved.	SF01000873
Previously, SQL queries with multiple result sets cannot be added on the same page. This issue has been resolved. Multiple instances of a query with	SF00965428, SF01002841

Table 3. Fixed Defects

The following fixed defects have been addressed with this version of Operations Hub.

(continued)

Description	Tracking ID
multipe result sets, each with different inputs per query can be added to the page.	
Previously in Operations Hub page designer, a query with an identical input and output name added to a page led to data issues in the end app. This issue has been resolved.	SF00984121
Previously in the end app, the values in a dropdown loaded inconsistently. This issue has been resolved.	SF00990033
iFIX Color and String lookup tables were not working in Operations Hub mimics. Animation with Exact Match did not work for analog tags (AI, AA). This issue has been resolved.	SF00990809
Previously in the dropdown plugin, a default label name appeared in the end app even if no label name was provided. This issue has been resolved.	SF01000424
Previously on importing an app with Operations Hub screens resulted in the entities being overwritten. This issue has been resolved.	SF00998136
Previously in Datagrid and Pivot grid, there was no option to disable data export at runtime. This issue has been resolved by providing the **Allow Export** property.	SF01004560
Previously, multiple pivot tables overlapped at runtime if the plugin height was set to `0`. This issue has been resolved.	SF01004570
Previously, the pivot grid table disappeared on using the export option at runtime. This issue has been resolved.	DE176354
Previously, the DateTime Range Picker design was not user-friendly. This issue has been resolved.	SF01004753
Previously in Interactive Map, some images were lost after exporting and importing the app. This issue has been resolved.	SF01004368

Table 3. Fixed Defects

The following fixed defects have been addressed with this version of Operations Hub.

(continued)

Description	Tracking ID
Previously, if a hidden condition was applied to a container with a paginated table, the table data was not populated as expected at runtime. This issue has been resolved.	SF00990614
Previously with Historian extension queries, the data calculation based on daylight saving time led to varied output values. This issue has been resolved.	SF00995370
Previously, Historian extension queries did not support the special character `/` (slash) in Historian tag names. This issue has been resolved by modifying the code to handle more special characters including `/` (slash).	SF00996737
Previously, errors occurred on upgrading from Operations Hub 2.1 to 2022. The upgrade related errors have been resolved.	SF01004243
Previously on upgrading to Operations Hub 2022, error logs indicated plugin transformation errors for some of the widgets. This issue has been resolved.	SF01004995
Previously, date and timestamp format error occurred on switching to the Japanese language in Chrome. This issue has been resolved.	SF01006938
Previously, an unknown error occurred on importing an app as a duplicate. This issue has been resolved.	SF01005341
Previously, issues were observed with the alignment of the Date Picker widget at runtime. This issue has been resolved.	SF01005133
Previously in Analysis App trend configuration section, the specification limit labels were missing if Chrome browser language was set to Norwegian. This issue has been resolved.	SF01010682
Import log file displayed errors on importing an asset model to Operations Hub. This issue has been resolved.	SF01009452
Random errors occurred in Operations Hub from time to time. This issue has been resolved.	SF01009316

Compatibility Matrix

Table 4. Compatibility Matrix

The following products are compatible with Operations Hub.

Product	Required Version
Proficy Historian	• Historian 7.2 with the latest SIM • Historian 8.0 • Historian 8.1 • Historian 9.0 • Historian 9.1 • Historian 2022 **Note:** Historian REST APIs are required for REST integration between Operations Hub and Historian 8.x and above. Historian REST APIs are installed automatically when you install Historian web-based clients.
Proficy Plant Applications	Plant Applications 2022
Proficy Authentication (UAA)	UAA 2022
Proficy iFIX	• iFIX 6.0 (read operations) • iFIX 6.1 (read operations) • iFIX 6.5 with latest SIM (OPC UA + Workspace) (read and write operations) • iFIX 2022 (read and write operations) **Note:** Mimic and model publish to Operations Hub 2.1 is supported only with iFIX 6.5 with latest SIM and iFIX 2022.
Proficy CIMPLICITY	• CIMPLICITY 10 (read operations) • CIMPLICITY 11 (read operations)

Table 4. Compatibility Matrix

The following products are compatible with Operations Hub.

(continued)

Product	Required Version
	• CIMPLICITY 11.1 (read and write operations) • CIMPLICITY 2022 (read and write operations) **Note:** Mimic and model publish to Operations Hub 2.1 is supported only with CIMPLICITY 11.1 CIMPLICITY 2022.
Proficy Workflow	Workflow 2.6 SP1 SIM4
GE Common Licensing	Version 20.2.2002

Chapter 2. Getting Started in Windows

Installing Operations Hub on Windows

System Requirements

This topic provides the requirements for hardware components, browsers, and operating systems.

When you install Operations Hub, all the required components are automatically installed.

Minimum Hardware Requirements

You can install Operations Hub on a processor with 4-core configuration and a RAM of 16 GB.

To support up to 300 concurrent users, you need a hardware configuration of at least 32GB and an 8-core CPU.

Supported Operating Systems

You can install Operations Hub on any of the following desktop operating systems:

- Microsoft Windows 11
- Microsoft Windows Server 2016
- Microsoft Windows Server 2019
- Microsoft Windows Server 2022

Operations Hub can also be installed on VMs deployed on Azure and AWS.

Supported SQL Versions

You can use Operations Hub with external data sources from the following relational databases:

- Microsoft SQL Server 2016
- Microsoft SQL Server 2017
- Microsoft SQL Server 2019

Supported Browsers

You can access Operations Hub using any of the following web browsers:

- Google Chrome (recommended)
- Mozilla Firefox

- Apple Safari
- Microsoft Edge

We recommend using a resolution of 1600 x 1200 for the browser. In addition, use a relatively modern device so that the browser has enough resources to render the visualizations and respond to user interactions with adequate performance.

The following mobile devices are supported for client access (end-app support only):

- iOS 12.0 or later
- Android 9.0 or later

Note:
We recommend using a device with medium to high resolution, and in landscape mode.

Compatibility Matrix

The following products are compatible with Operations Hub.

Product	Required Version
Proficy Historian	• Historian 7.2 with the latest SIM • Historian 8.0 • Historian 8.1 • Historian 9.0 • Historian 9.1 • Historian 2022 **Note:** Historian REST APIs are required for REST integration between Operations Hub and Historian 8.x and above. Historian REST APIs are installed automatically when you install Historian web-based clients.
Proficy Plant Applications	Plant Applications 2022
Proficy Authentication (UAA)	UAA 2022

<table>
<tr><th>Product</th><th>Required Version</th></tr>
<tr><td>Proficy iFIX</td><td>• iFIX 6.0 (read operations)
• iFIX 6.1 (read operations)
• iFIX 6.5 with latest SIM (OPC UA + Workspace) (read and write operations)
• iFIX 2022 (read and write operations)

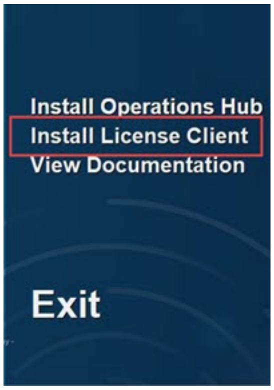
Note:
Mimic and model publish to Operations Hub 2.1 is supported only with iFIX 6.5 with latest SIM and iFIX 2022.</td></tr>
<tr><td>Proficy CIMPLICITY</td><td>• CIMPLICITY 10 (read operations)
• CIMPLICITY 11 (read operations)
• CIMPLICITY 11.1 (read and write operations)
• CIMPLICITY 2022 (read and write operations)

Note:
Mimic and model publish to Operations Hub 2.1 is supported only with CIMPLICITY 11.1 CIMPLICITY 2022.</td></tr>
<tr><td>Proficy Workflow</td><td>Workflow 2.6 SP1 SIM4</td></tr>
<tr><td>GE Common Licensing</td><td>Version 20.2.2002</td></tr>
</table>

Licenses for Operations Hub

This topic describes the licenses available, and the differences between them.

Install the licensing client software from the Operations Hub ISO right after installing Operations Hub.



> **Note:**
> Previous licensing is replaced with Proficy licensing. For information on installing and configuring your license, refer to the GE Support site.

These are the three license levels for using Operations Hub.

Trial Version

If you do not have a license yet, you can start with a trial version that lasts for a period of two hours, and is limited to a single user.

Operations Hub Add-On for Historian

It is available as an Add-On when you purchase Proficy Historian. This is the only application provided for this tier with limited functionality. Refer to the Functionality Comparison *(on page 23)* table to compare with the full product functionality.

Analysis Tier

With this tier, you have complete access to Operations Hub end-to-end functionality.

Functionality Comparison

Functionality	Operations Hub Add-On for Historian	Analysis Tier
Ability to create, edit, and delete data sources	Yes	Yes
Ability to create, edit, and delete entities	Yes	Yes

Functionality	Operations Hub Add-On for Historian	Analysis Tier
Ability to create, edit, and delete queries	Yes	Yes
Ability to assign permissions for events	Yes	Yes
Ability to view Out of the box Analysis App	Yes	Yes
Ability to create, edit, and delete apps	No	Yes
Ability to assign permissions for apps	Yes	Yes
Ability to assign permissions for app pages	Yes	Yes
Ability to create, edit, and delete users	Yes	Yes
Ability to change your own password	Yes	Yes
Ability to create, edit, and delete roles	Yes	Yes
Ability to map existing UAA groups	Yes	Yes
Ability to map Existing LDAP groups	Yes	Yes

Install Operations Hub

This topic describes how to perform step-by-step installation of Operations Hub.

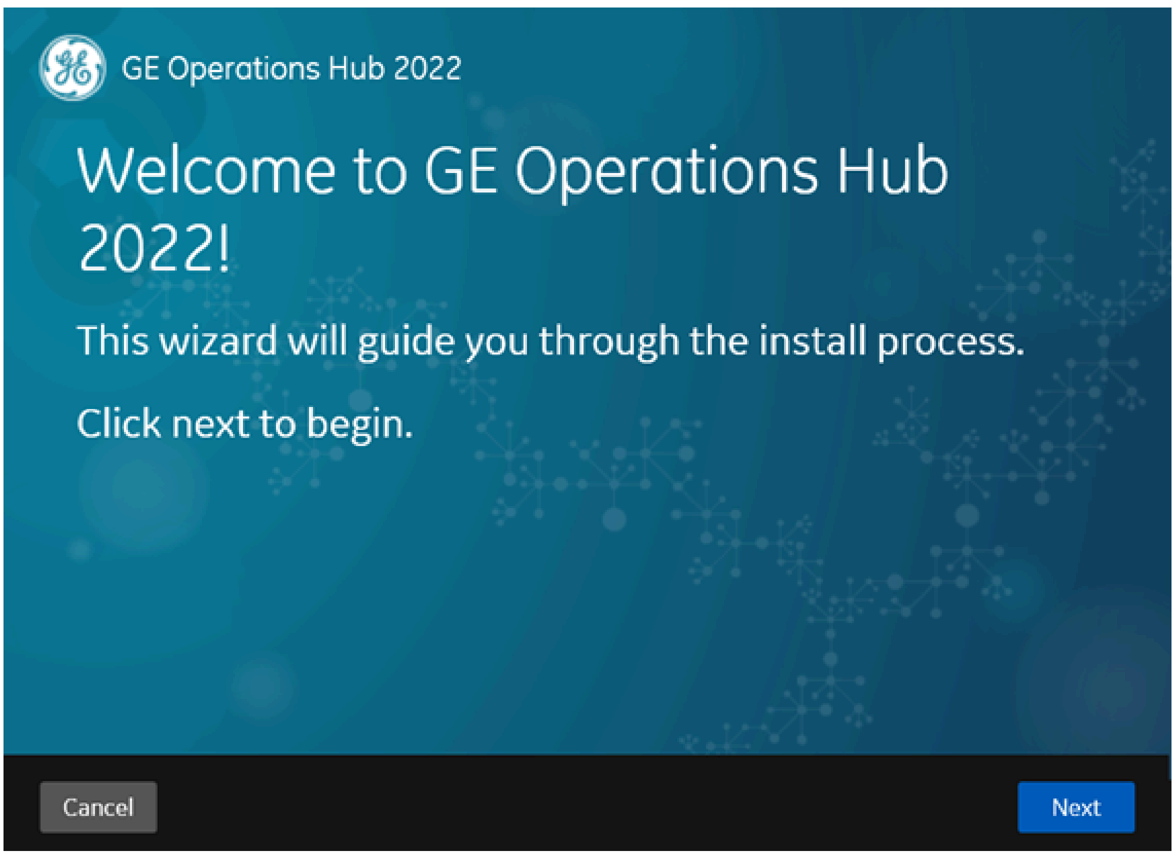
- Ensure that the machine on which you want to install Operations Hub meets the System Requirements *(on page 20)*.
- Use a machine that does not host any applications that are bundled with Operations Hub.
- Run a Windows update (including security updates).
- Use a host name that contains up to 24 characters and any of the following characters:

  - Alphabetic characters
  - Numeric characters
  - Minus
  - Period
- Ensure that you have administrative privileges to the machine on which you want to install Operations Hub.

This topic describes how to install Operations Hub stand-alone (by downloading the installer from Salesforce).

You can also install Operations Hub in unattended mode *(on page 43)*.

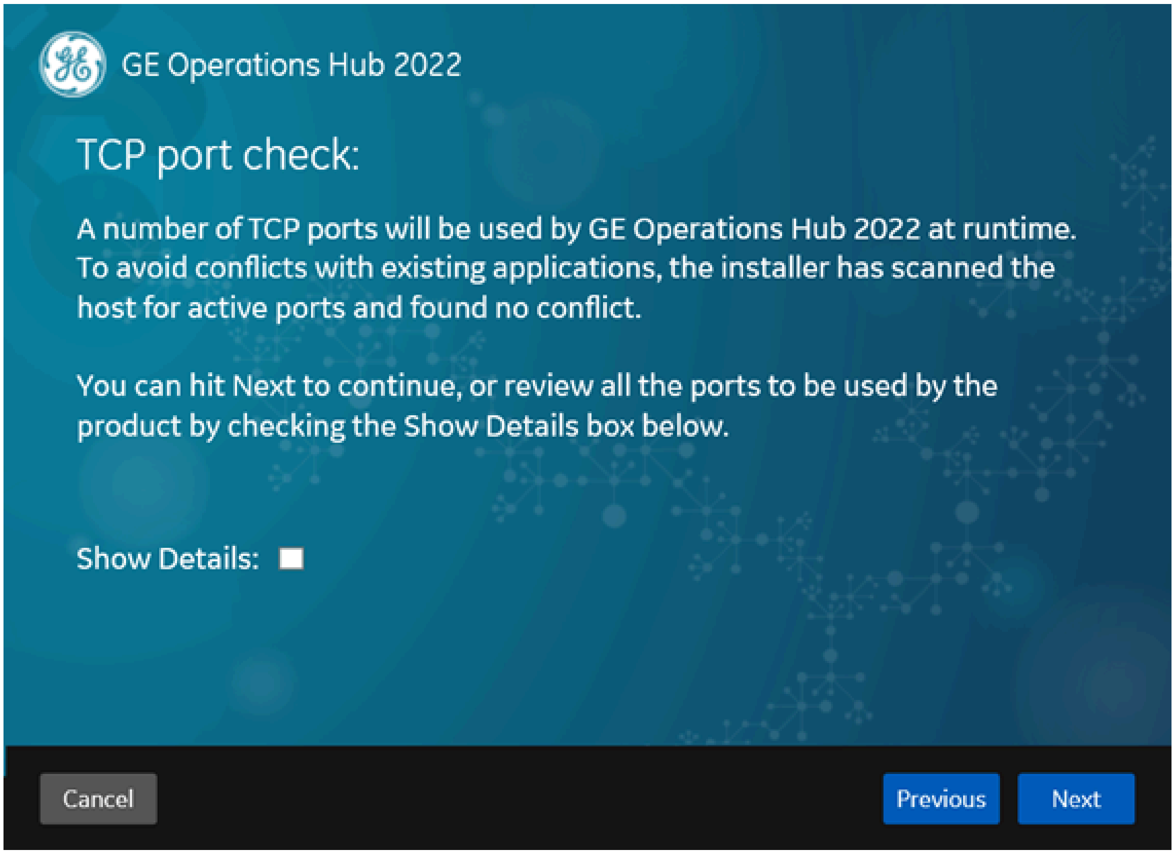
1. Run the Operations Hub installation DVD, and then select **Install GE Operations Hub**.
   The welcome screen appears.

2. Select **Next**.
   The license agreement screen appears.

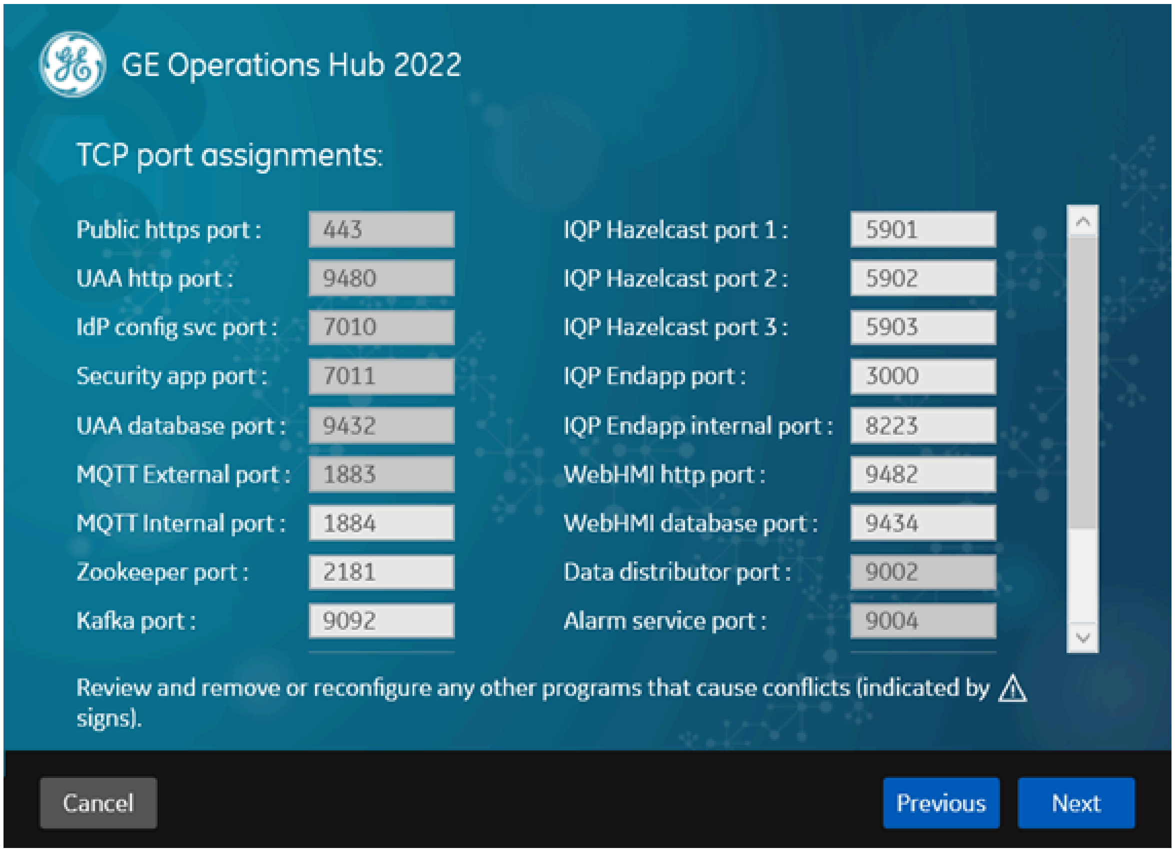
3. Select the **Accept** check box, and then select **Next**.

   The TCP port screen appears to check whether the ports chosen for Operations Hub are available.



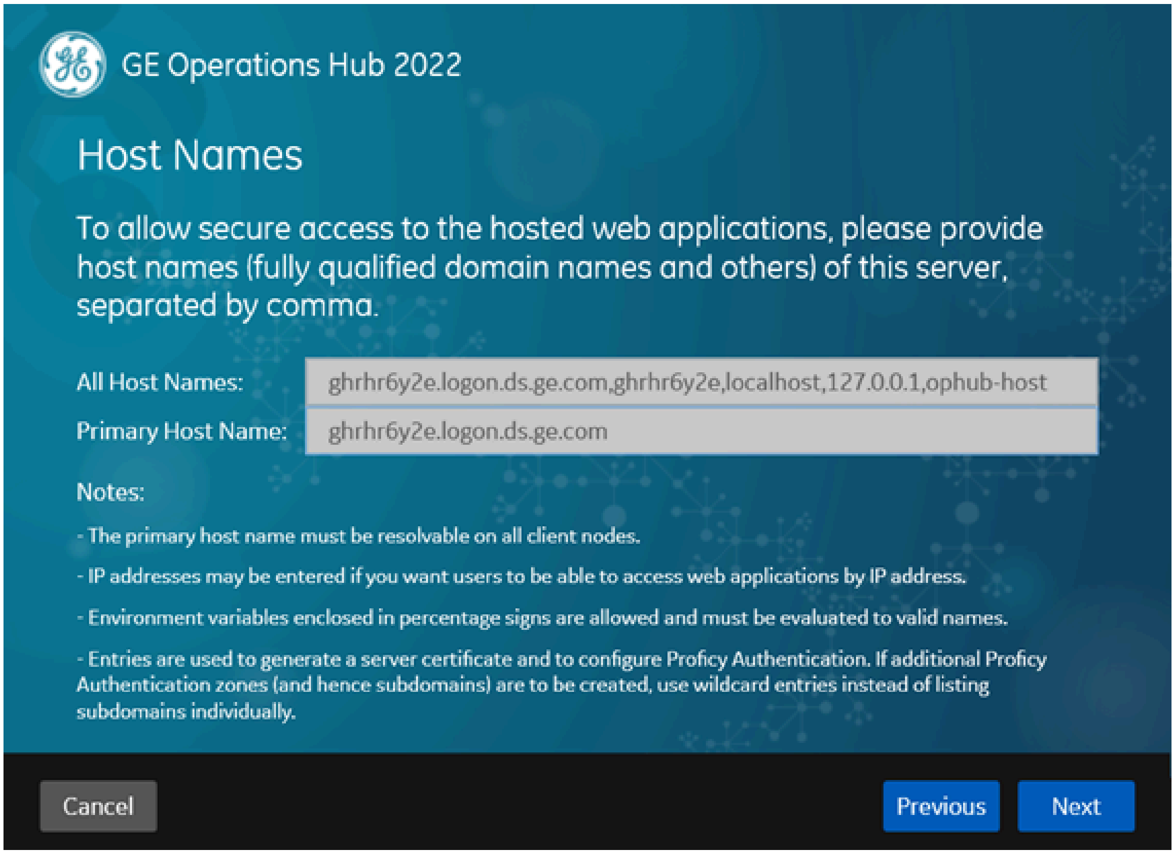
4. To review or change the ports for Operations Hub, select the **Show Details** check box.

   The TCP port assignments screen appears with a list of ports used by the various components in Operations Hub.



Note:
Use care when changing port numbers to avoid conflict with an existing application. Generally, a port number higher than 1023 should be assigned, since ports 0 to1023 are well known ports typically already assigned on Windows systems for different purposes.

5. If needed, modify the port numbers, and then select **Next**.
   The Host Names screen appears populating default host name values.



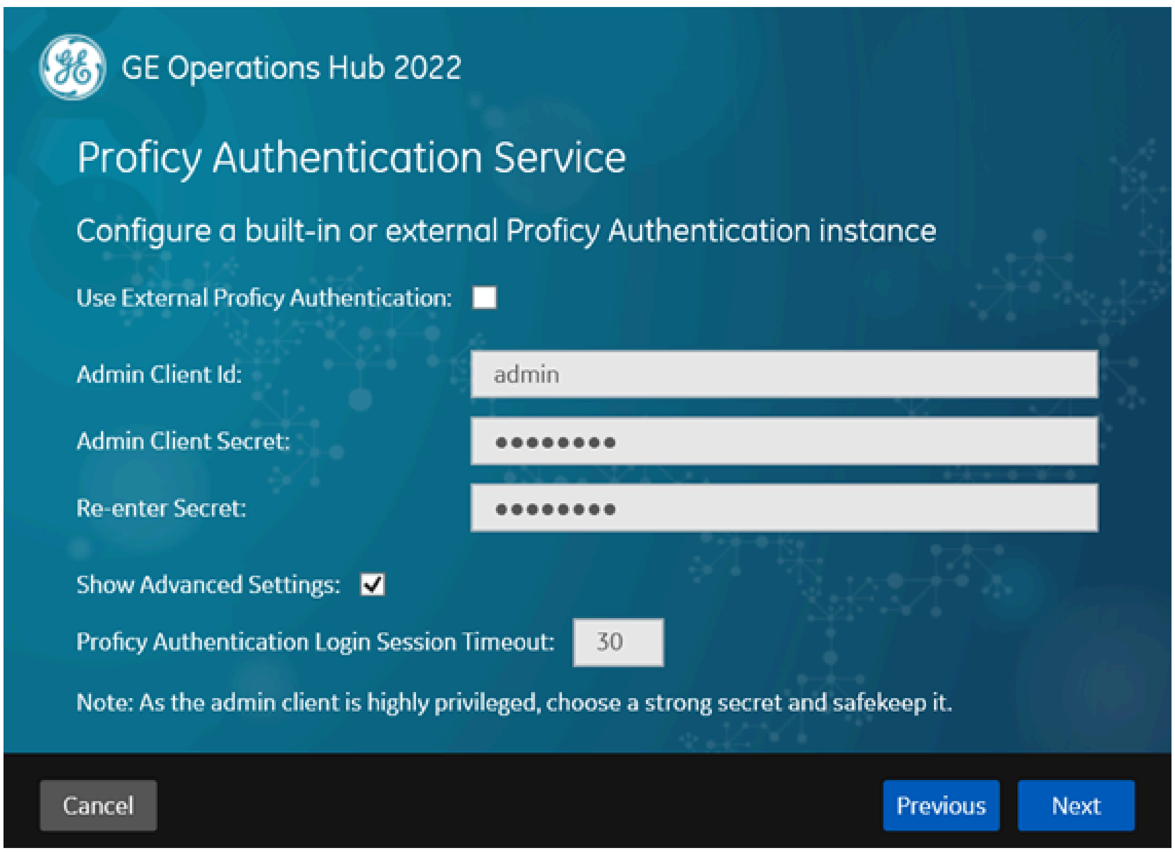
6. Enter the details as follows:

Field	Description
All Host Names	Machine details to access Operations Hub following the install. Choose from: ◦ Fully qualified domain name (FQDN) ◦ host name ◦ IP address **Note:** ◦ If you want to provide more than one of the aforementioned values, use a comma to separate them. ◦ If you want to add the Fully Qualified Domain Name (FQDN) after completion of the install, the

Field	Description
	safest way to apply the FQDN is to uninstall without purge, and then reinstall with the FQDN in the Host Names screen.
Primary Host Name	This field remains in a disabled state. It is updated with the first value from **All Host Names**.

7. Select **Next**.

The Proficy Authentication Service screen appears.



8. If you want to use the Proficy Authentication (UAA) service that is integrated with Operations Hub, then enter the following details.

Field	Description
Admin Client Id	The client Id to log in to the Proficy Authentication application.

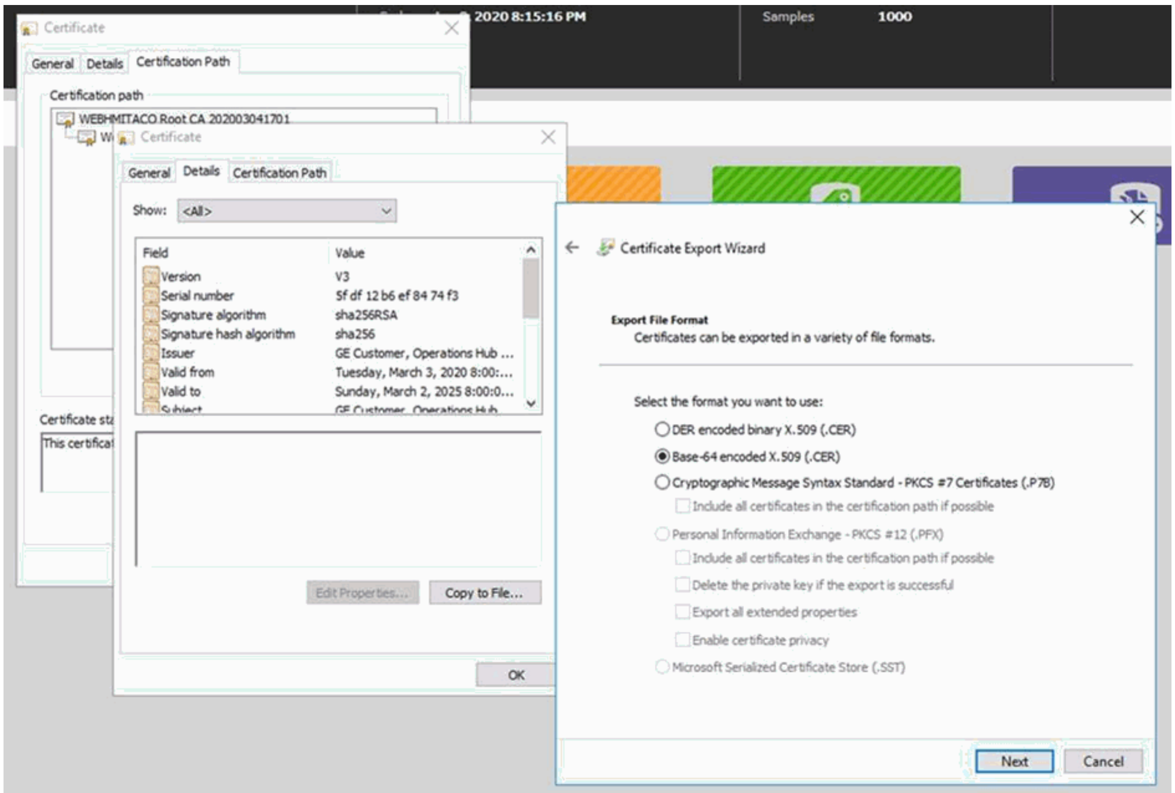
Field	Description
Admin Client Secret	The client secret to log in to the Proficy Authentication application. ◦ Client secret should be at least 8 characters, containing at least: ▪ one upper case ▪ one lower case ▪ one numeric ▪ one special character ◦ Client secret cannot contain the ampersand (&) or percent (%) special characters.
Re-enter Secret	Verifies and confirms the client secret.
Use External Proficy Authentication	Select the check box if you want to use an external Proficy Authentication service.
Show Advanced Settings	Select the check box to reveal the option to set login session timeout.
Proficy Authentication Login Session Timeout	Enter the idle time for a login session in minutes. After expiry of the idle time, you must log in to the application again to resume working.

9. If you choose to use an external Proficy Authentication service, then enter the details as follows:

Field	Description
Proficy Authentication Base URL	URL of Proficy Authentication (UAA) service. **Note:** ◦ If referencing Historian 7.x UAA, then use a URL similar to this: `https://historian7x:8443/uaa`. If referencing Historian 8.x or later, then use a URL without port number. For example: `https://historian8x/uaa`.

Field	Description
	◦ Historian 7.x requires a different port than Historian 8.x or later. For Historian 7.x, the default port to connect to Proficy Authentication is `8443`. For Historian 8.x or later, the default port to connect to UAA is `443`. ◦ If the ports were customized, then use the selected port.
Admin Client Id	ID of the administrator account of the Proficy Authentication client.
Admin Client Secret	Client secret of the administrator account.
Proficy Authentication certificate file	The path to the certificate file used by the Proficy Authentication service. **Note:** ◦ If provided, the certificate file must be a `.pem` file for the root issuer (not the Proficy Authentication server certificate). ◦ Export the root certificate from Proficy Authentication Service, and save using the Base 64 option (as shown in the following figure). Then, rename the exported `.cer` file to `.pem` so you can use it here in Operations Hub. ◦ After completion of install, this certificate should also be imported into Trusted Root Certification Authorities certifi-

Field	Description
	cate store on client machines, to suppress warnings given by browsers such as Chrome.



10. Select **Test** to test the connection to the external Proficy Authentication instance based on the provided details.

    These are some of the possible messages you may encounter when testing the connection.

Issue	Warning	Resolution
Invalid credentials	401 Unauthorized.	Check the admin client ID and admin client secret provided to the External Proficy Authentication URL.
No certificate	The test will pass, but the user is requested to provide the Proficy Authentication root issuer's certificate.	Provide the Proficy Authentication root issuer certificate file in the install.

Issue	Warning	Resolution
Invalid certificate	Test succeeds but the certificate is not used- error reported if bad certificate used.	Provide the correct Proficy Authentication root issuer certificate file in the install.
Incorrect case sensitivity in URL or host name has a mismatch	Test succeeds but changes are required due: ◦ External Proficy Authentication server name resolution. ◦ Actual mismatch with the Proficy Authentication base URL and the issuer Uri in the `uaa.yml` file.	Make sure the issuer Uri in the `uaa.yml` file and the Proficy Authentication Base URL match exactly.
Error connecting to External Proficy Authentication	External Proficy Authentication server name resolution issue.	Check to make sure the External Proficy Authentication is running. Check to make sure the issuer Uri in the `uaa.yml` file and the Proficy Authentication Base URL match.
Error negotiating TLS connection	The issuer Uri in the `uaa.yml` has just the host name while the user provides an FQDN in the Proficy Authentication base URL.	This error happens either while testing the user entered Proficy Authentication Base URL or when testing the issuer Uri. The error message will indicate what issue is. The root cause is due to either the name in the Proficy Authentication base url or the issuer URI name under testing can not be authenticated by the certificate provided. Again, make sure the issuer Uri in the `uaa.yml` file and the Profi-

Issue	Warning	Resolution
		cy Authentication Base URL match exactly.

Note:

- To locate the `uaa.yml` file on the Historian machine, go to the following folder: `C:\ProgramData\GE\Operations Hub\uaa-config\uaa.yml`. Find the issuer: `uri: https://<YourHistorianServerName>/uaa`.
- The install is not blocked from proceeding without the corrections from the previous table. However, there will be some runtime errors which may require an administrator to reconfigure. See the following scenarios for Historian 7.x and Historian 8.x or later.

For Historian 8.x or Later: If Proficy Authentication URL in the Operations Hub install does NOT match with the Historian 8.x or later UAA URL, then you receive an `Issue not trusted` error when attempting to import a model. Examples of Proficy Authentication URLs used during the Operations Hub install may be a URL with a Fully Qualified Domain Name (FQDN) or one that includes a port number such as: `https://z840his2019:443/uaa`. If there is a mismatch, change Historian's UAA `uaa.yml` file so the issuer URI matches with that in the certificate. If Historian 8.x or later is installed with a Fully Qualified Domain Name (FQDN), then utilize the FQDN when specifying the external Proficy Authentication URL. For example: `http://histFQDN/uaa`.

If Historian 8.x or later is installed with a host name like `historian8`, then utilize the host name when specifying the external Proficy Authentication URL. For example: `http://historian8/uaa`.

Basically, the issuer URI in the `uaa.yml` file and the Proficy Authentication Base URL must match exactly. This will ensure the Operations Hub Administrator user is able to login successfully.

For Historian 7.x: If Proficy Authentication URL in the Operations Hub install does NOT match the Historian 7.x UAA URL, then you receive an `Issue not trusted` error when attempting to import a model. To resolve this:

a. Get the external Proficy Authentication URL that you entered during install. For example, `https://historian7:8443/uaa`.
b. On the Historian machine, access the yaml file located here: `C:\Program Files\GE Digital\UAA\uaa.yml`.
c. Modify the `uaa.yml` to add the following lines at the end of the file:

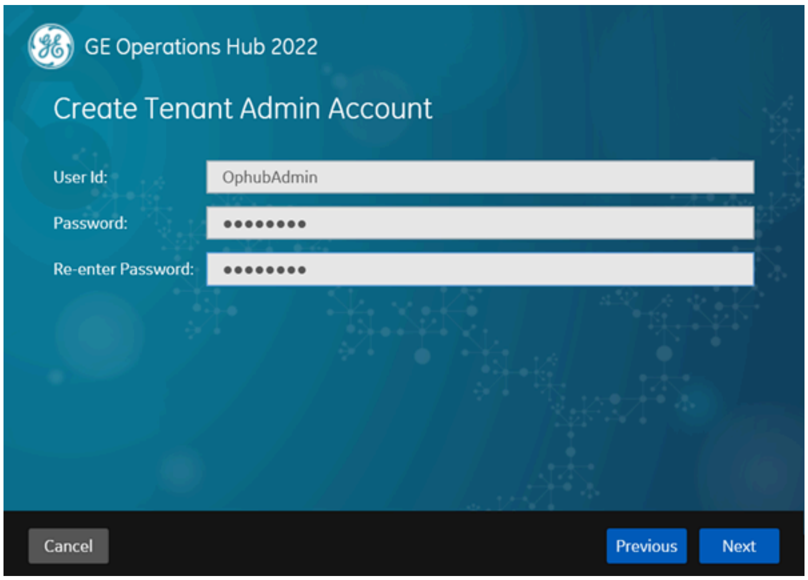
```
issuer:

uri: https://historian7:8443/uaa
```

If Historian 7.x is installed with a host name like `historian7`, then it is recommended to use the external Proficy Authentication URL of `https://historian7:8443/uaa` during the Operations Hub install. In this case, the Operations Hub Admin user is created correctly, and avoids `invalid redirect URL` error.

11. Select **Next**.

    The Create Tenant Admin Account screen appears.

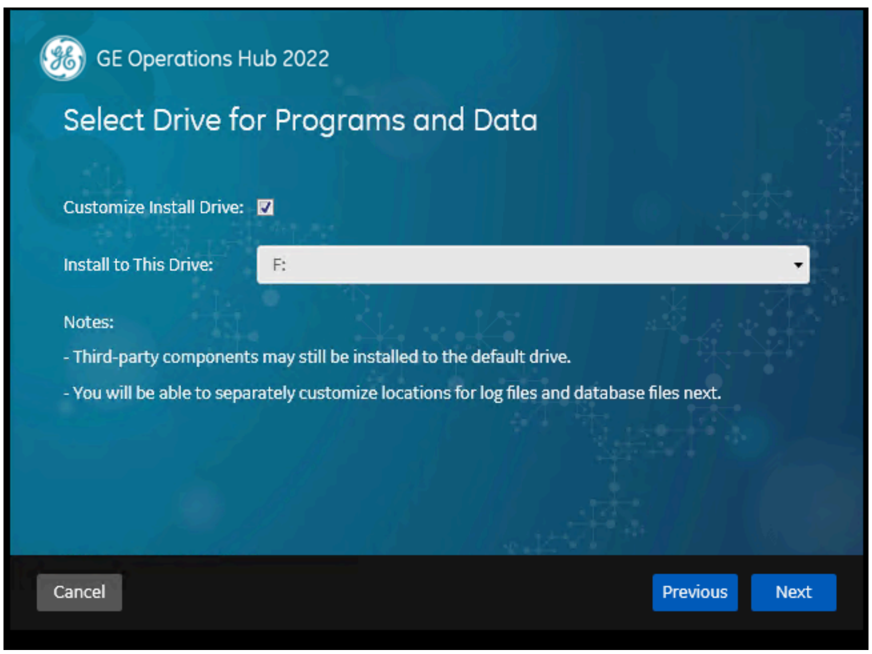


12. Enter the following details, and then select **Next**.

Field	Description
User Id	User ID of the administrator account for Operations Hub. When you provide the tenant user ID, the following conditions apply: ◦ If you are installing Operations Hub for the first time, do not provide StudioAdmin as the tenant user ID because it is used by Operations Hub. ◦ If you want to use a shared Proficy Authentication to work with Operations Hub, do not provide the user ID of an existing user of the Proficy Authentication

Field	Description
	instance. If you do so, the installation fails. ◦ If you are reinstalling Operations Hub, do not provide the tenant user ID that you previously provided. This is because even if you purged the data while uninstalling Operations Hub, the user account, along with the groups and privileges assigned to the user, still exists in the Proficy Authentication instance.
Password	Password for the administrator account.
Re-enter Password	To confirm, re-enter the password for the administrator account.

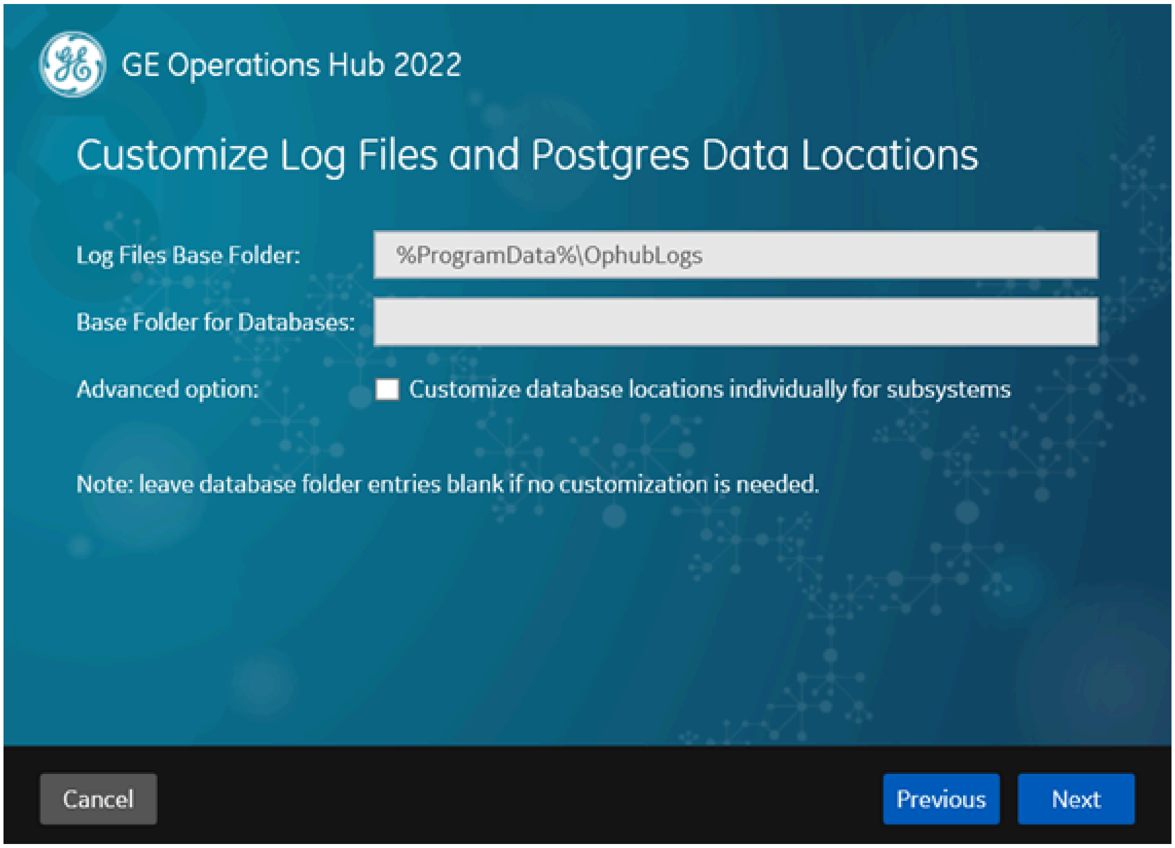
The Select Drive for Programs and Data screen appears.



13. If you want to choose a different drive to install, select the **Customize Install Drive** check box.

    A list of available fixed hard drives on your system appears on the install screen. This screen appears only when more than one fixed hard drive is available on the host machine.
14. Select the drive where you want to install, then select **Next**.

    The Customize Log Files and Postgres Data Locations screen appears.

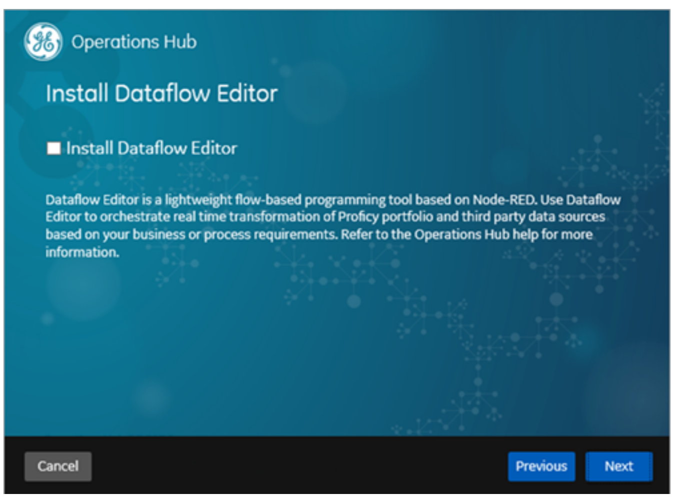


15. Enter the following details, and then select **Next**.

Field	Description
Log Files Base Folder	The path to the log files generated by Operations Hub. By default, the value in this field is `%ProgramData%\OphubLogs`.
Base Folder for Databases	The path to the base folder for the Proficy Authentication, Operations Hub, and WebHMI databases. If you want to use the default folder, leave this field blank. Otherwise, enter the path to the folder that you want to use.
Customize database locations individually for subsystems	Select the check box if you want to use different folders for each database.
Proficy Authentication Database Folder	This field appears only if you have selected the **Customize database locations individually for subsystems** check box. Enter the database

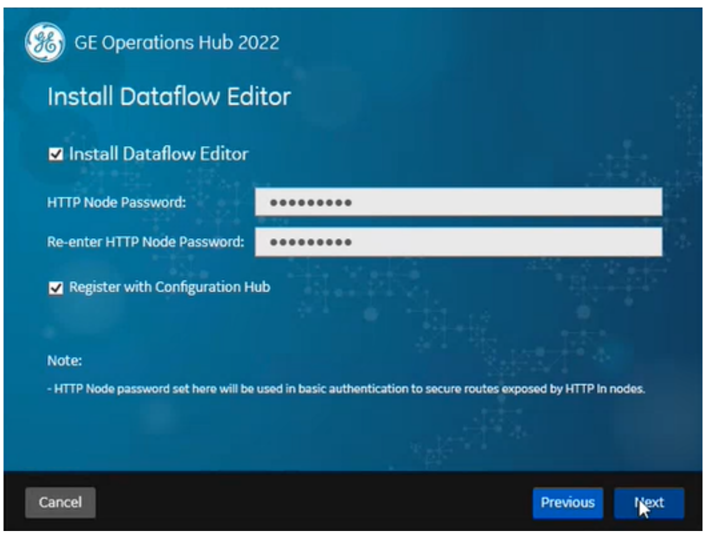
Field	Description
	folder that you want to use for Proficy Authentication. If you want to use the default folder, leave this field blank.
IQP Database Folder	This field appears only if you have selected the **Customize database locations individually for subsystems** check box. Enter the database folder that you want to use for Operations Hub. If you want to use the default folder, leave this field blank.
WebHMI Database Folder	This field appears only if you have selected the **Customize database locations individually for subsystems** check box. Enter the database folder that you want to use for WebHMI. If you want to use the default folder, leave this field blank.

The **Install Dataflow Editor** screen appears.



16. Select the **Install Dataflow Editor** check box if you want to install the tool along with Operations Hub.
17. Enter the following details, then select **Next**.

Field	Description
Http Node Password	Password to secure the Dataflow Editor http node.
Re-enter Http Node Password	Verifies and confirms the password.
Register with Configuration Hub	Select the check box if you want to register Dataflow Editor with Configuration Hub. Before registering, make sure that security authentication source is configured for Configuration Hub. If you choose to register later, refer to Manually Register Dataflow Editor with Configuration Hub *(on page 130)*.

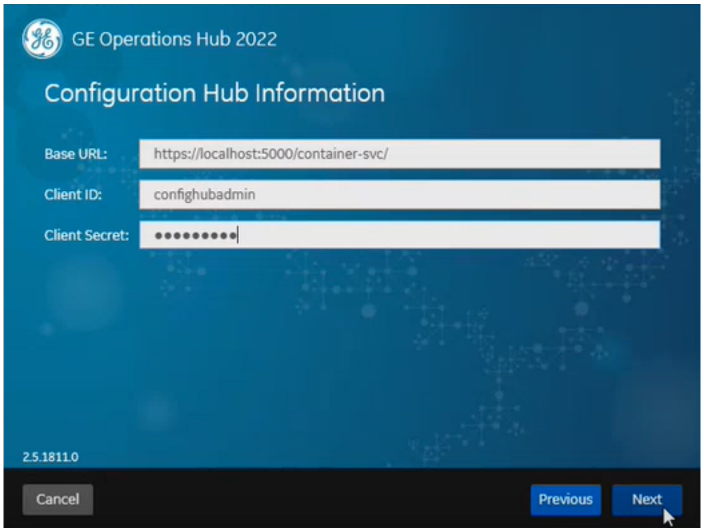


If you choose to register with Configuration Hub, the **Configuration Hub Information** screen appears.

18. Enter the following details:

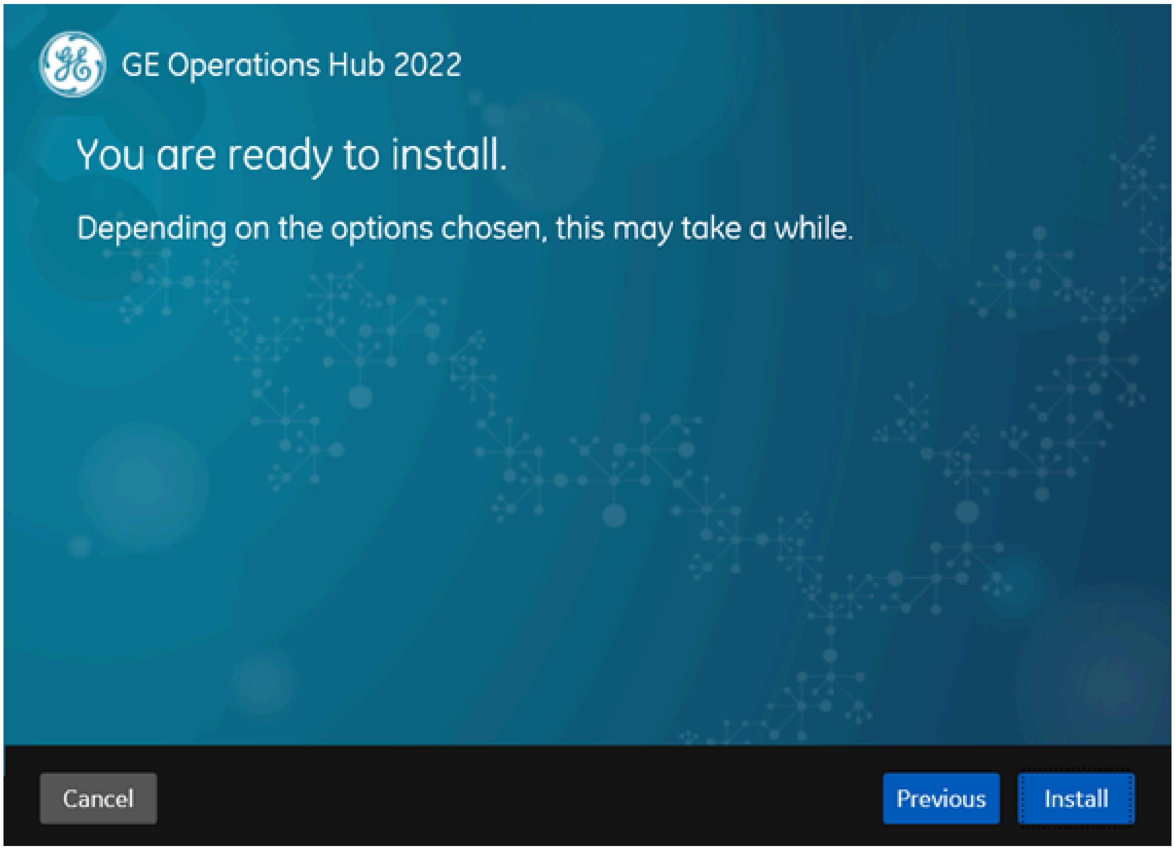
Field	Description
Base URL	Base URL of Configuration Hub container service, such as `https://chhost:5000/container-svc/`.

Field	Description
Client Id	Identifier of a client that has permission (authority) to register with Configuration Hub.
Client Secret	Client secret that can authenticate the client.



19. Select **Next**.

    The ready to install screen appears.



20. Select **Install**.

After the installation is complete, a message appears, specifying that the installation is complete. A link to the log folder appears. All the services used by Operations Hub are started.

Important:

1. It is recommended that you restart your computer following an upgrade of Operations Hub if Plant Applications and Operations Hub coexist on the same resource.
2. After upgrading to Operations Hub 2.0, you will notice the IQP designer uses `app_name` instead of `app_id` in its URLs.
3. If upgrading from 2.0 to 2.1 or later, restart the WebClient services to allow the Plant Applications Web Client to connect successfully to Operations Hub.
    - If using Enterprise WebClient version, restart the Docker service.
    - If using Standard WebClient version, restart the GE PlantApps WebClient Master Control service.
4. Remember to clear your browser cache after upgrading to a newer version of Operations Hub.

5. If a firewall is running on the server, configure the firewall to make sure the public https port used by Operations Hub Public is not blocked. Typically, the port is `443`, but can be a different value that you have selected or that was changed to avoid a conflict. If you are not sure of the port number, the shortcut (URL) placed on the desktop should contain it.

- Install the Certificate on your Clients *(on page 44)* (on each client that you will use to access Operations Hub).
- Log in to Operations Hub *(on page 51)*.
- Install Site Administration Addon *(on page 52)*.

Install Operations Hub in Unattended Mode

This topic describes how to perform a silent install for Operations Hub.

1. Open an elevated command prompt in Windows.
   Command Prompt > Run as administrator
2. Run the following command:
   `<Operations Hub installation folder>\OpHub-Windows-Installer>ophub_bundle.exe <switch>`,
   where `<switch>` is one of the following values:
   - -q, -quiet, -s, -silent: Use one of these values to initiate the automated installation.
   - -passive: Use this value if you want progress bar to appear during the installation.

   For example: `ophub_bundle.exe /quiet UAA_ADMIN_CLIENT_SECRET=adminclientsec OPHUB_TENANT_PASSWORD=adminuserpassword`

Operations Hub is installed.

To install to a different drive from the command line, refer to Non-System Drive Install *(on page 43)*.

You can also install Operations Hub manually *(on page 24)*.

Log in to Operations Hub *(on page 51)*.

Non-System Drive Install

This topic describes how to install to a drive other than C: drive using command line.

Open Windows PowerShell or the Command Prompt with Administrative privileges to install from command line.

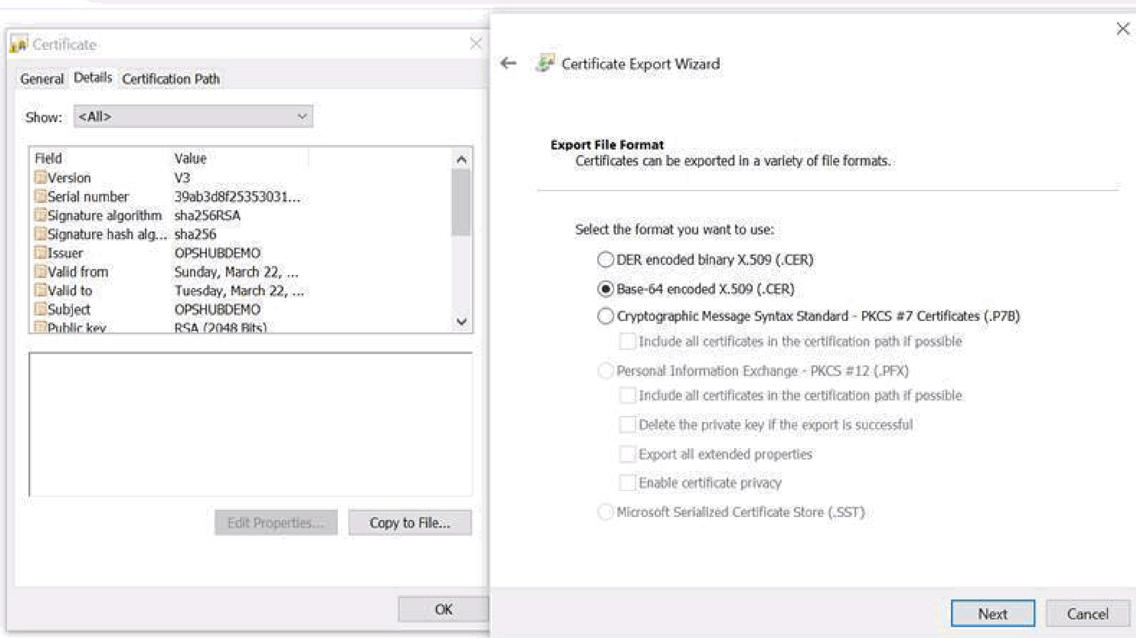
1. Right-click Windows PowerShell or Command Prompt and select **Run as administrator**.
2. Type `Ophub_bundle.exe CUSTOM_INSTALL_DRIVE=E:`
3. Press Enter on your keyboard.

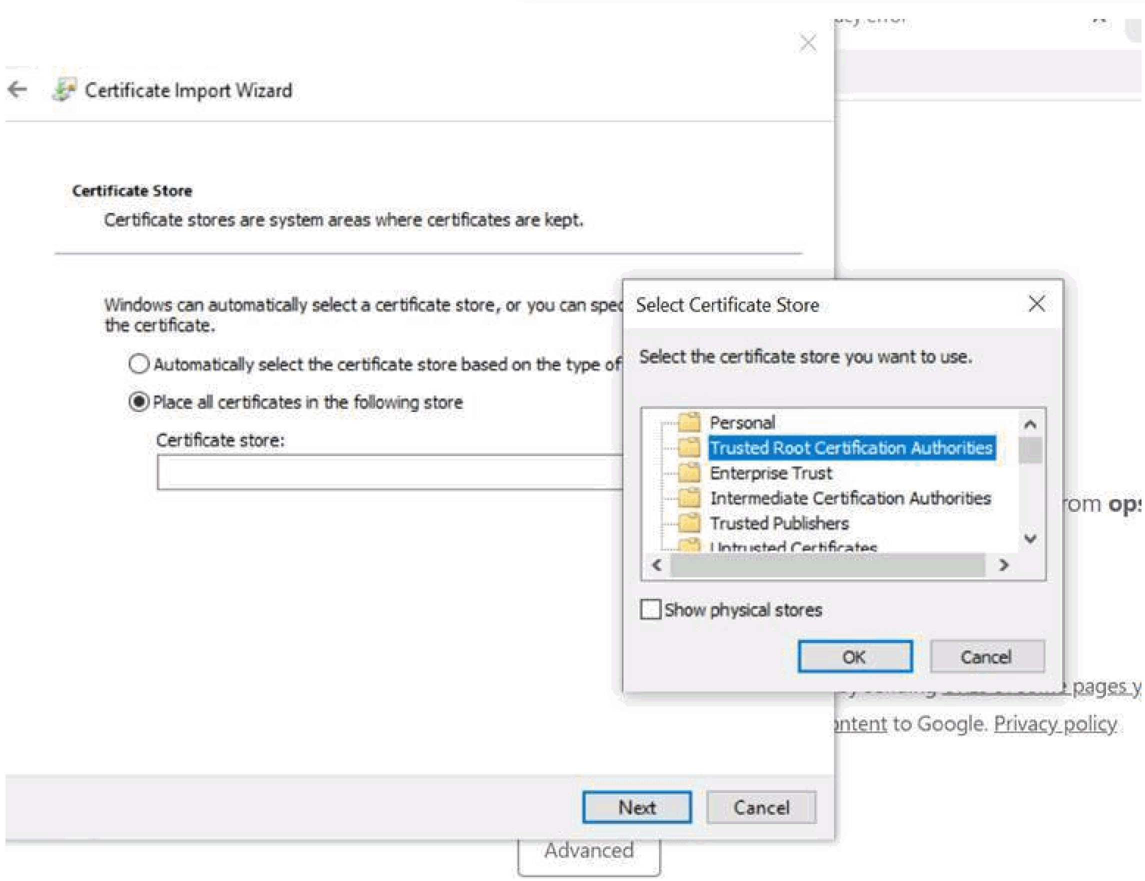
The application program files (which usually go to `C:\Program Files\GE`) and runtime data directories (usually under `C:\ProgramData\GE\`) are relocated to E: drive.

Install the Certificate on your Clients

This topic describes how to install the Certificate Authority (CA) certificate on each client that you will use to access Operations Hub.

1. On the client machine, open a browser such as Google Chrome and access the Operations Hub server using the url: `https://opshubservername/iqp.`
   The browser should display a "Not secure" icon.
2. Right-click the Not Secure icon, which should lead you to a Certificate dialog box.
3. Find the issuer in the **Certificate Path** tab.
4. On the issuer, select **View Certificate**.
5. In the **Certificate** dialog box, on the issuer certificate, select the **Details** tab and then **Copy To File**.
6. Right-click that exported certificate file, and choose to import it into the Trusted Root Certificate Authorities store.


Certificate
General
Details
Certification Path
Show: <All>
Field
Value
Version
V3
Serial number
39ab3d8f25353031...
Signature algorithm
sha256RSA
Signature hash alg...
sha256
Issuer
OPSHUBDEMO
Valid from
Sunday, March 22, ...
Valid to
Tuesday, March 22, ...
Subject
OPSHUBDEMO
Public key
RSA (2048 Bits)
Edit Properties...
Copy to File...
OK
Certificate Export Wizard
Export File Format
Certificates can be exported in a variety of file formats.
Select the format you want to use:
DER encoded binary X.509 (.CER)
Base-64 encoded X.509 (.CER)
Cryptographic Message Syntax Standard - PKCS #7 Certificates (.P7B)
Include all certificates in the certification path if possible
Personal Information Exchange - PKCS #12 (.PFX)
Include all certificates in the certification path if possible
Delete the private key if the export is successful
Export all extended properties
Enable certificate privacy
Microsoft Serialized Certificate Store (.SST)
Next
Cancel


Certificate Import Wizard
Certificate Store
Certificate stores are system areas where certificates are kept.
Windows can automatically select a certificate store, or you can spec
the certificate.
Automatically select the certificate store based on the type of
Place all certificates in the following store
Certificate store:
Select Certificate Store
Select the certificate store you want to use.
Personal
Trusted Root Certification Authorities
Enterprise Trust
Intermediate Certification Authorities
Trusted Publishers
Untrusted Certificates
Show physical stores
OK
Cancel
Next
Cancel
Advanced

Install Operations Hub, Historian and SCADA on a Single Machine

This topic describes the installation of Operations Hub, Historian, and SCADA (iFix, Cimplicity) on the same computer.

Ensure that the machine on which you want to install meets the installation requirements for these applications.

- Operations Hub 2022
- Historian 2022
- iFix 2022
- Cimplicity 2022 and Webspace 6.0

You can install the applications in any order, and in multiple combinations, on the same machine. The order of installation in the following steps is only an example to accomplish this task. You can use a shared Proficy Authentication (UAA) for installing multiple products on the same computer.

1. Run the installation DVD for Historian, and install web-based clients:
    - Historian Server
    - Historian Collectors
    - Historian Web-based Clients

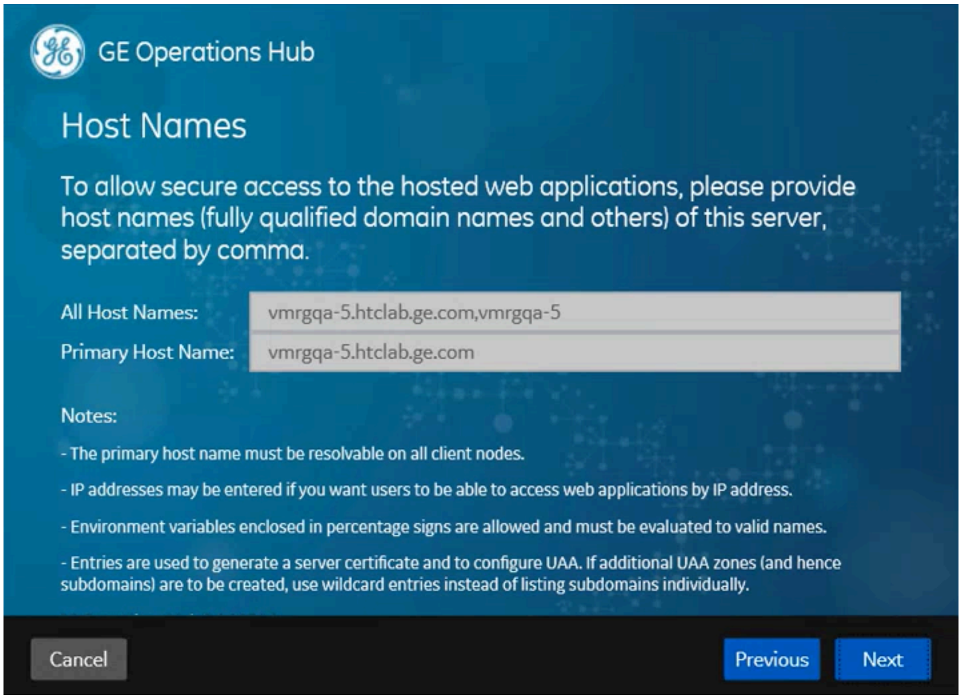
    The installation creates an application shortcut for the components on your desktop. Proficy Authentication is also installed as part of the Historian installation.

    > **Important:**
    > Do NOT install Historian Standalone Help. This restriction applies to installing Historian and Operations Hub on the same machine.
    >
    > If Historian online help is already installed, make sure to uninstall before installing Operations Hub.

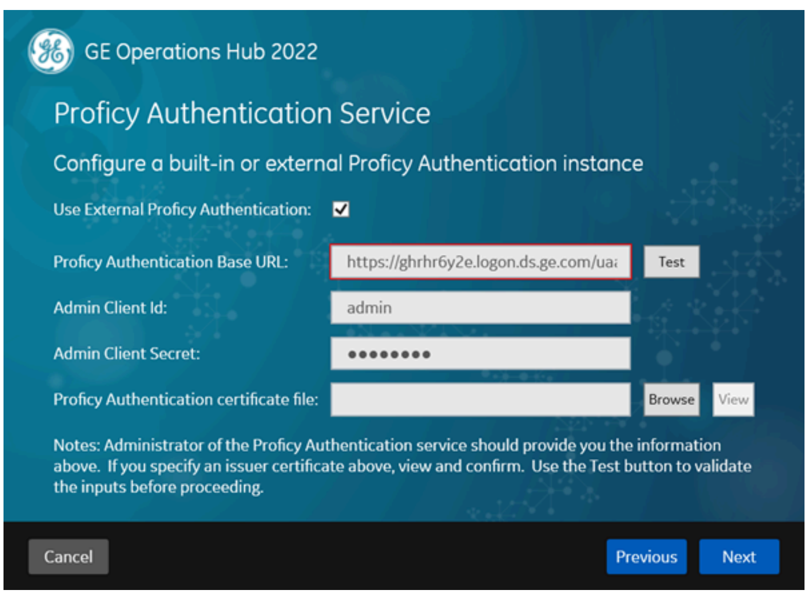
2. On the same machine, run the installation for SCADA (iFix or Cimplicity). Configure the following:
    a. Create and configure SCADA points.
    b. Configure Alarms.
    c. Configure and publish pictures/mimics to Operations Hub (after Operations Hub is installed).
3. On the same machine, run the installation DVD for Operations Hub, and follow the wizard to install the application *(on page 24)*.

    Important points to consider:

- The FQDN details cannot be modified if you install Operations Hub after installing Historian on the same machine. The host names provided during Historian installation are acquired by default.



- Do not select **Use External Proficy Authentication** if installing Operations Hub after installing Historian on the same machine. Historian's UAA instance is already installed on your machine.



4. After installing, log in to Operations Hub with your user credentials.
   If you open Historian Web Admin while logged into Operations Hub on the same machine, you may receive an error stating that access is denied due to insufficient privileges.
5. In Operations Hub, go to **Manage > Users**, and access your user account.
6. Add `historian_visualization.admin` and `historian_visualization.user` to **Groups** and save.
   Historian privileges are assigned to the user account.
7. If you run into a *Unable to load data sources* error, refer to troubleshooting *(on page 613)* for resolving the issue.

If you installed Operations Hub followed by Historian on the same machine, then search for Operations Hub log files in the Historian's log folder. Both application log files are created in `C:\ProgramData\HistorianWebBasedClientLogs`.

> **Note:**
> If uninstalling applications (Operations Hub and Historian) installed on the same machine, follow this order to uninstall successfully:
>
> 1. Uninstall Historian Web-based clients.
> 2. Uninstall Operations Hub.

Backup and Restore

This topic describes how to perform backups and restore the Operations Hub database.

You must have Administrator access.

You can backup and restore Operations Hub versions starting from 1.7 to the current release.

> **Note:**
> During the execution of backup and restore scripts, all services are stopped. Services start automatically once the backup/restore is complete.

1. Download the PowerShell scripts for backup, restore, and scheduler.
2. Unzip the downloaded file to access the scripts and jar files.
3. Perform an Operations Hub backup *(on page 49)*.
4. Restore from an Operations Hub backup *(on page 49)*.
5. Schedule a backup of Operations Hub *(on page 49)*.

Back Up the Operations Hub Database

Refer Backup and Restore *(on page 48)*.

1. Launch Windows PowerShell, and navigate to the location of the backup script file.
2. Execute `BackUp_OperationsHub.ps1` to perform a backup of the UAA, IQP, and WebHMI database. The `OPERATIONS_HUB_BKP_20211013-120559.zip` backup is saved to `C:\ProgramData`. The filename includes the respective backup's datetime in the `YYYYMMDD-HHMMSS` format.

Restore the Operations Hub Database

It is recommended to take a backup of your current database before continuing with the restore operation. In case you cancel the restore operation, you can recover your current data from the backup.

> **Note:**
> The restore operation deletes everything from the current system database.

Refer Backup and Restore *(on page 48)*.

1. Log in to the machine where Operations Hub is installed.
2. Copy the `db-intializer.jar` of the version you want to restore to this location: `\Program Files\GE \Operations Hub\iqp-tomcat\webapps\site\WEB-INF`

   > **Note:**
   > You can skip this step if you are restoring versions 2.1 SIM 2 or later. The jar file is already available at the location.

3. Launch Windows PowerShell, and navigate to the location of the restore script file.
4. Enter the path to the backup zip file, and execute `Restore_OperationsHub.ps1` to restore the database.

   For example:

   ```
   PS C:\Users\Administrator\Desktop> .\Restore_OperationsHub.ps1
    C:\ProgramData\OPERATIONS_HUB_BKP_20211013-120559.zip
   ```

   The database is restored.

Schedule Operations Hub Database Backup

Refer Backup and Restore *(on page 48)*.

1. Launch Windows PowerShell, and navigate to the location of the backup scheduler script file.
2. Execute `BackupScheduler_OperationsHub.ps1` to schedule a backup.

    a. To create a scheduler, enter `Create`.

    b. Enter a name for your backup.

    c. Enter a description of your backup.

    d. Enter `Daily` to take a backup every day, or `Weekly` to backup every week.

    e. Enter time in the suggested format to take a daily/weekly backup at the given time.

    f. Enter the location of your backup script.
    For example:

    ```
    PS C:\Users\Administrator\Documents\db-backup-restore\Backup_OperationsHub.ps1
    ```

    A daily/weekly backup is scheduled.

    a. To delete a scheduler, enter `Delete`.

    b. Enter the name of the backup for which you want to delete the schedule.
    The daily/weekly schedule for the respective backup is deleted.

The backups are saved to `C:\ProgramData`.

Troubleshooting:

- When you run a `.ps1` PowerShell script you might get the following message `.ps1 is not digitally signed. The script will not execute on the system.`

  To fix it you have to run the following command to run `Set-ExecutionPolicy` and change the Execution Policy setting.

  ```
  Set-ExecutionPolicy -Scope Process -ExecutionPolicy Bypass
  ```

  This command sets the execution policy to bypass for only the current PowerShell session after the window is closed. The next PowerShell session will open running with the default execution policy. “Bypass” means nothing is blocked. No warnings, prompts, or messages are displayed.

- For LDAP user connectivity, make sure the Active Directory server is accessible to both the servers:
  - the server from where we take the data backup
  - the server to which we restore the data

  If the data restored server cannot access LDAP server, the `Invalid Credentials` error message appears.

Post-Installation Tasks

Setting Up Operations Hub

Log in to Operations Hub

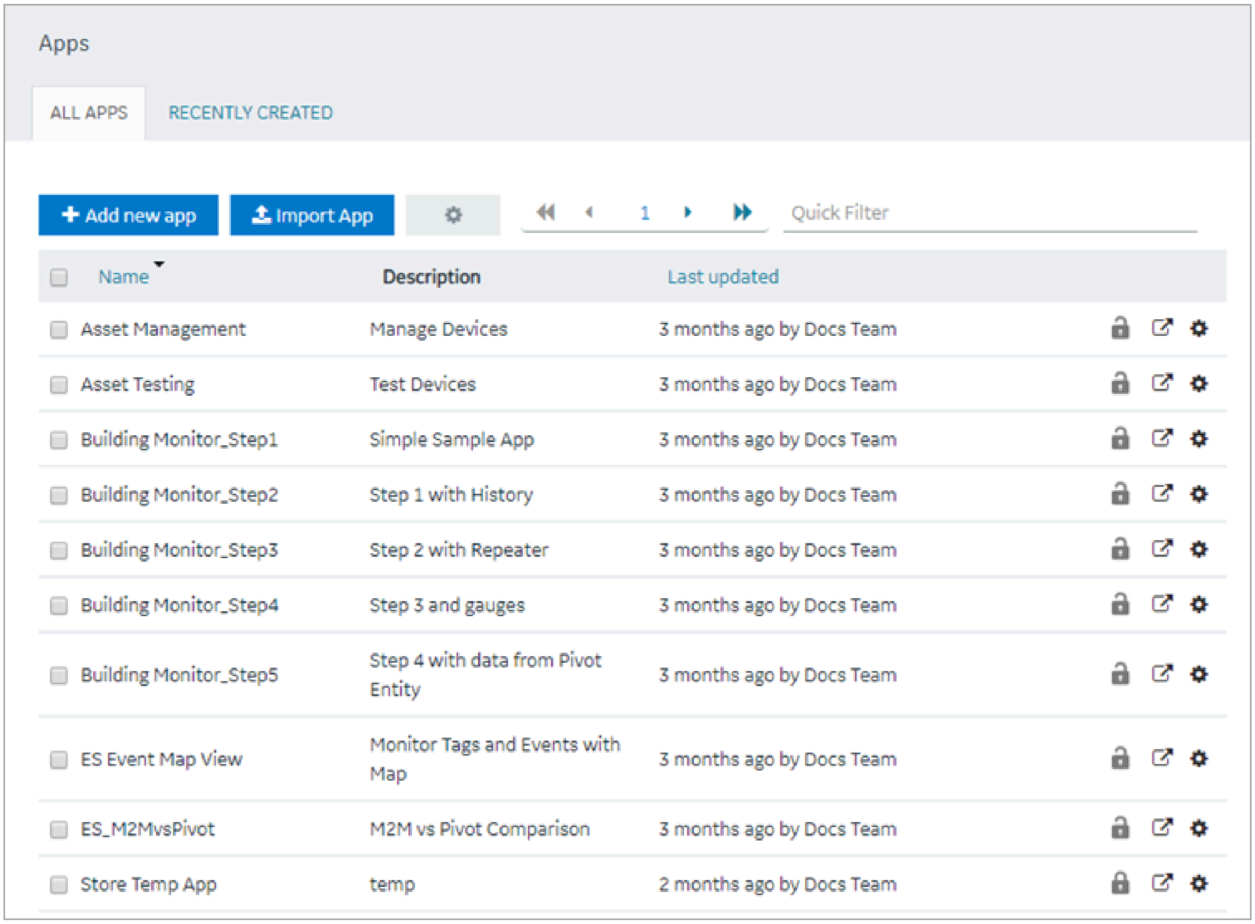
Use your credentials to login and access the Operations Hub homepage.

Only a single user from a UAA instance can be logged into a browser instance at a time, even across multiple tabs.

If you want to log in as a different user, you must first log out of all the active product sessions. For Operations Hub, this includes the Operations Hub Designer, the Site Admin console, and applications created using Operations Hub.

1. In a web browser, enter the `server name`. Alternatively, you can use the shortcut provided on the desktop after installation.
2. Log in with the credentials that you specified during installation.

The Operations Hub home page appears.



Depending on the Operations Hub solution you purchased, perform one of the following steps:

- If you have installed Operations Hub by downloading it from Salesforce, run the `siteadmin_addon` installer package *(on page 52)* to access the Site Admin console, which is used to configure an MQTT server *(on page 54)* or an email server.
- If you have installed the Operations Hub add-on for Historian, access the Historian analysis application. This is the only application you can access. You cannot modify or delete this application.

On iOS devices (iPhone/iPad), enable the self-signed certificate to secure websockets.

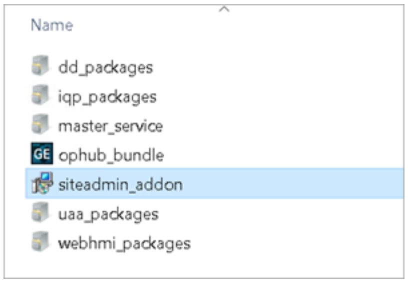
1. Go to **Settings > General > About > Certificate Trust Settings**.
2. Under **Enable Full Trust for Root Certificates**, enable your root certificate.

Install Site Administration Addon

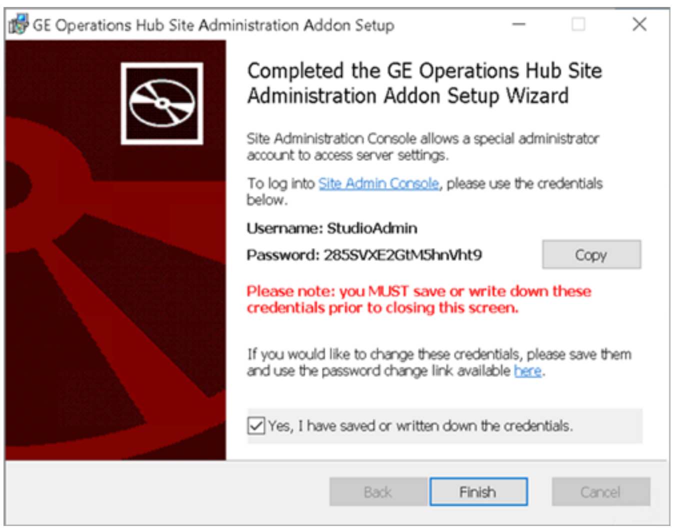
You must install the addon to access the Site Administration Console.

Log out and close all the browser windows before you run the installer.

1. Run the **siteadmin_addon** Windows installer package from the Operations Hub installation DVD.



2. Accept the license agreement and install the package.
3. Make a note of the Site Admin user account credentials before you finish the installation.



   - In case you closed the setup wizard without making a note of the credentials (password), then reinstall the addon and note them down.
   - If you changed the password of the Site Admin user account, remember to enter the new password on the login page. Some web browsers may populate cached credentials that are outdated.
   - The Site Admin Console is used to configure MQTT settings or an email server. Do not use the console to change the password.
   - If you have configured Historian UAA as the external UAA to be used with Operations Hub, you can change the password only after performing the following steps:

a. Access the `uaa.yml` file. By default, this file is located in the following folder: `C:\Program Files\GE Digital\UAA`
b. Add the following line at the end of the `uaa.yml` file: `issuer: uri: https://historian:8443/uaa`. Do not enter a leading space before the line.
c. Restart the Historian Embedded Tomcat Container service.

Configure MQTT Broker Settings *(on page 54)*.

Set up an Email Server

If using a Self-Signed certificate to set up an email server, follow these steps:

1. Copy the `certificate.pem` to a folder on the Operations Hub host machine.
2. Access `C:\ProgramData\GE\Operations Hub\iqp-config\IQP\app\setting.conf`.
3. Update `setting.conf` with the following code: `iqp_mail_cert_file=c:\\cert\\certificate.pem`

Configure MQTT Broker Settings

If you want to use an MQTT broker to connect to devices, you must configure the settings.

Install Site Administration Addon *(on page 52)*.

1. In the **Site Administration Console** page, select **Server settings**, and then select **Mqtt settings**.
2. In the **Select tenant to configure** drop-down list box, select the tenant, and then select **Continue**. The **Account Settings** workspace appears.
3. Enter values as specified in the following table, and then select **Update**.

Field	Description
Cloud url	Enter the IP address or the URL of the MQTT broker that you want to use.
Pull interval	Enter the time interval, in milliseconds, at which the Operations Hub MQTT client will connect to send or receive data. By default, it is set to 500 milliseconds.
Use password	Specify if the MQTT broker requires a user name and password to connect. By default, the value in this field is *False*.
Password	If you selected *True* in the **Use Password** field, enter the password in this field. The default

Field	Description
	password for the installed MQTT broker is `mqttpassword`. **Note:** It is highly recommended to create a new password if using MQTT in a production environment. The Mosquitto password file is located here: `C:\Program Files\GE\Operations Hub\mosquitto`. To create a new password file, run the following command: `mosquitto_passwd -c passwordfile mqttuser` Visit https://mosquitto.org/man/mosquitto_passwd-1.html for command related information. Visit https://mosquitto.org/man/mosquitto-conf-5.html for information on Mosquitto configuration.
User	If you have selected true in the Use password field, enter the user name in this field. The default user for the installed MQTT broker is `mqttuser`.
Qos	Specify the quality of service (QoS) of the MQTT broker by entering one of the following values:

Field	Description
	◦ 0: Indicates that the message is delivered at most once or it is not delivered at all. ◦ 1: Indicates that the message is always delivered at least once. ◦ 2: Indicates that the message is delivered once.
Port	The port number of the MQTT broker. By default, the value in this field is 1883, which is the standard MQTT port number.

The MQTT broker settings are configured.

Display Asset Locations on a Map

Enable Google Maps for your applications to display asset locations.

While designing a page, you can use the Google Maps widget to display the locations of assets on a map. To do so, you require the API key generated by Google. This topic describes how to access the key and use it in the application that you want to create.

1. Access https://cloud.google.com/maps-platform/, and follow the on-screen instructions to generate the API key.
   The API key is generated.

   > **Note:**
   > Ensure that the following APIs are enabled for the key:
   > - The Geocoding API
   > - The Maps JavaScript API

2. Modify the `userconfig.json` file located here:
   `C:\Program Files\GE\Operations Hub\iqp-endapp\public\scripts\data`
3. Update the file using the API key and version information provided by Google:
   Search for `"googleMapsVersion"` and enter the version number for it.
   Search for `[GOOGLEAPIKEY]` and replace (including the brackets) with your API key.
4. Save and close the file.

5. Restart the Operations Hub IQP Tomcat Web Server service.
   The Google Map widget is now available for use in the application. Asset locations are now displayed on a map.

Configure Session Timeouts

With Operations Hub, you can configure how soon a login session expires when a session is idle.

Before doing so, consider which application sessions you need to configure. The Designer, the End-app, and Proficy Authentication (formerly UAA) each can have its session timeout configured independently.

Operations Hub Session Timeouts

Access the `web.xml` file from these locations, and update the configuration as follows, for End-app and Designer session timeouts respectively:

- `C:\Program Files\GE\Operations Hub\iqp-tomcat\webapps\app\WEB-INF`
- `C:\Program Files\GE\Operations Hub\iqp-tomcat\webapps\site\WEB-INF`

```
<session-config>

 <session-timeout>30</session-timeout>

</session-config>
```

A session is tracked by a cookie, wherein the cookie age must be longer than the session timeout. Therefore, if the timeout is increased, make sure the cookie's max-age (configured in the same `web.xml`) is not shorter than the session timeout as shown here:

```
<session-config>

 <session-timeout>2</session-timeout>

 <cookie-config> <max-age>120</max-age> </cookie-config>

</session-config>
```

`session-timeout` and `cookie-config/max-age` are in different units of measurement (see note below).

Additionally, if you set either of the session timeouts greater than one hour in `web.xml`, you also need to add a system environment variable `SESSION_DESTROY_TIMEOUT` with value `session_timeout_in_millisec + 10 minutes in millisec`. For example, if you set a session timeout to two hours, then set it to `130 * 60 * 1000 = 7800000`.

Note:

1. Restart IQP tomcat service whenever you reconfigure any of the settings/parameters mentioned above.
2. `session-timeout` is measured in minutes, whereas `cookie-config/max-age` is measured in seconds.
3. Any manual configuration changes, including changes for timeouts, are overwritten on upgrade.

Proficy Authentication Session Timeout

Proficy Authentication session timeout decides how long your Proficy Authentication login session remains valid. It in turn determines whether you need to enter the credentials again when logging into an application that depends on Proficy Authentication for login.

Example: If the session timeout for Operations Hub Designer is set to 30 minutes, and Proficy Authentication is set to one hour, then you are not required to enter the credentials to re-login if the Designer session times out within one hour. You need to enter credentials only when the Designer session lasts longer than an hour, or you explicitly log out of a session.

You can configure session timeout during Proficy Authentication installation. To configure after installation, access the `web.xml` file from `C:\ProgramFiles\GE\Proficy Authentication\uaa-tomcat\webapps\uaa\WEB-INF` or `C:\ProgramFiles\GE\Operations Hub\uaa-tomcat\webapps\uaa\WEB-INF)`, and update the configuration as follows:

```
<session-config>
 <session-timeout>30</session-timeout>
</session-config>
```

The cookie's max-age may also need to be adjusted, similar to Operations Hub session timeouts.

Mapping Proficy Authentication Groups

About User Groups

A user group is created for specific type of users, likely to perform the same type of activities.

These are the different types of users in Operations Hub:

Type of User	Description
Site administrator	This user creates tenants and tenant administrators using the Site Admin Console application. This user is created automatically when installing Operations Hub. You cannot access, modify, or delete this user from the Designer.
Tenant administrator	This user manages the user accounts of developers and application users. The first tenant administrator is created automatically when installing Operations Hub. You cannot delete this user from the Designer.
Developer	This user creates applications using Operations Hub.
Application user	This user accesses applications created using Operations Hub.

You can create new user groups in the Proficy Authentication application. Refer to Create Proficy Authentication Groups.

Important:
Exercise caution in modifying the membership of a user because it is possible for a user to remove their privileges to access Operations Hub, including the user management section, thus preventing themselves from accessing Operations Hub.

About Proficy Authentication (UAA)

User authentication in Operations Hub is handled using Proficy Authentication.

Proficy Authentication provides identity-based security for Proficy based applications and APIs. It supports open standards for authentication and authorization, including Oauth2.

When a user is created or deleted in a product that uses Proficy Authentication, the associated user account is created or deleted in the UAA instance, respectively.

Note:
This is done in the backend automatically. Therefore, most users will not need knowledge on Proficy Authentication to perform basic user management, except when additional configuration is required.

Several Proficy products use Proficy Authentication, including Historian, Plant Applications, and Operations Hub. To use Proficy Authentication, you must install one of these products. Each product can install an independent instance of UAA, or it can reuse an existing instance of UAA which was previously installed by another Proficy product. When more than one product uses the same instance of Proficy Authentication (UAA), this is called a shared or common UAA.

Shared UAA means that if you have a Proficy product installed that uses Proficy Authentication, additional Proficy products installed after that initial product can also share that existing, already configured UAA architecture.

Proficy Authentication can additionally be configured to use an external identity provider. This includes identity providers which use Lightweight Directory Access Protocol (LDAP) or Security Assertion Markup Language (SAML). When you integrate Proficy Authentication with an external identity provider, you can provide the users and groups from that identity provider with access to Proficy products and their features.

For more information on Proficy Authentication, please refer to the Proficy Authentication documentation.

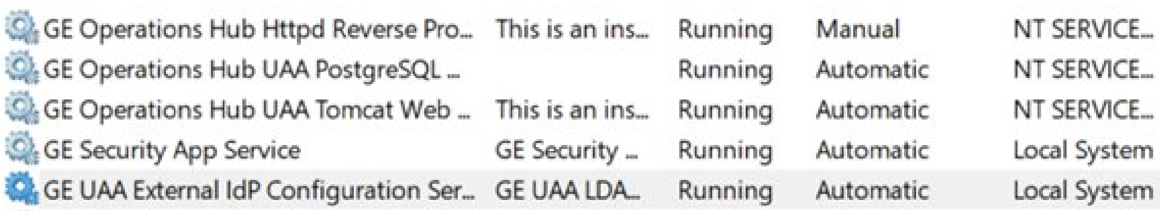
Install and Components

To use Proficy Authentication, you must install one of the products which bundles Proficy Authentication, such as Historian, Plant Applications, or Operations Hub. At the time of install, you can choose from the following options:

- Creating a new instance of UAA: Use this option if you are not currently using another UAA instance. For instance, use this option if you are installing your first Proficy product, or if the product you are installing is a stand-alone instance which does not need to share users and groups with another Proficy product.
- Using an existing UAA: Use this option if you are currently using an instance of Proficy Authentication which contains users and groups that you want to reuse. For instance, use this option if you are already using Historian and you want to install Plant Applications and Operations Hub, and you want your existing Historian users to have access to Plant Applications and Operations Hub. To use an existing instance of UAA, you must provide the details while installing Proficy Authentication.

> **Important:**
> The decision of whether to share a UAA must be made at the time of product install; there is currently no post-install option to change what UAA a product is using, nor is there a utility to migrate users from one instance of UAA into another.

As part of install, a basic UI for configuring UAA is provided along with the instance of UAA. This includes a number of required services and other components. You can see the associated services when you open the services pane. These will start automatically after install.



GE Operations Hub Httpd Reverse Pro...	This is an ins...	Running	Manual	NT SERVICE...
GE Operations Hub UAA PostgreSQL ...		Running	Automatic	NT SERVICE...
GE Operations Hub UAA Tomcat Web ...	This is an ins...	Running	Automatic	NT SERVICE...
GE Security App Service	GE Security ...	Running	Automatic	Local System
GE UAA External IdP Configuration Ser...	GE UAA LDA...	Running	Automatic	Local System

> **Note:**
> Proficy Authentication supports UAA version 4.30.0 or later.

Map Existing UAA Groups With Proficy Authentication

This topic describes the process to map existing UAA groups with Proficy Authentication groups.

1. Double-click  on your desktop.
   The icon appears on your desktop after you install Proficy Authentication.
2. Select the **Identity Providers** tab.
   The **UAA/LDAP/SAML Connectivity Tool** appears.
3. Select the **Map Existing UAA Groups** check box.
4. In the **UAA Connection** section, provide values as specified in the following table.

   > **Important:**
   > The values that you provide in this step must match the values that you provided while installing your Proficy product. These values are required to connect to the Proficy Authentication.

Field	Description
URL	This information is read-only. The authorization server URL of the Proficy Authentication server is populated by default. This is the **UAA Base URL** that you specified during installation.
Client ID	Enter the client ID of the Proficy Authentication server that you specified for **Admin Client ID** during installation.
Client Secret	Enter the client secret configured for the OAuth client that you specified for **Admin Client Secret** during installation.

5. Select **Test**.

   If connection to the UAA server is established, a message appears, confirming the same.
6. Select **Continue**.

   In the **UAA Mapping** section, the drop-down list box contains a list of groups in Proficy Authentication. In the **Filter** box, a list of groups in the existing UAA instance appear.
7. In the drop-down list box, select the Proficy Authentication group to which you want to map the existing UAA groups.
8. In the **Filter** box, select the check boxes corresponding to the existing UAA groups that you want to map.

   > **Note:**
   > If a group is already mapped to the Proficy Authentication group that you have selected, the check box is already selected.

> **Tip:**
> Clear the check boxes corresponding to the UAA groups for which you want to remove the mappings.

9. Select **Map Members**.
   A message appears, confirming that the Proficy Authentication group is mapped to the existing UAA groups that you have selected.
10. Repeat steps 7-9 for all the Proficy Authentication groups that you want to map.

The existing UAA groups are mapped with the Proficy Authentication groups.

Map LDAP Groups With Proficy Authentication

If you want LDAP users to use Proficy Authentication, you must map the corresponding LDAP groups with the Proficy Authentication group created during the Proficy product installation.

1. Double-click  on your desktop.
   The icon appears on your desktop after you install Proficy Authentication.
2. Select the **Identity Providers** tab.
   The **Proficy Authentication/LDAP/SAML Connectivity Tool** appears.
3. Select the **Map Existing LDAP Groups** check box.
4. In the **UAA Connection** section, provide values as specified in the following table.

> **Important:**
> The values that you provide in this step must match the values that you provided while installing your Proficy product. These values are required to connect to the Proficy Authentication. Proficy Authentication works only with a single instance of Proficy Authentication, which is specified during Proficy Authentication installation. After installation, you cannot change the instance of Proficy Authentication that Proficy Authentication will use.

Field	Description
URL	This information is read-only. The authorization server URL of the Proficy Authentication server is populated by default. This is the **UAA Base URL** that you specified during installation.

Field	Description
Client ID	Enter the client ID of the Proficy Authentication server that you specified for **Admin Client ID** during installation.
Client Secret	Enter the client secret configured for the OAuth client that you specified for **Admin Client Secret** during installation.

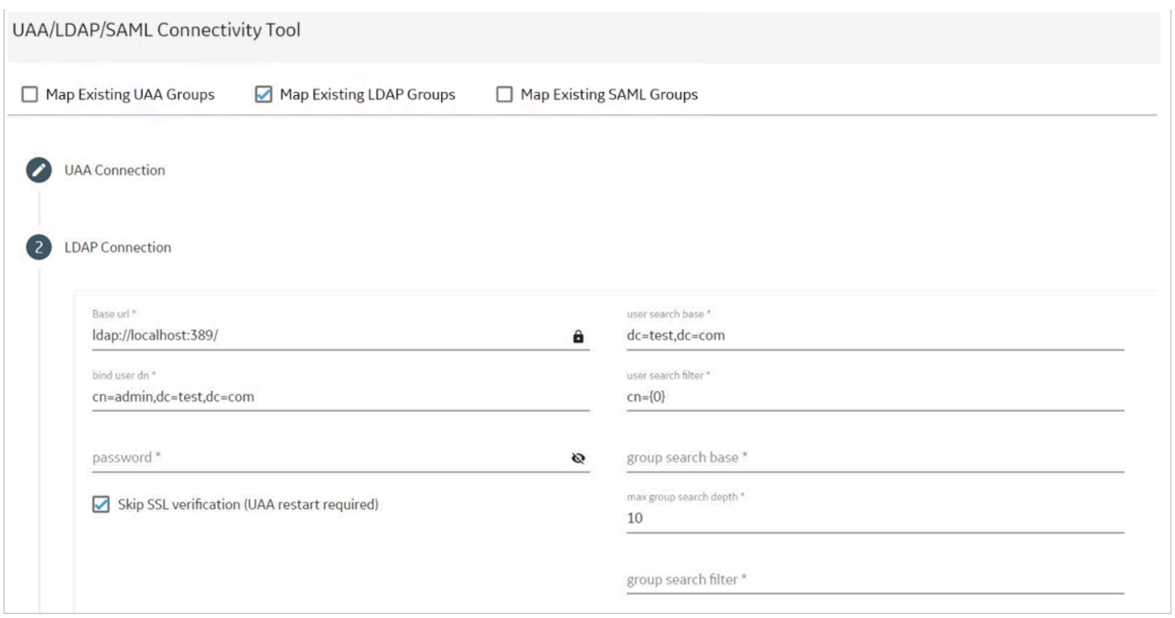
5. Select **Test**.
If connection to the Proficy Authentication server is established, a message appears, confirming the same.

> **Note:**
> Currently, the Test Button displays a successful connection for LDAP even when no security certificate or a bad certificate is found.

6. In the **LDAP Connection** section, provide values as specified in the following table.

Field	Description
URL	Enter the base URL of the LDAP server (for example, https://localhost).
Bind User DN	Enter the distinguished name of the bind user (for example, `cn=admin,ou=Users,dc=test,dc=com`).
Password	Enter the password for the LDAP user ID that searches the LDAP tree for user information.
Skip SSL Verification	Select this check box if you do not have the certificate to access the LDAP server. Messages are still encrypted, but the certificate is not verified for correctness. Do not select this option if you are not confident of the direct connection to the LDAP server; it could result in redirected traffic outside of your controlled network.
User Search Filter	◦ `cn={0}`: Allows the LDAP user (active directory user) to login with their display name. ◦ `sAMAccountName={0}`: Allows the LDAP user (active directory user) to login with their account name (Windows login name).
User Search Base	Enter the starting point for the LDAP user search in the directory tree (for example, `dc=developers,dc=com`).

Field	Description
	If you use only `DC=pa,DC=com`, timeout may occur due to slow system response. Use the exact `OU` to avoid timeout.
Group Search Base	Enter the starting point for the LDAP group search in the directory tree (for example, `ou=scopes,dc=developers,dc=com`). If you use only `DC=Ge,DC=com`, timeout may occur due to slow system response. Use the exact `OU` to avoid timeout.
Max Group Search Depth	Enter a value to define the maximum depth for searching LDAP groups. (This may impact performance for very large systems.) By default this value is `10`.
Group Search Filter	Enter the subdirectories to include in the search (for example, `member={0}` retrieves the `memberOf` attribute values for the specific user).

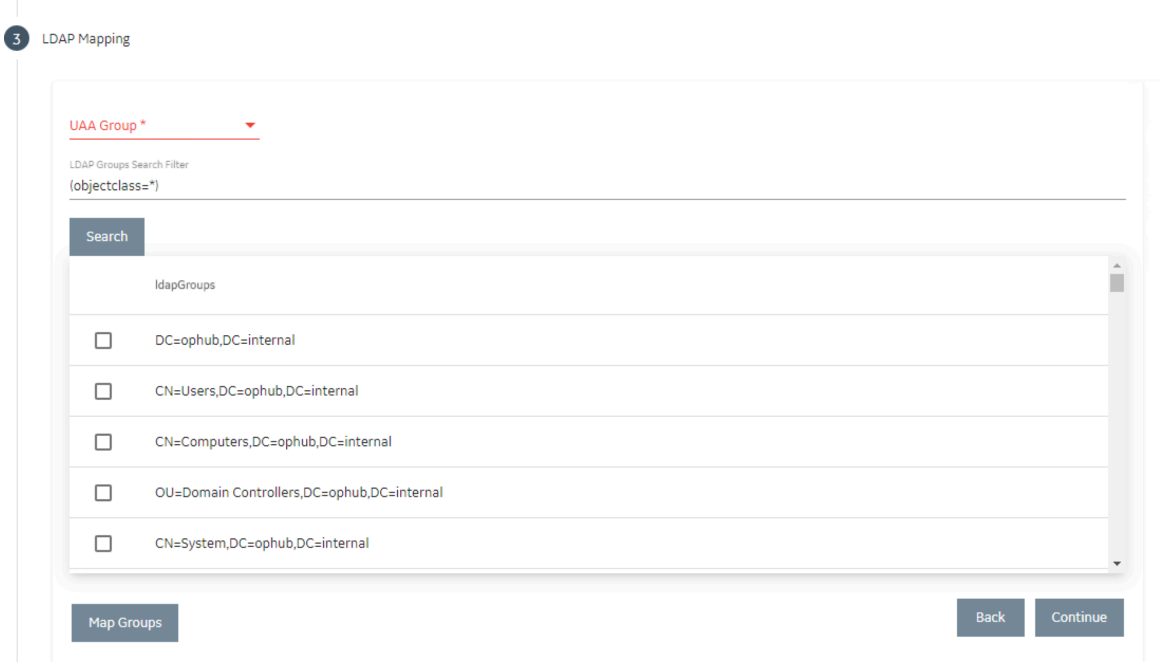


7. Select **Test**, and then select **Submit**.

   If connection to the LDAP server is established, a message appears, confirming the same.
8. Select **Test** again, and then select **Continue**.

   In the **LDAP Mapping** section, the drop-down list box contains a list of groups in Proficy Authentication.

9. In the drop-down list box, select the Proficy Authentication group to which you want to map LDAP groups. You can also search for a group in the **LDAP Groups Search Filter** box. When searching, be sure to use the standard LDAP query language for your search.



> **Note:**
> If a group is already mapped to the Proficy Authentication group that you have selected, the check box is already selected.

10. Select **Map Groups**.
    A message appears, confirming that the LDAP groups are mapped to the Proficy Authentication group.
11. Repeat steps 8-10 for all the Proficy Authentication groups that you want to map.

The LDAP groups are mapped with the Proficy Authentication groups.

Map SAML Groups With Proficy Authentication

If you want SAML users to use Proficy Authentication, you must map the corresponding SAML groups with the Proficy Authentication group created during the Proficy product installation.

1. Double-click  on your desktop.
   The icon appears on your desktop after you install Proficy Authentication.

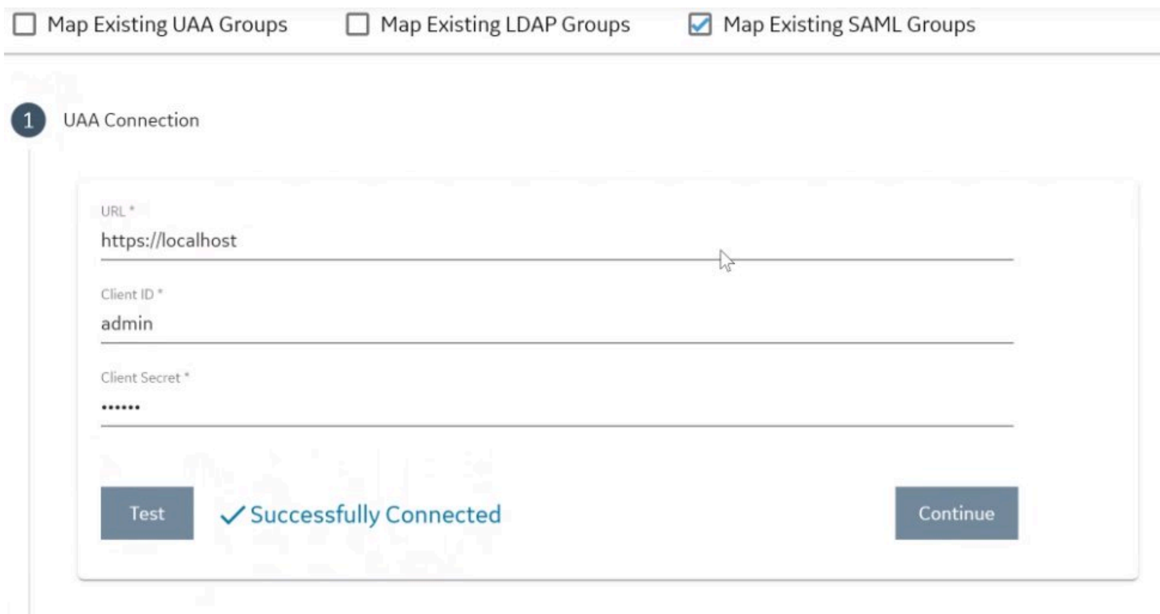
2. Select the **Identity Providers** tab.

   The **Proficy Authentication/LDAP/SAML Connectivity Tool** appears.
3. Select the **Map Existing SAML Groups** check box.
4. In the **UAA Connection** section, provide values as specified in the following table.

   > **Important:**
   > The values that you provide in this step must match the values that you provided while installing your Proficy product. These values are required to connect to the Proficy Authentication. Proficy Authentication works only with a single instance of Proficy Authentication, which is specified during installation. After installation, you cannot change the instance of Proficy Authentication that Proficy Authentication will use.

Field	Description
URL	This information is read-only. The authorization server URL of the Proficy Authentication server is populated by default. This is the **UAA Base URL** that you specified during installation.
Client ID	Enter the client ID of the Proficy Authentication server that you specified for **Admin Client ID** during installation.
Client Secret	Enter the client secret configured for the OAuth client that you specified for **Admin Client Secret** during installation.

5. Select **Test**.



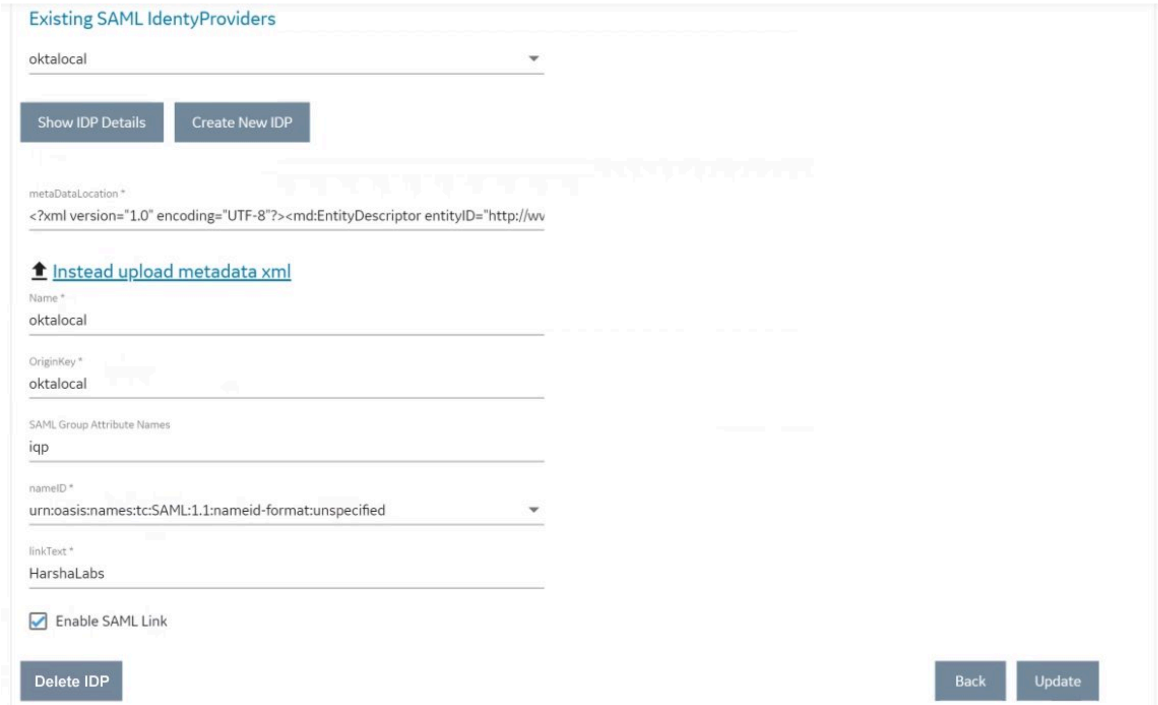
If connection to the Proficy Authentication server is established, a message appears, confirming the same.

6. In the **Existing SAML Identity Provider** section, select the Identity Provider.
7. Click **Show IDP Details**, or **Create New IDP** and provide values as specified in the following table.

Field	Description
Metadata Location	Specify the SAML Metadata – either an XML string or a URL that will deliver XML content. Optionally, you can select **Instead Upload Metadata Xml** to enter the metadata location using a file you downloaded from your SAML Identity Provider.
Name	Specify the name of your SAML provider.
Origin Key	Specify the unique alias for the SAML provider.
SAML Group Attribute Names	Specify the names of the attributes that contain the group membership information about a user in a SAML assertion.
NameID	Optionally, enter a SAML Name ID and associated fields that you want to use in a Link Test.
Link Text	Specify the text you want to appear in a link test.

Field	Description
Enable SAML Link	Select this check box to enable the SAML Link; clear to disable.

> **Note:**
> It is recommended to use the same Name and Origin Key (not mandatory).



8. Select **Add** or **Update** to save your changes.

> **Tip:**
> Click **Delete IDP** to remove the existing IDP, and instead create a new one (using the Create New IDP button).

The **SAML Mapping** screen appears.

9. In the drop-down list box, select the Proficy Authentication group to which you want to map SAML groups.
10. Enter a **SAML Group** and click **Add Group**. Repeat this step for each SAML group you want to add.

11. When finished adding SAML groups, click **Map Groups**.
12. Next, select **Continue** to complete.
    A message appears, confirming that the SAML groups are mapped to the Proficy Authentication group.

Change Password

Proficy Authentication local users can log in to their accounts and change password.

You must know your current password to log in to Proficy Authentication and change it.

1. Log in to Proficy Authentication on a web browser.
2. Go to your **Account Settings** screen.
3. Select **Change Password**.
4. Provide the following information:

Current password	Enter the password that is currently used for Proficy Authentication login.
New password	Enter a new password to replace the current password.
Confirm new password	Enter the new password again for confirmation.

5. Select **CHANGE PASSWORD**.

The password is changed successfully.

Reset Password for a User

Administrators can reset the password for Proficy Authentication users.

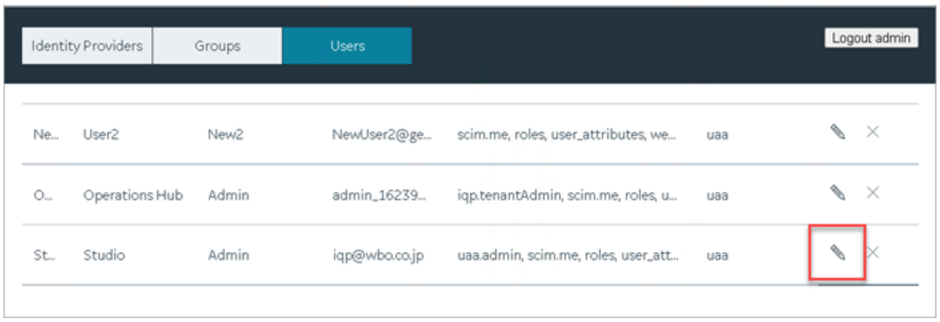
You must have administrator access to log in to the application.

1. Double-click  on your desktop.

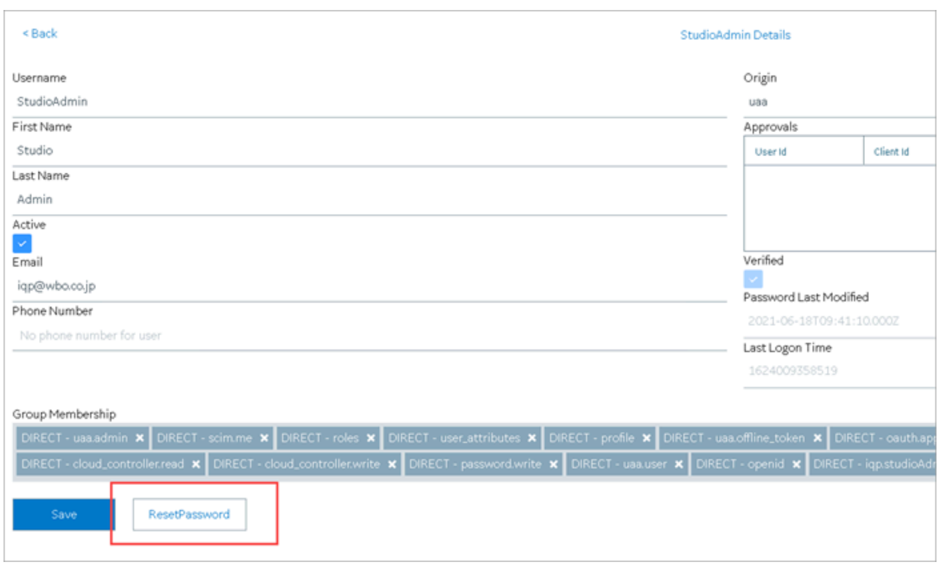
   The icon appears on your desktop after you install Proficy Authentication.
2. Log in to Proficy Authentication using `admin` account.
3. Select the **Users** tab.

   The list of all Proficy Authentication users appears.
4. Select  for the username you want to reset the password.

   The pencil icon to edit the respective user is available under the **Action** column.

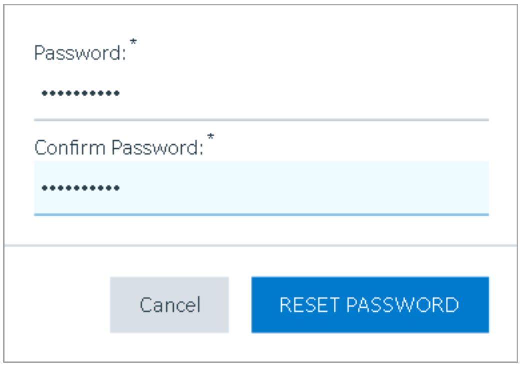
   

5. Select **Reset Password**.

6. Enter a new password for the user and confirm the new password.

7. Select **RESET PASSWORD**.



The password for the user is reset successfully.

Certificate Management

About the Certificate Management Tool

The Certificate Management tool allows you to manage external certificates and renew expired certificates.

The tool is installed automatically when you install Operations Hub. Using the Certificate Management tool, you can manage the following types of certificates:

- Server certificates, which include local certificates and imported certificates.
- Issuer certificates, which include certificates that are trusted by Operations Hub. This is required to connect to an external UAA instance. If you want to connect to LDAP, use the LDAP service to generate the certificate. Typically, you will only require the root CA certificate.

Using the Certificate Management tool, you can perform the following tasks:

- Access a certificate *(on page 72)*.
- Renew a local certificate *(on page 74)*.
- Import a server certificate or an issuer certificate *(on page 73)*.
- Remove a server certificate or an issuer certificate *(on page 74)*.
- View log messages *(on page 75)* that are generated while managing the certificates.

Access a Certificate

Using the Certificate Management tool, you can access server certificates and issuer certificates.

1. Double-click 

on your desktop.

   The icon appears on your desktop after you install Proficy Operations Hub.

   The **GE Operations Hub Certificate Management Tool** page appears, displaying the **Server Certificate** section.
2. Depending on the type of certificate that you want to access, perform one of the following tasks:
   - If you want to access a server certificate, select **View** in the **Local Certificate** or the **Imported Certificate** subsection.
   - If you want to access an issuer certificate, select **External Trust**, and then select **View**.

   The certificate appears.

Import a Certificate

Using the Certificate Management tool, you can import the following types of certificates:

- Server certificates: You can import a certificate (chain) file of the PEM, PFX, or P12 format. To import a certificate of the PFX or a P12 format, you must enter a password.
- Issuer certificates: You can import a certificate file of the PEM format that contains only one certificate for the root CA. If you are currently using a certificate for the external UAA instance, it is replaced by the imported certificate.

1. Double-click 

on your desktop.

   The icon appears on your desktop after you install Proficy Operations Hub.

   The **GE Operations Hub Certificate Management Tool** page appears, displaying the **Server Certificate** section.
2. If you want to import a server certificate, perform the following steps:

   a. In the **Imported Certificate** subsection, next to the **Certificate File** box, select **Select**.

   b. Navigate to and select the certificate file, and then select **Open**.

   c. Next to the **Key File** box, select **Select**.

   d. Navigate to and select the key file, and then select **Open**.
   e. If you have selected a PFX or a P12 file, enter the password in the **Password** box.
   f. Select **Import**.
      A message appears, asking you to confirm that you want to import a certificate.
   g. Select **Yes**.

   The certificate is imported.
3. If you want to import an issuer certificate, perform the following steps:
   a. In the **External Trust** subsection, next to the **Certificate File** box, select **Select**.
   b. Navigate to and select the certificate file, and then select **Open**.
   c. Select **Import**.
      A message appears, asking you to confirm that you want to import a certificate.
   d. Select **Yes**.

   The certificate is imported and replaces the currently used certificate for the external UAA, if any.

Renew a Certificate

Using the Certificate Management tool, you can renew local certificates that have expired.

1. Double-click 

 on your desktop.

   The icon appears on your desktop after you install Proficy Operations Hub.

   The **GE Operations Hub Certificate Management Tool** page appears, displaying the **Server Certificate** section.
2. Select the local certificate that you want to renew, and then select **Renew**.
   A message appears, specifying that the certificate has been renewed.

Remove a Certificate

Using the Certificate Management tool, you can remove a server certificate or an issuer certificate. When you do so, the local certificate is used by Operations Hub.

1. Double-click 

on your desktop.

   The icon appears on your desktop after you install Proficy Operations Hub.

   The **GE Operations Hub Certificate Management Tool** page appears, displaying the **Server Certificate** section.
2. Depending on the type of the certificate that you want to remove, perform one of the following tasks:
   - If you want to remove a server certificate, in the **Imported Certificate** subsection, select **Remove**.
   - If you want to remove an issuer certificate, select **External Trust**, and then select **Remove**.

   A message appears, asking you to confirm that you want to remove the certificate.
3. Select **Yes**.

   The certificate is removed, and the local certificate is used by Operations Hub.

View Log Messages

Using the Certificate Management tool, you can view the log messages that are generated while managing certificates.

1. Double-click 

on your desktop.

   The icon appears on your desktop after you install Proficy Operations Hub.

   The **GE Operations Hub Certificate Management Tool** page appears, displaying the **Server Certificate** section.
2. Select **Messages**.

   The **Messages** section appears, displaying the log messages.

Send Certificate Expiry Notification

Sends email notification on certification expiry.

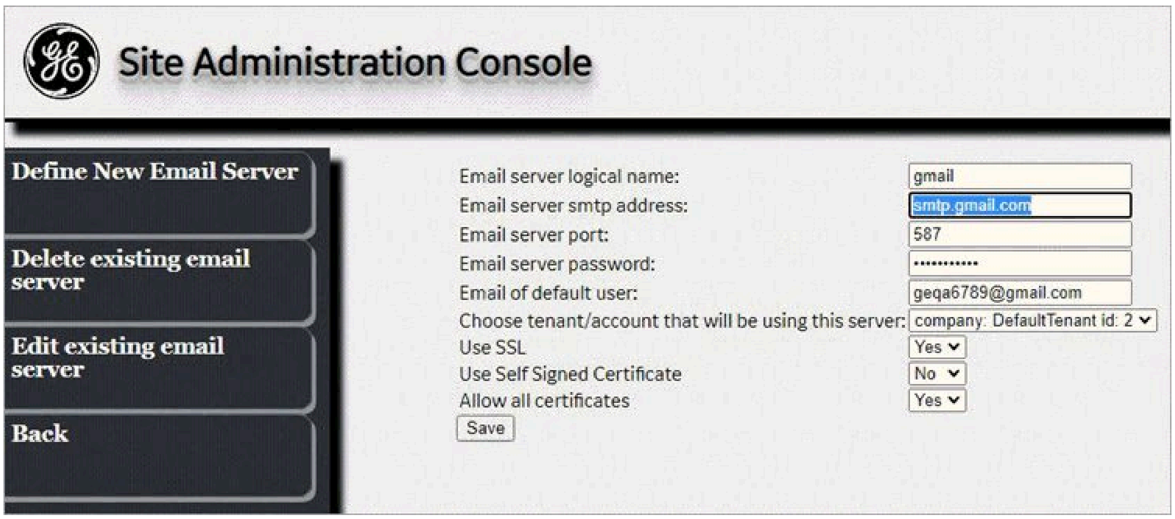
Install Site Administration Addon *(on page 52)*.

Email notifications must be sent to the recipients when their Operations Hub certificate expires, or is about to expire. Use the default entity *(on page 161)*, event *(on page 229)*, and template *(on page 240)* to complete this task. These are available on installing Operations Hub *(on page 24)*.

- `SendEmailEntity`
- `CertificateExpiryEvent`
- `CertificateEmailTemplate`

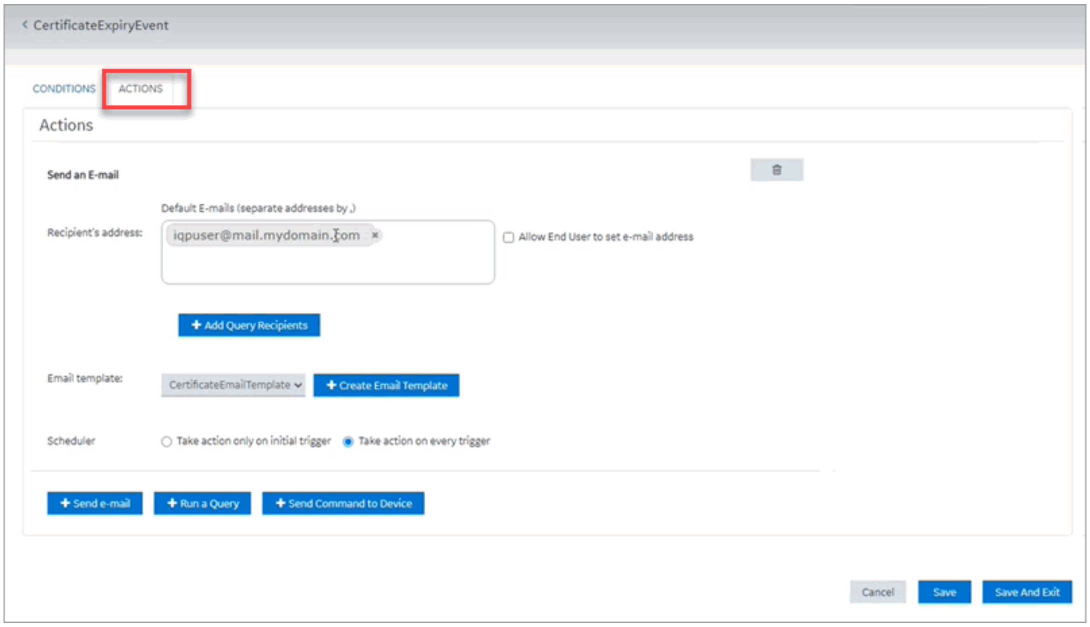
1. Log in to Site Administration Console and set up an email server.

   Here is an example of gmail setup:

   If using a Self-Signed certificate, you need to perform additional steps *(on page 54)* to update the `setting.conf` file.
2. Log in to Operations Hub as an administrator.
3. From the main navigation menu, select **Events**.
4. Open `CertificateExpiryEvent`.
5. On the **ACTIONS** tab, enter the email address of the recipients.

> **Note:**
> Do not modify the default populated details for `CertificateExpiryEvent` or `CertificateEmailTemplate`.



6. Select **Save And Exit**.

When certification expiry is detected in the next 45 days, daily emails are sent to the recipients asking them to renew their certificates. The email also contains the details of the certificates about to expire (or already expired, if not renewed within 45 days).

Integrating with Historian

Integrating Operations Hub and Historian

A trend chart allows you to trend data from Historian.

You can choose to trend data from an asset model or directly from Historian. To do so, you must integrate Historian and Operations Hub.

Access the Trend Chart with Asset Model

1. Create a data source to connect to the Historian server.
   For instructions, refer to the Data Sources section of the User Guide.
2. Set up the Historian server.
   For instructions, refer to the Administration section of the User Guide.
3. Import the model to Operations Hub.
   For instructions, refer to the Administration section of the User Guide.

4. For the model that you have imported, enable the trendable properties by performing the following properties:
    a. In the **Admin** workspace, select **Visualizations > Designer**.
    b. For each data variable that is trendable, select the check box in the Trendable check box.
5. Access the Historian Analysis application.
   For instructions, refer to the Applications section of the User Guide.

When you navigate to the model, the trend chart plots data based on the selected context.

Access the Trend Chart without Asset Model

You can access the trend chart without the asset model (that is, by browsing through the Historian data source directly for use in the trend chart).

1. Create a data source to connect to the Historian server.
   For instructions, refer to the Data Sources section of the User Guide.
2. Set up the Historian server.
   For instructions, refer to the Administration section of the User Guide.
3. Access the Historian Analysis application.
   For instructions, refer to the Applications section of the User Guide.
4. Access the trend chart configuration to select the tags that you want to plot on the trend chart.
   For instructions, refer to the Widgets section of the User Guide.

Data for the selected tags is plotted on the trend chart.

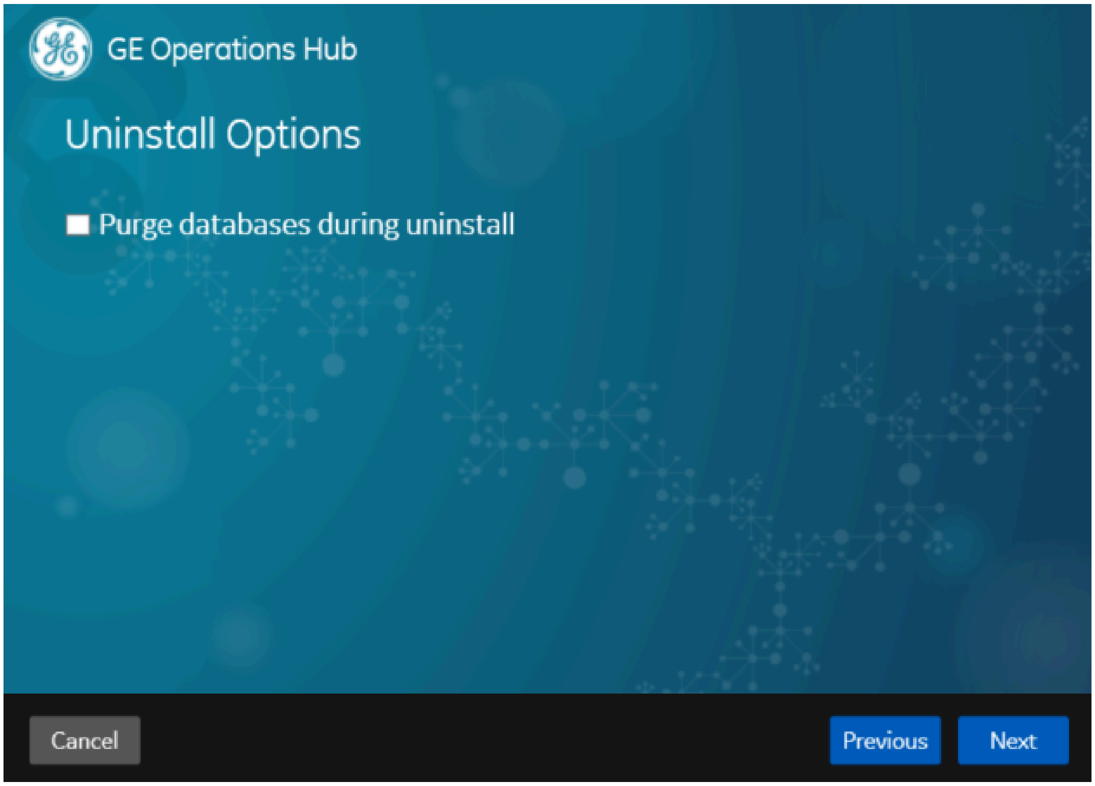
Uninstalling Operations Hub

Uninstall Operations Hub on Windows

1. If you want to uninstall Operations Hub automatically, open Command Prompt, and enter the following command: `<Installation folder path of Operations Hub>\OpHub-Windows_Installer>ophub_bundle -uninstall`
2. If you want to uninstall Operations Hub manually, perform the following steps:

    a. On the machine on which you want to uninstall Operations Hub, select **Control Panel > Uninstall a Program**.
       A list of programs that you can uninstall appears.

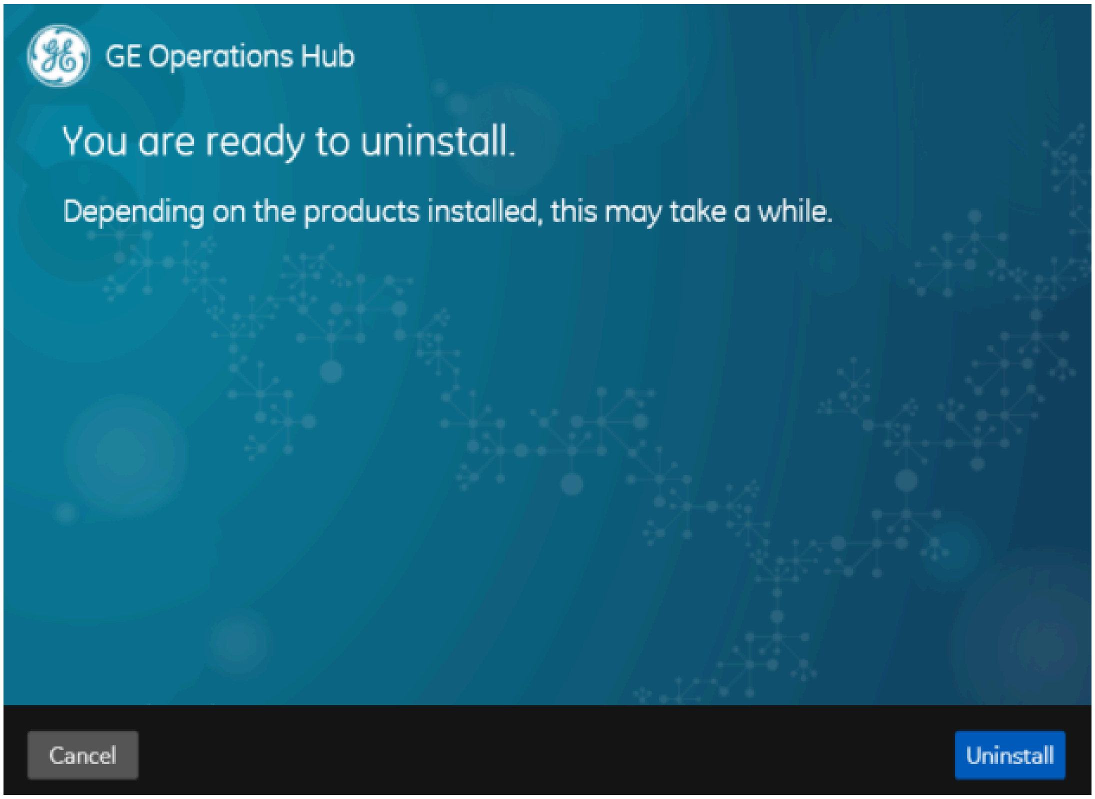
    b. Right-click **Operations Hub**, and then select **Uninstall**.
       The **Uninstall Options** page appears.



c. In addition to uninstalling Operations Hub, if you want to delete all the related data and applications, select the **Purge databases during uninstall** check box.

d. Select **Next**.

   The You are ready to uninstall page appears.



e. Select **Uninstall**.

Operations Hub is uninstalled from the Windows machine.

Getting Started with Proficy Historian

Get Started with Proficy Historian and Operations Hub

This topic guides you through how to get started integrating Proficy Historian and Operations Hub.

Before You Begin

Before beginning, make a note of the following:

- Ensure the Historian Web Clients are installed on the Historian machine; this is very important if you will be using the Historian REST API in Operations Hub.
- Ensure that you can access Historian Web Trending Client from a remote machine or from the Operations Hub machine.
- Ensure that certificates are trusted for both Operations Hub and Historian (not strictly necessary if you use option to ignore TLS/SSL, but a good idea).

Steps

The following sections walk you through:

1. Configuring a Historian data source (System API or REST API) in Operations Hub. See Configure Historian Data Sources for Operations Hub *(on page 81)*.
2. Creating a Model. See Create a Model for Operations Hub to use with Historian *(on page 83)*.
3. Using the Trend widget to trend model-based Historian data or trend data directly from a Historian. See Use the Trend Widget for Historian Data Source *(on page 85)*.
4. Creating a Historian REST query. See Create Historian REST Query for Operations Hub *(on page 88)*.
5. Using the Query in the page designer. See Use the Historian Query in the Operations Hub Page Designer *(on page 89)*.

Configure Historian Data Sources for Operations Hub

Overview

Look at the following examples for configuring a data source for Historian 7.x and Historian 8.x.

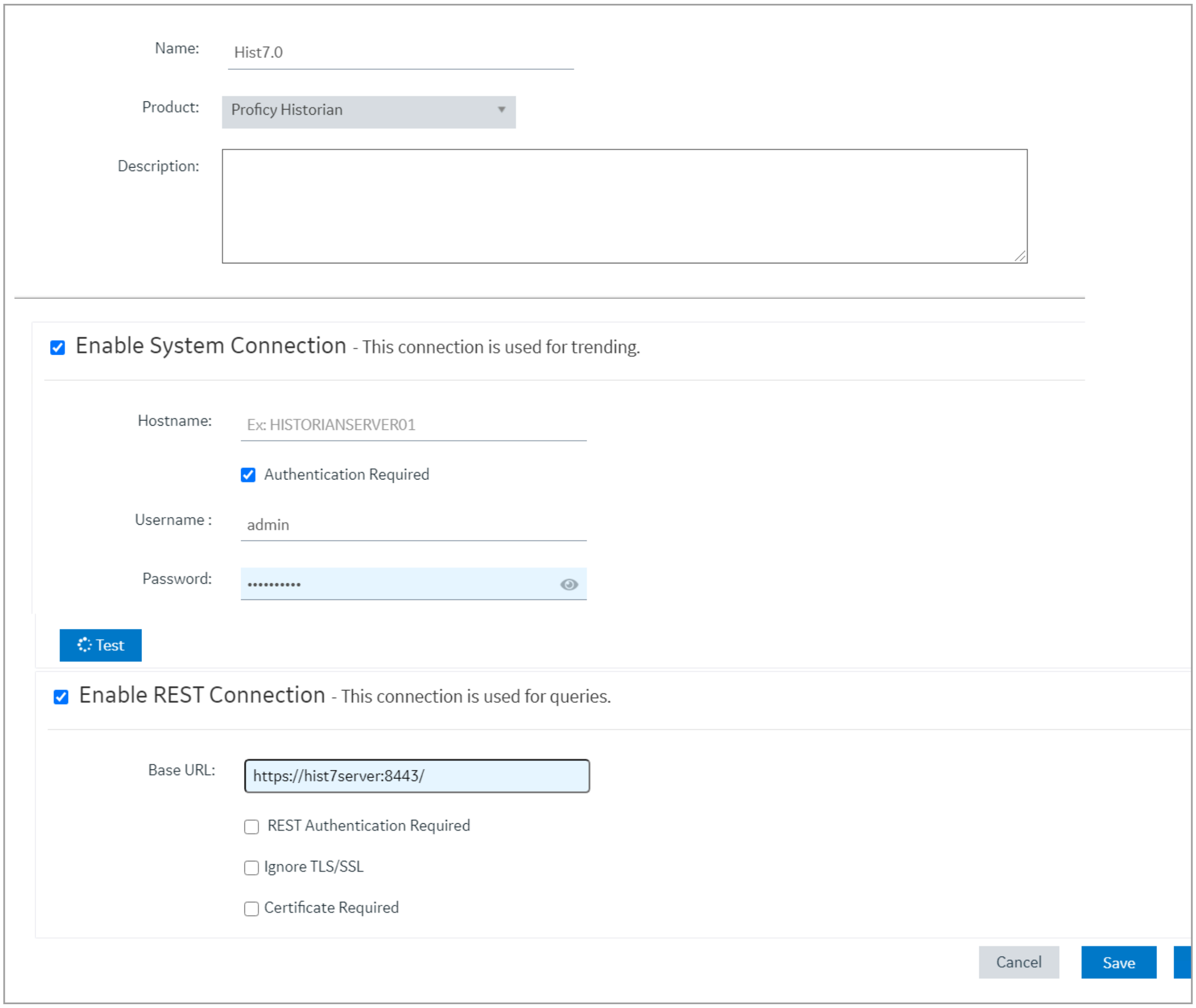
- **Historian 7.x** requires entry of port used – in this instance, port 8443.
- The Auth Client ID is the admin (case sensitive) for Historian 7.x.
- **Historian 8.x** does not require any port to be specified.
- The Auth Client ID for Historian 8.x must be in the form of MachineName.admin, where MachineName is case sensitive.
- For both **Historian 7.x and 8.x**, ensure Data source URL and Client ID are in the right format.

Note:

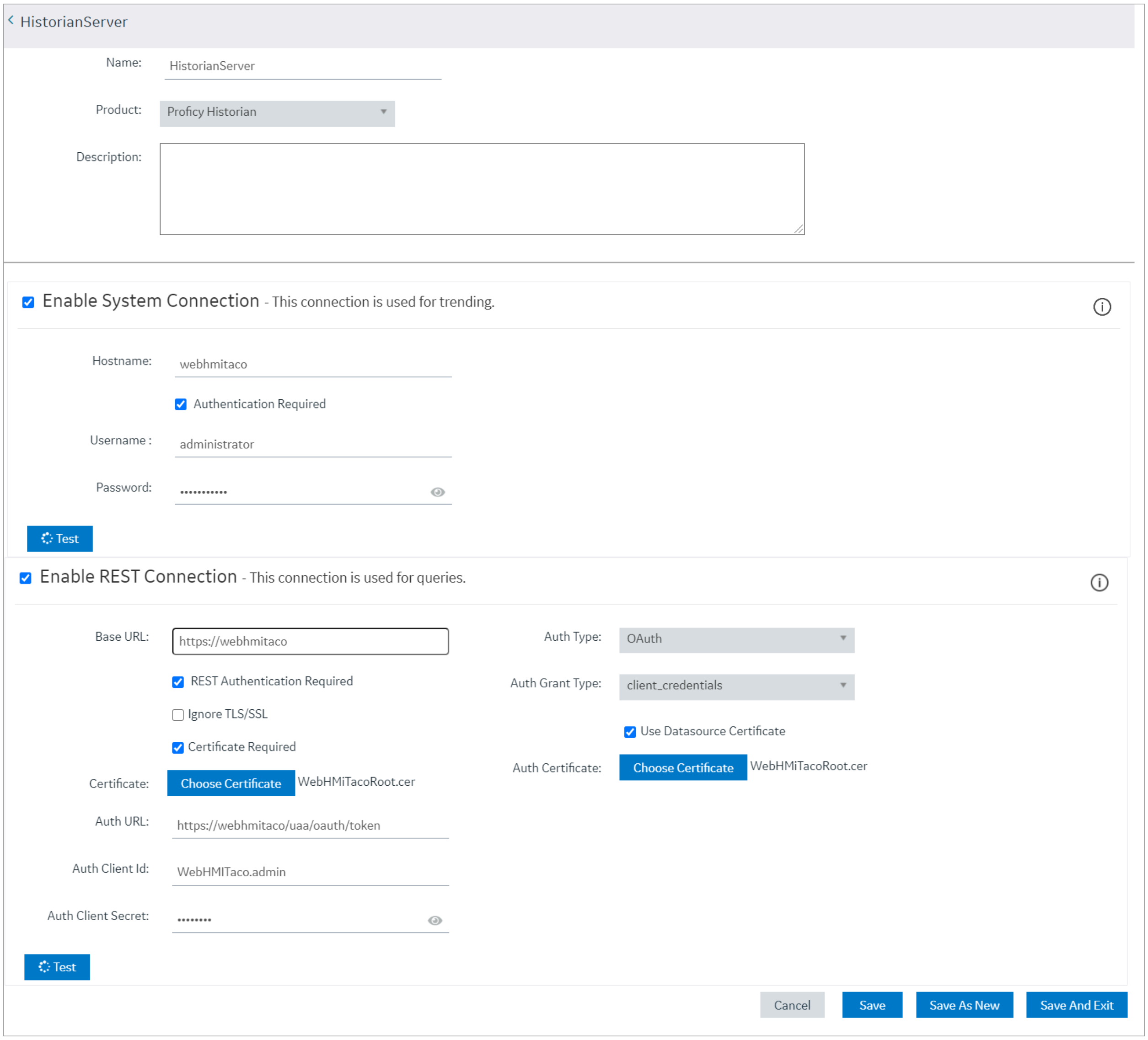
- The **System API** connection is necessary for Trending Historian data in the Trend widget.
- The **REST API** connection is necessary for creating REST queries against the Historian REST API. These queries can then be bound to widgets like gauges, grids, etc to visualize this data
- When configuring a REST data source, be sure to provide all necessary parts to the Base URL, including any required ports. (Example: `https://<HistorianServerName>:8443`)

Refer to Add Historian or Custom REST Data Source *(on page 288)*.

Configuring Historian 7.x in Operations Hub



Configuring Historian 8.x in Operations Hub

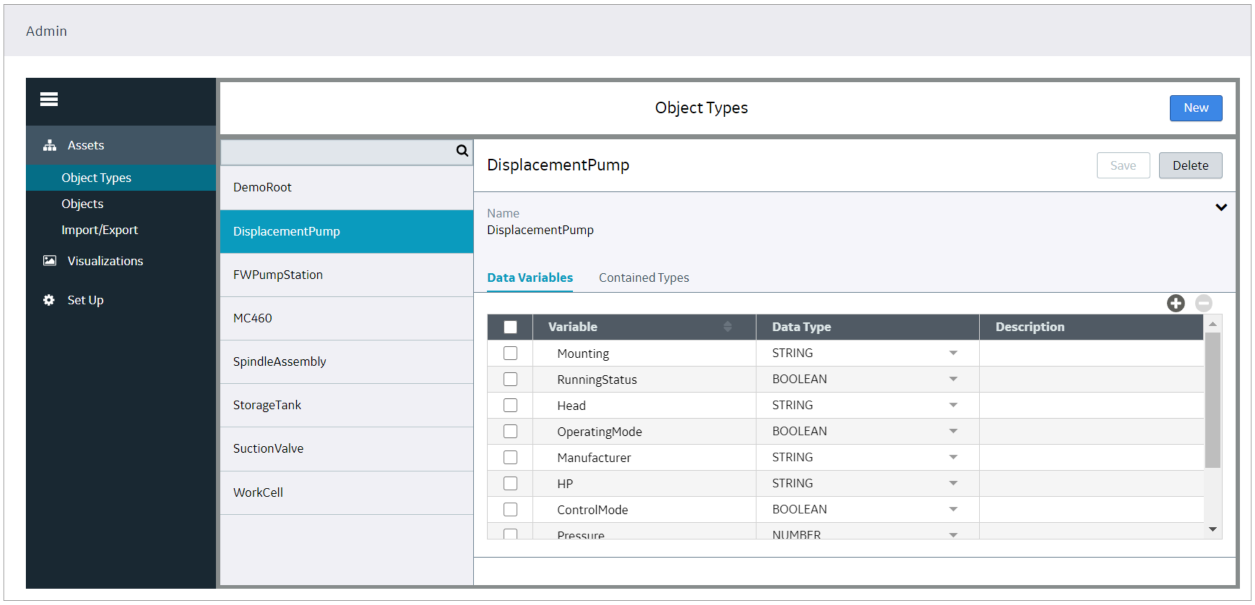


Note:

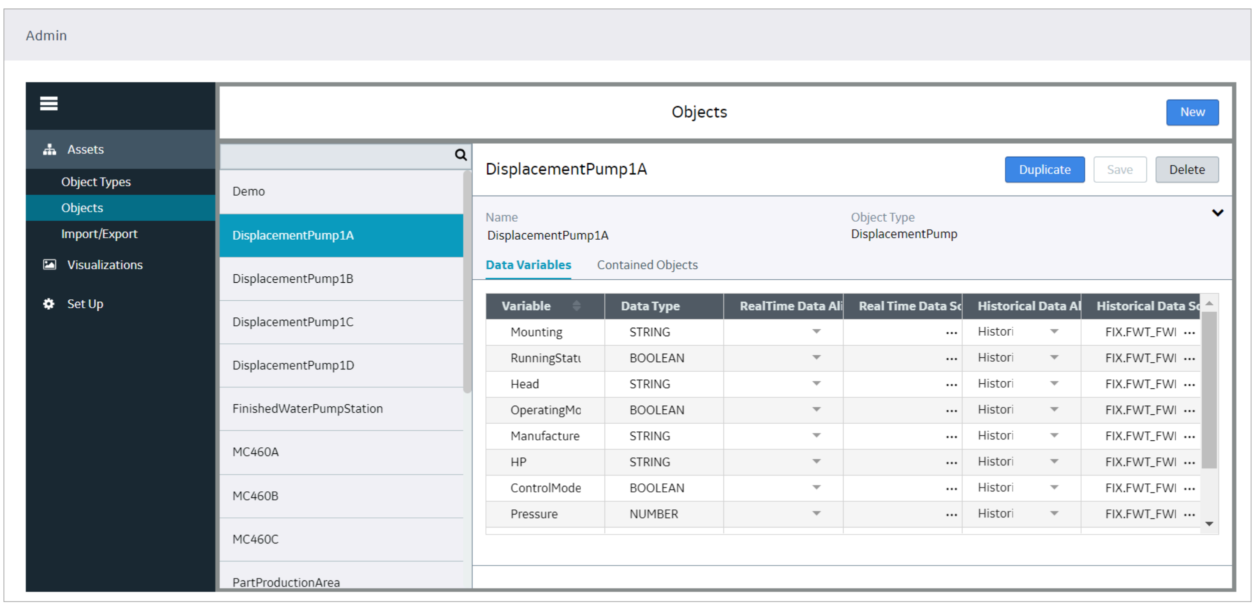
The Auth Client ID field is case sensitive. For example, if the Historian server name is hist8Server, the user must use hist8Server.admin and not HIST8Server.admin or Hist8Server.admin, otherwise REST authentication will fail. If your rest connection fails, make sure you can login to the Historian Web trend client (https://webhmitaco/historian-visualization/hwa) Once successful, use the same user name and password for the client id in the REST configuration in Operations Hub.

Create a Model for Operations Hub to use with Historian

Create an Object Type



Create an Object based on the New Type



Tie the properties of the Data variables to the Historian data source.

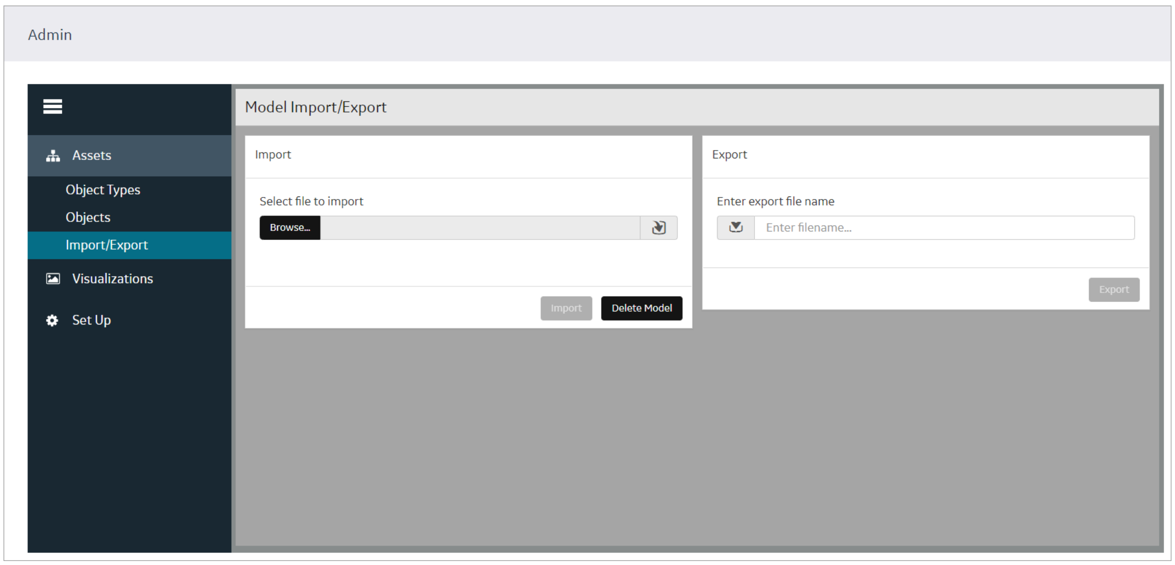
Refer to Set Up the Model Structure *(on page 272)* and Define Objects *(on page 273)*.

Use the Trend Widget for Historian Data Source

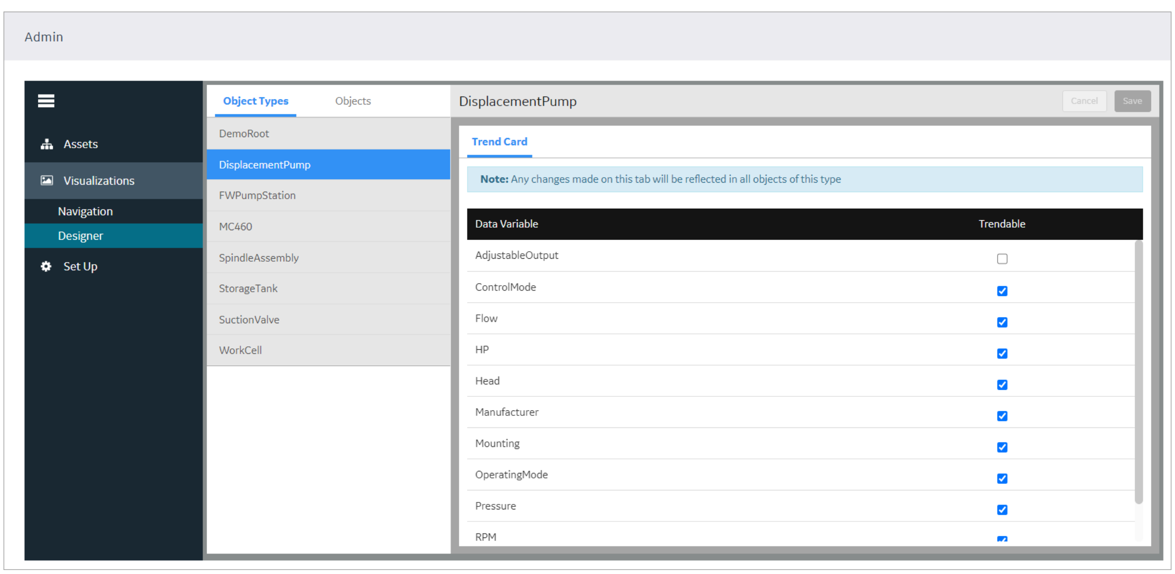
When using Operations Hub with Historian use the following guidelines to successfully get data flowing in the Trend widget.

Use the Trend Widget with an Asset Model

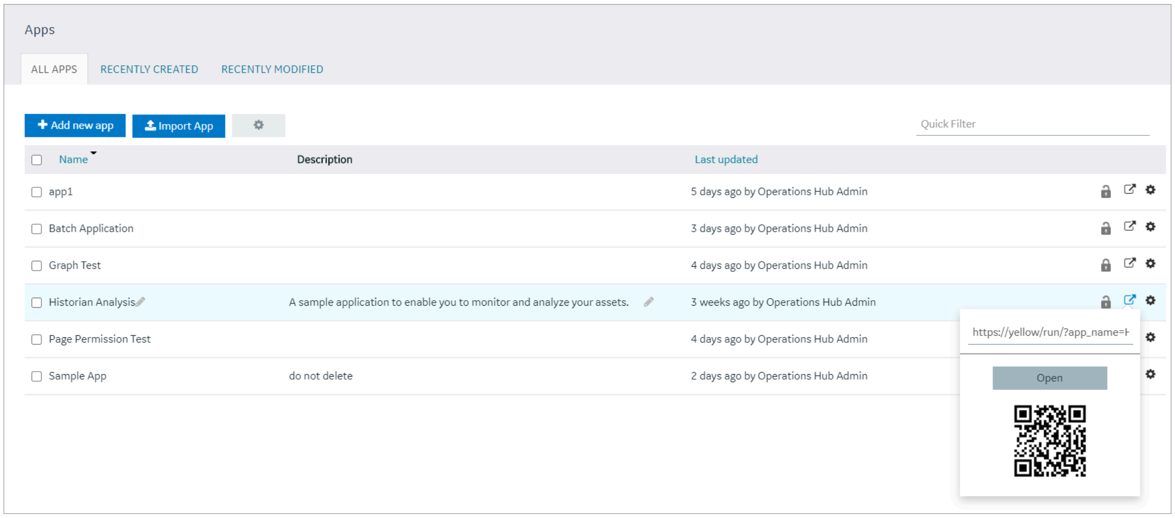
1. Create a Historian data source *(on page 288)*.
2. Import the model from the **Admin** > **Import/Export** option.



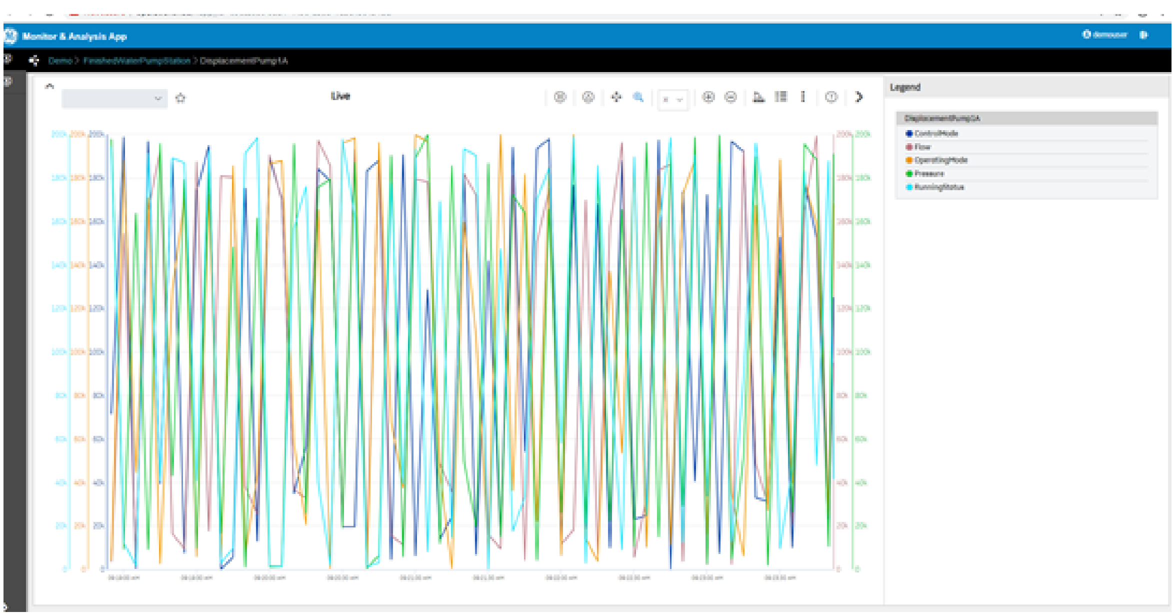
3. After the model is successfully imported, go the **Visualizations > Designer** section and enable the Trendable properties and save.



4. Switch to the **Apps** section.
5. Choose the **Historian Analysis** app.
6. Select the button to open the app.

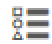


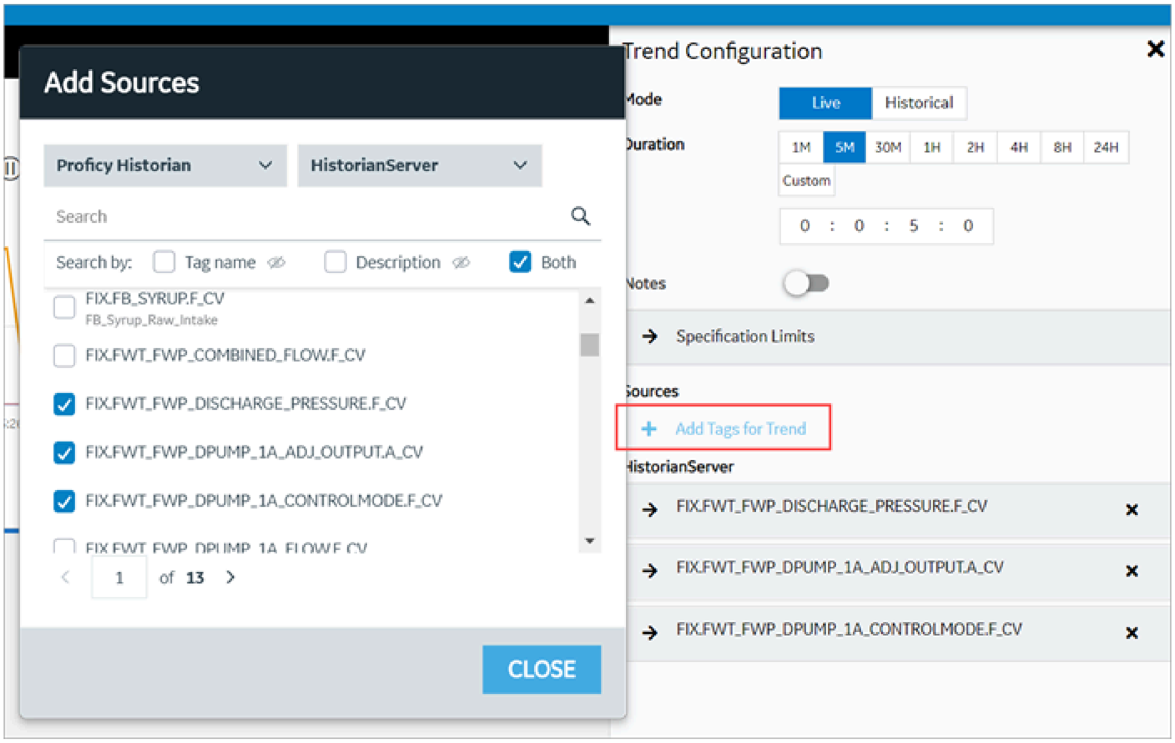
7. At run time, navigate through the model and the Trend chart will display data based on the context selected.

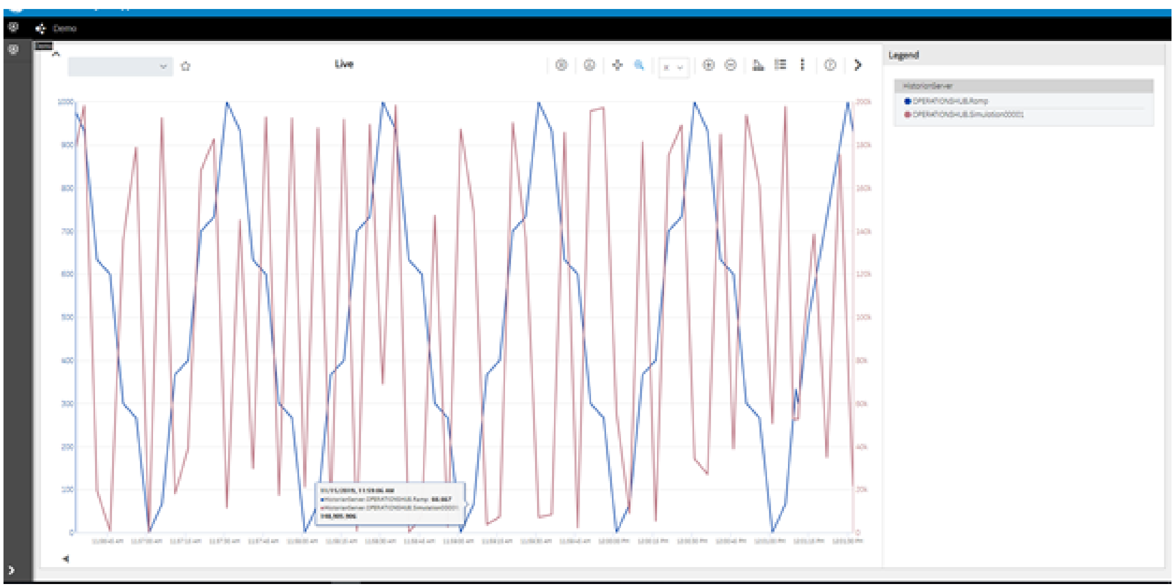


Use the Trend Widget without an Asset Model (Browsing Data Source Directly for Trend Widget)

1. Create a data source to historian via the **Data Sources** section.
2. Make sure the test passes.

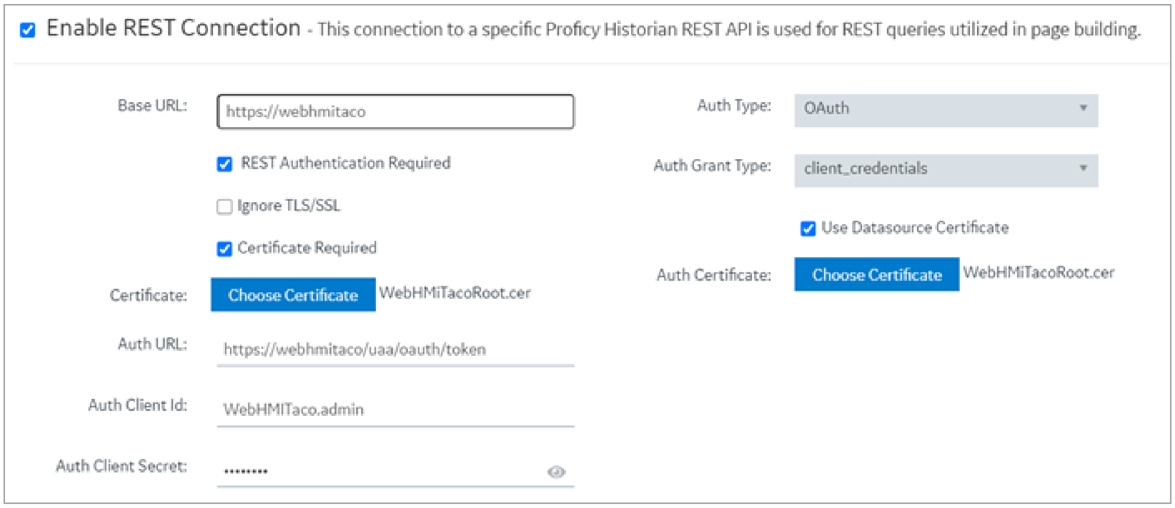
3. In the **Admin**, make sure the Historian server is also setup via the Setup area.
4. Switch to the **Apps** section.
5. Choose the **Historian Analysis** App
6. Select the  button to open the app.
7. At run time, open the Trend chart configuration via the  button, then select **Add Tags for Trend** to browse Historian and add tags to the chart for trending.





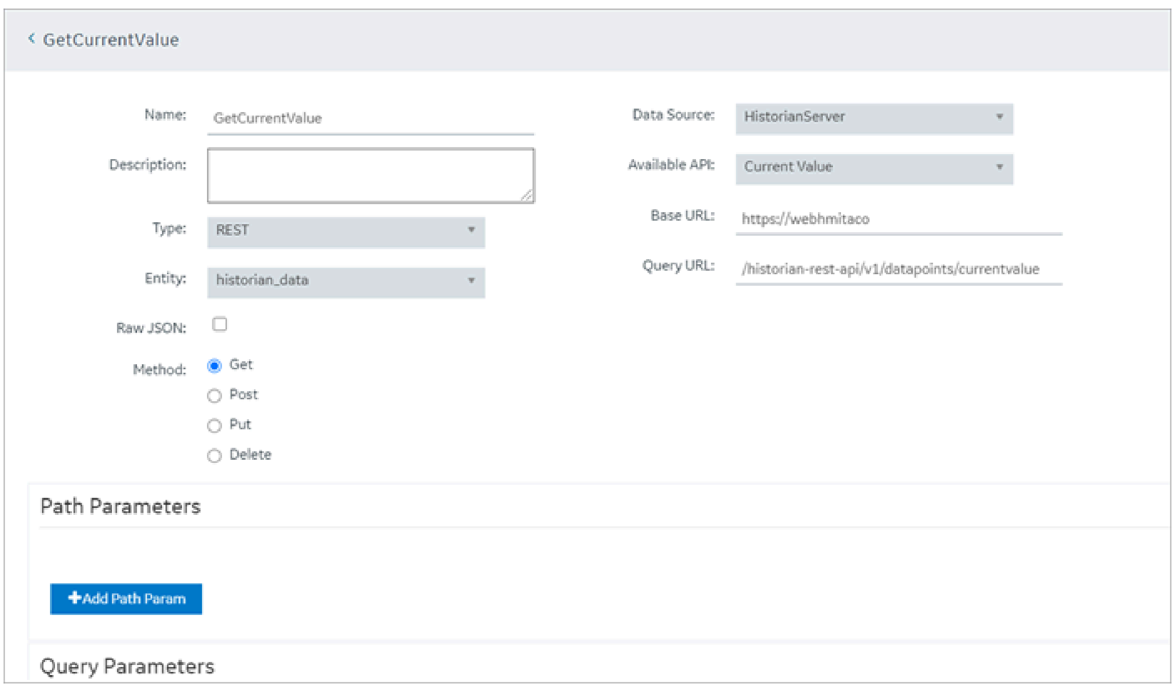
Create Historian REST Query for Operations Hub

1. Make sure the data source for Historian REST API is configured as described in the Configure Historian Data Sources for Operations Hub *(on page 81)* section.



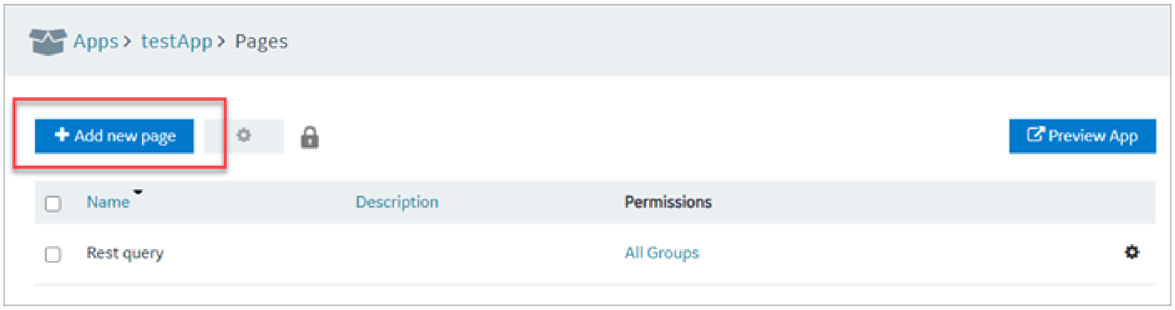
2. Create a query for Current value.

   Refer to Create REST Query *(on page 204)*.

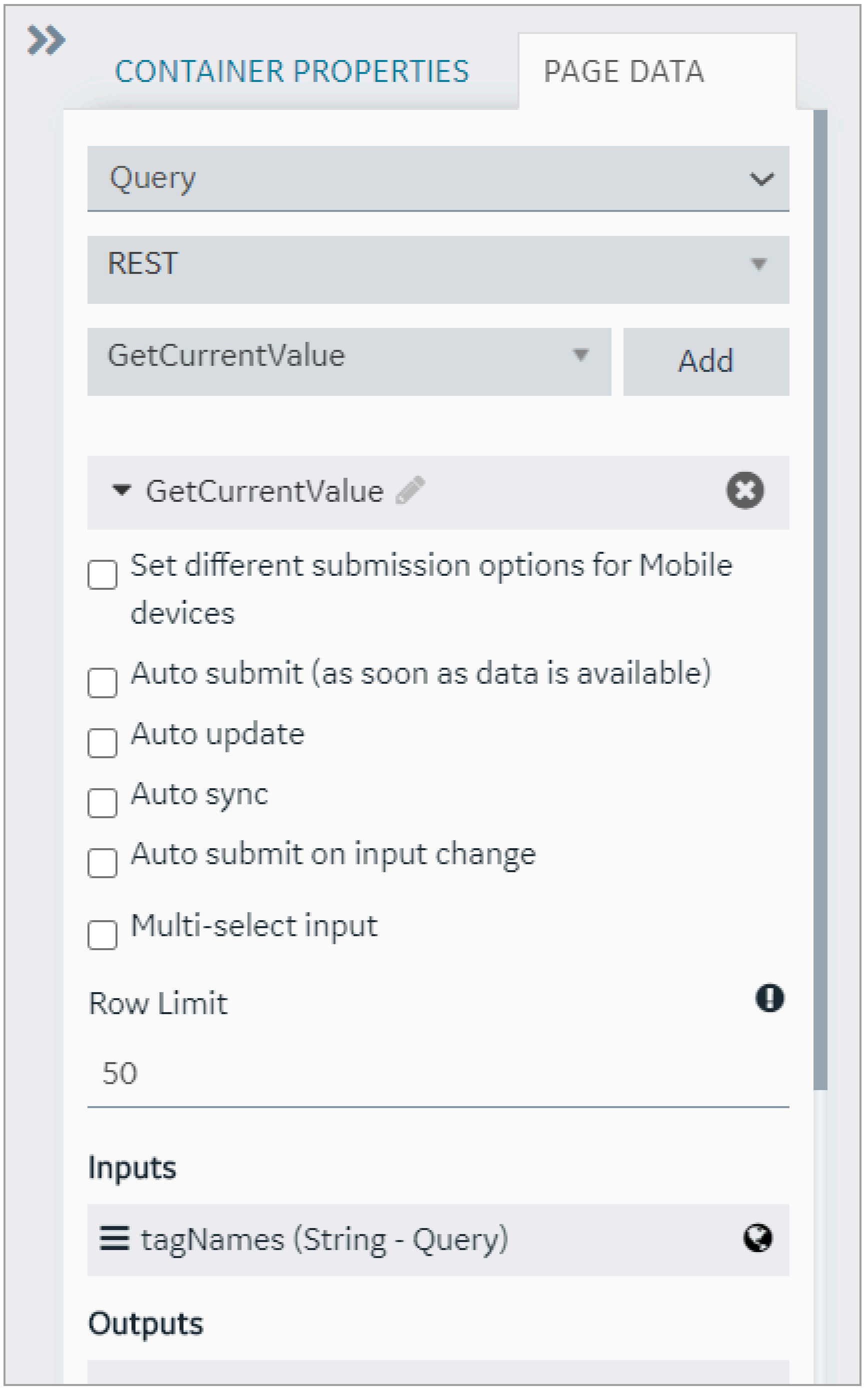


Use the Historian Query in the Operations Hub Page Designer

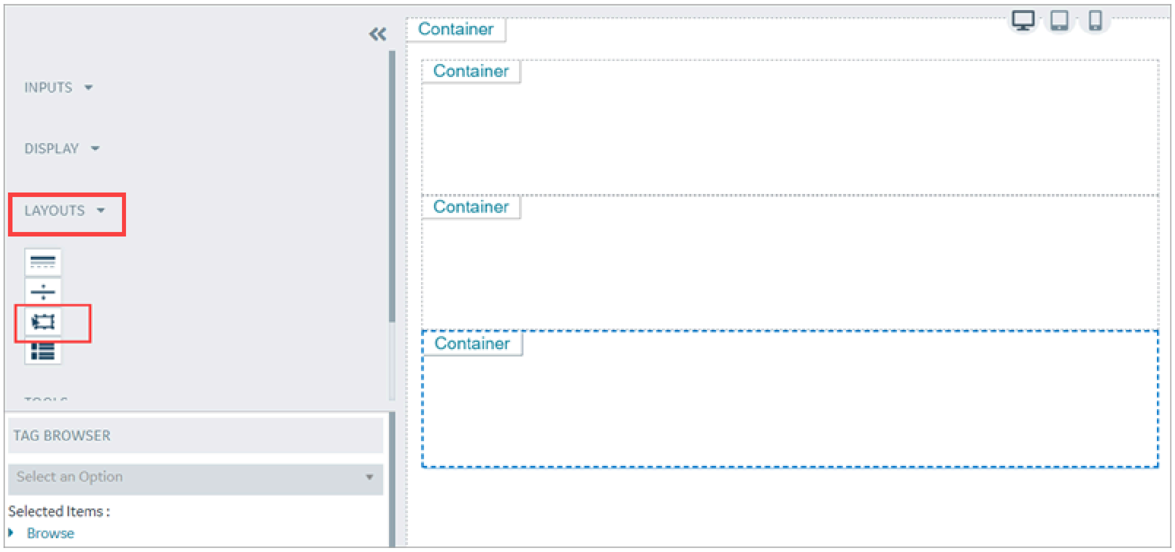
1. Go to **Apps** > **Pages** and then **Add a New Page** from within the App.



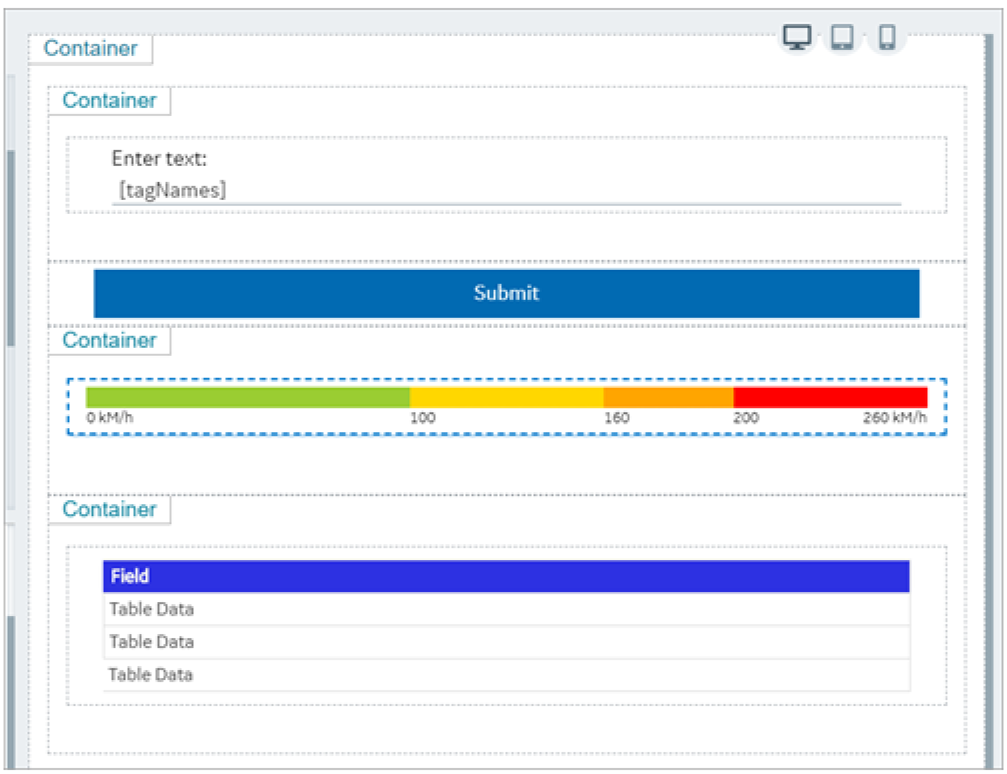
2. Within Page > Page Data, select Query > REST, next to **Get Current Value**, click Add to add the "Current Value Query" to Page.



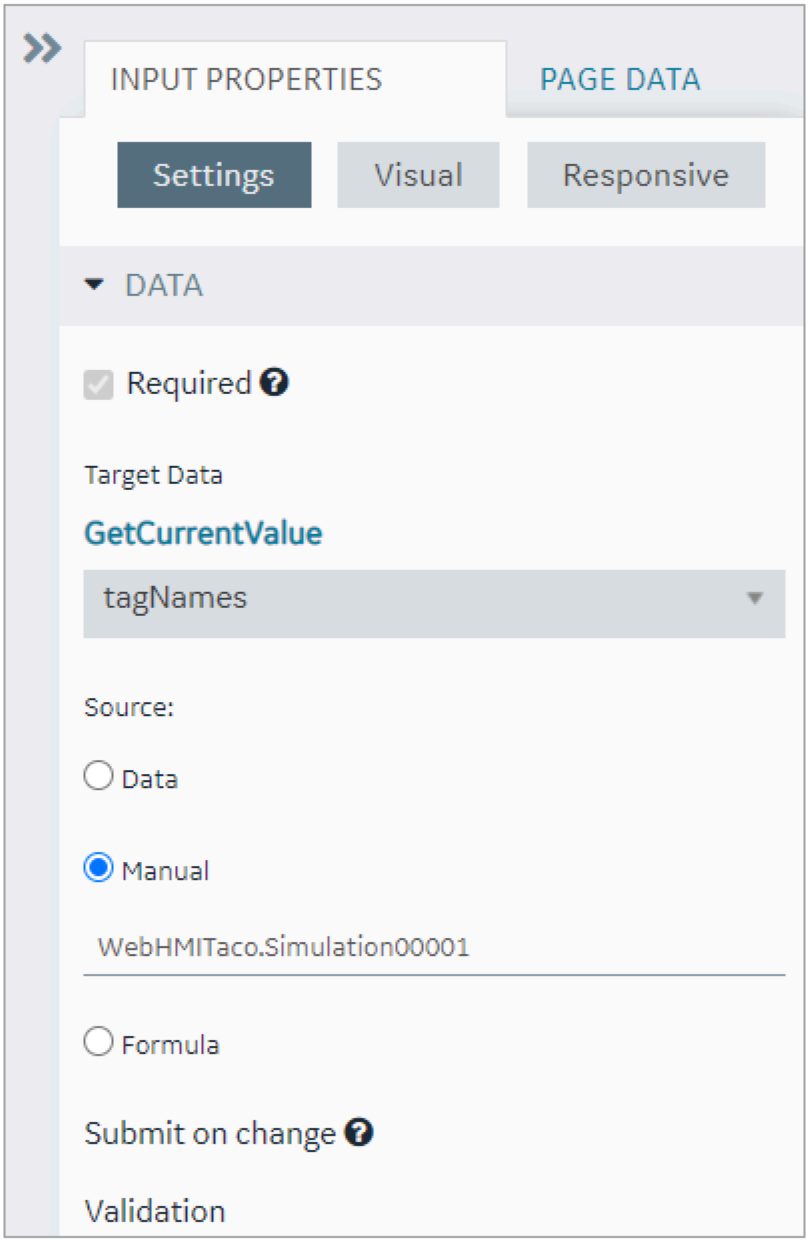
3. Add widgets to the Page, by first adding three containers to the page. From Layouts, select and drag Containers.



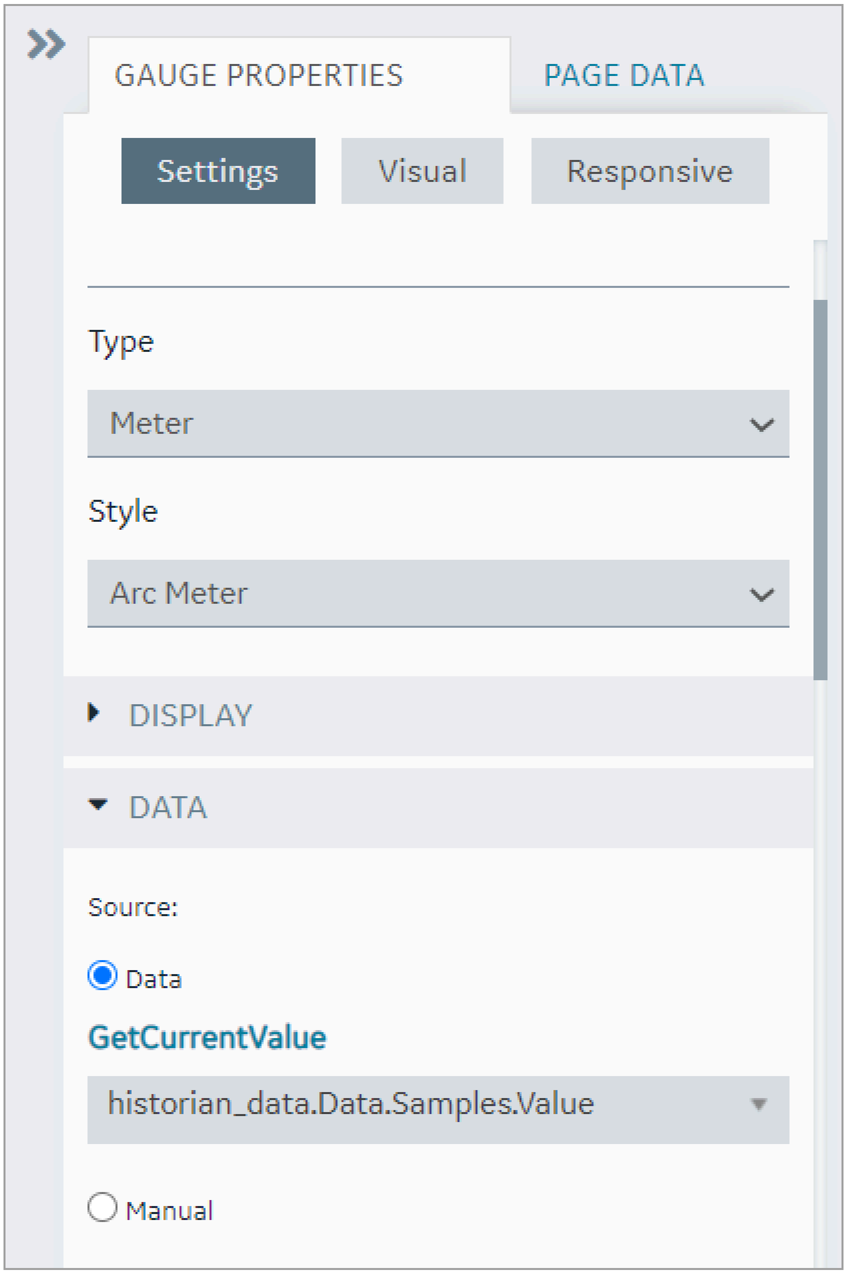
4. Add an Input > Input widget and a button into the first container, Display > Gauge into the second container, and Display > Table into the third container.



5. Now we need to bind the query parameters to each of the widgets: For the Input widget set the target data to the “GetCurrentValue” > TagNames. For the Source you can put in a manual entry of a known Historian tag name.



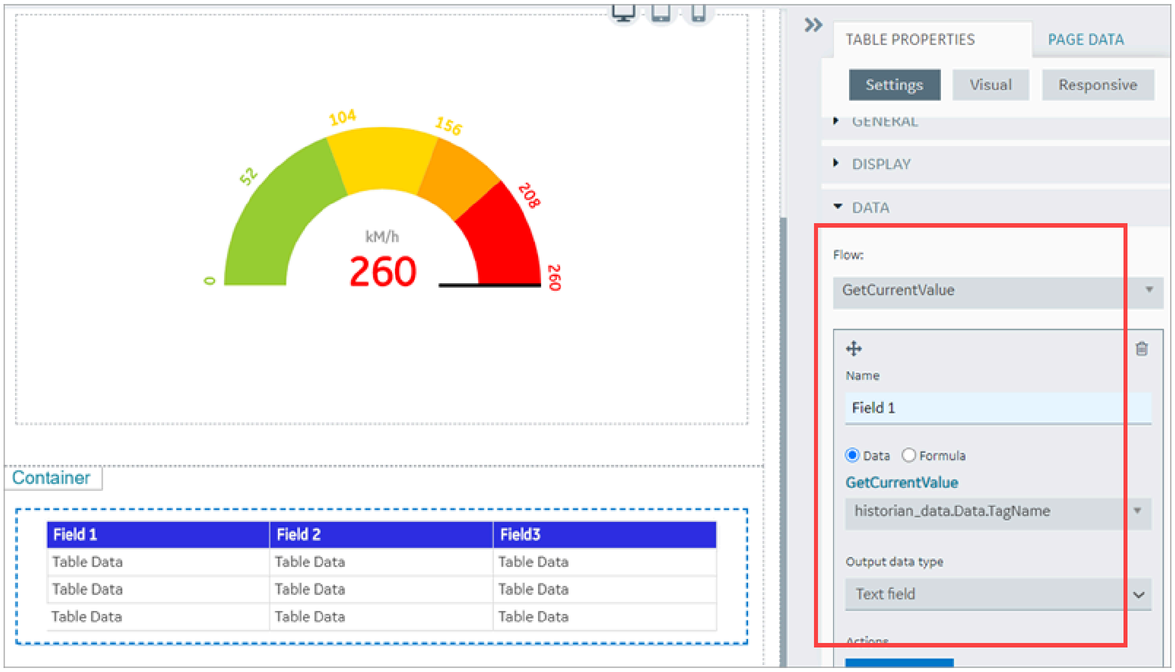
6. For the Gauge widget, set the style to “Arc Meter” and set the Data > Source > Get Current Value > historian_data.Data.Samples.Value.



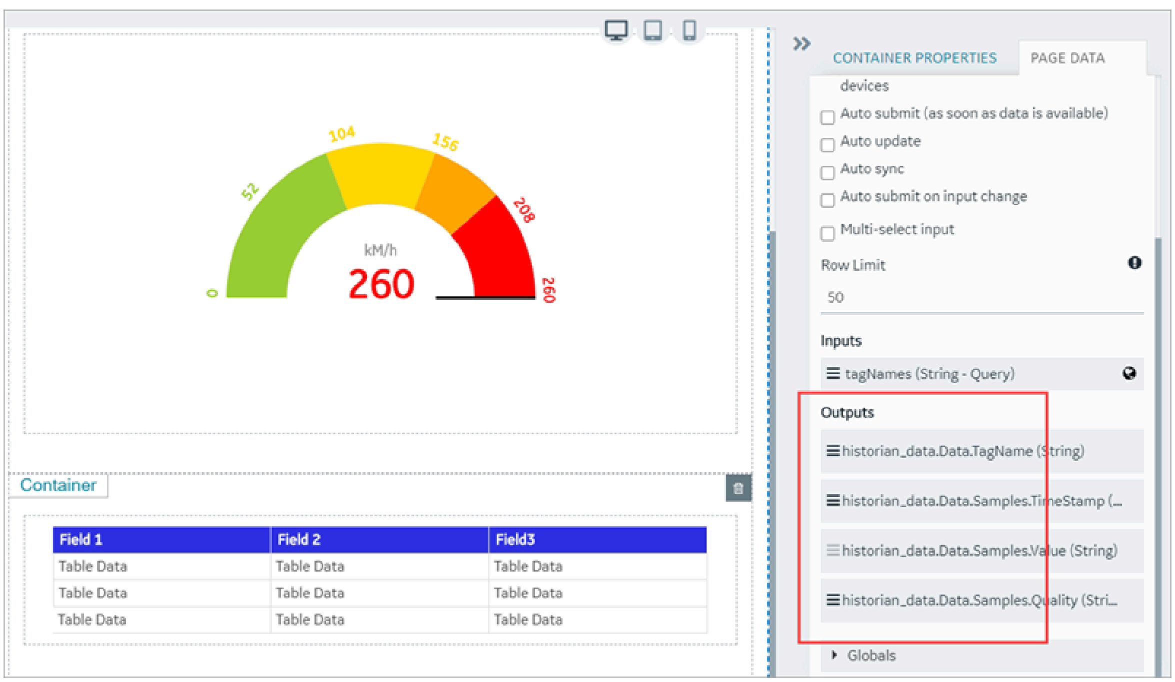
7. Set the color and start position numbers based on the data source High and Low as shown in the following figure.


GAUGE PROPERTIES
PAGE DATA
Settings
Visual
Responsive
GENERAL
DISPLAY
DATA
BEHAVIOR
Start position
100
Color
gold
Start position
160
Color
orange
Start position
200
Color
red

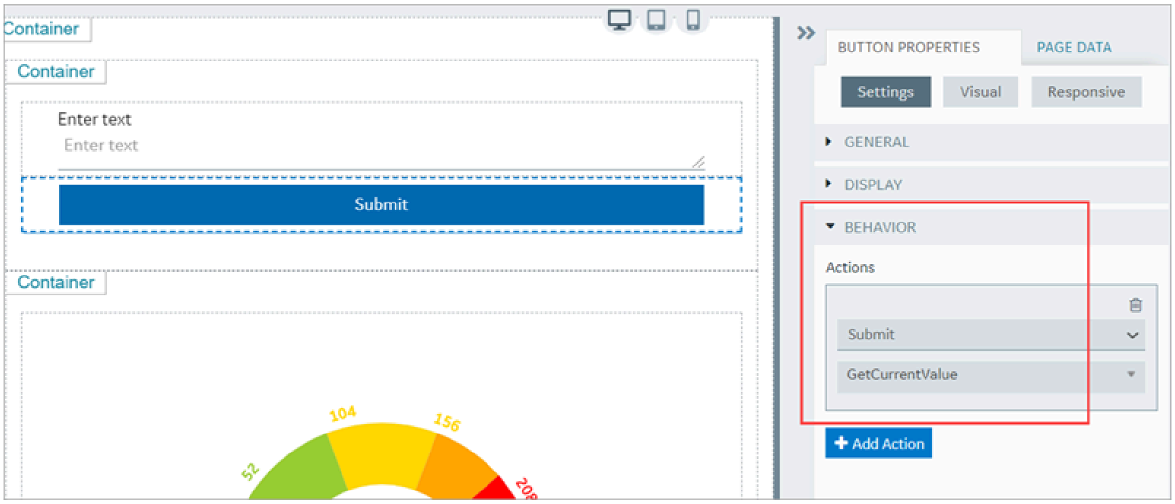
8. For the Table widget, set the Flow->Get Current Value. Now add fields, and set the value for each of the fields.



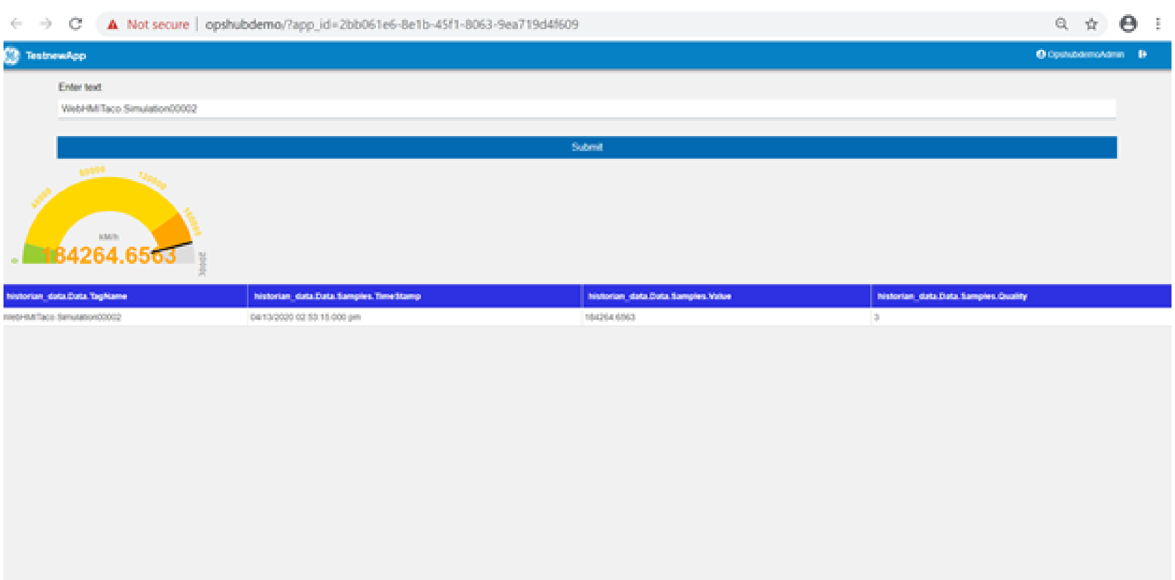
9. Alternatively, you can drag and drop the output parameters from the query onto the grid.



10. Bind the **Submit Action** on button to the query as shown in the following figure:



11. Save the App.
12. Open the App.
13. In the End app, click the **Submit** Button.



14. To update the gauge and the table with the current value of the specified Historian tag, enter a different Historian tag name and click on the **Submit** button.

Getting Started with the Relational Database Connector

Get Started with Relational Database Connector

This topic guides you through how to get started integrating the Relational Database Connector and Operations Hub.

Before You Begin

Before beginning with your relational database connector, be aware of the following:

- This release of Operations Hub supports fetching data via stored procedures from Microsoft SQL Server only.
- Be sure to confirm that you can to successfully connect to the SQL Database:
    - Test that you can connect to SQL Server with another client (for example: SSMS, UDL files), using the SQL account you want to use in Operations Hub.
    - Confirm that the TCP/IP Protocol is enabled on the SQL Server. You will not be able to connect from Operations Hub until you enable TCP/IP using the SQL Server Configuration Manager.
- Ensure that you have a working SQL Database, and that the selected database has stored procedures.

Steps

The following sections walk you through:

1. Create a data source of type Relational Database. Refer to the Add Relational Database Data Source *(on page 286)* section.
2. Provide the details to the external database. Refer to the Create a Query to a Relational Database *(on page 98)* section.
3. Create a Query of type Relational Database, and specify the expected inputs and outputs of a Stored Procedure. Refer to the Create a Query to a Relational Database *(on page 98)* section.
4. Map the query in the page designer to use the query to fetch the data from the external database. Refer to the Use the Relational Database Query in the Designer *(on page 102)* section.
5. View the page in the end app. For an example, see Example of Adding Relational Database Queries to a Page *(on page 106)*.

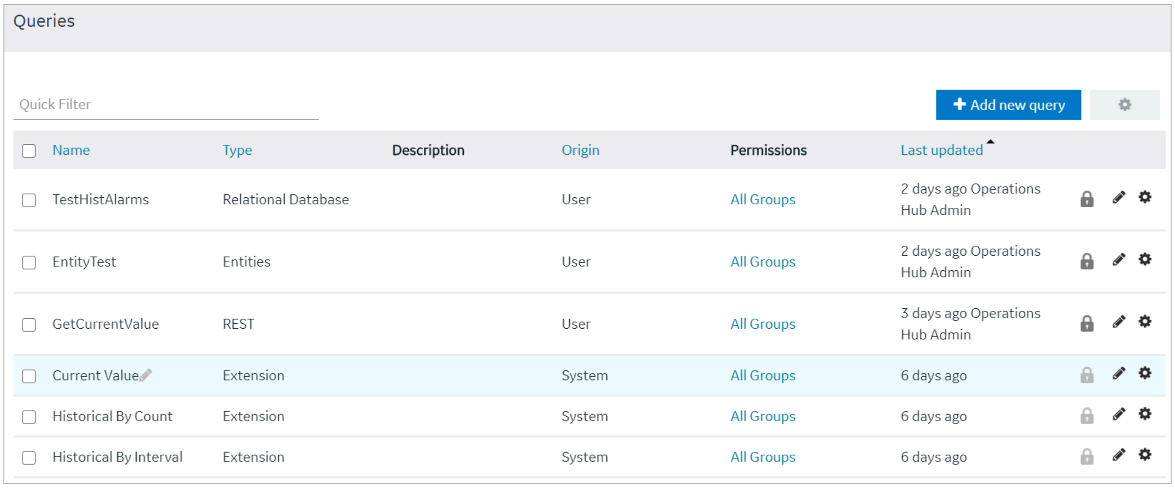
Create a Query to a Relational Database

This topic describes how to create a SQL query.

In order to proceed you must have a working SQL database, and the selected database must have stored procedures. You must also have created a data source for the relational database in Operations Hub. See Create a SQL Data Source *(on page 301)*.

1. In the main navigation menu, select **QUERIES**.

   The **QUERIES** workspace appears.

2. Select **Add new query**.

   The **Create Query** window appears.
3. In the **Name** field, enter a name, and then select **Create**. The name must contain at least one uppercase or lowercase letter.

   The available options for creating the query appear.
4. In the **Description** field, enter a description for the query.
5. In the **Type** field, select **Relational Database** .
6. In the **Data Source** field, select the name of the data source from the list.
7. In the **Query Type** field, observe that the field defaults to 'Stored Procedure' when you select 'Relational Database' as the Type.
8. In the **Schema** field, select the database schema that you want to use. All the database schemas will be loaded for the selected data source. The default selection is *dbo*.
9. In the **Stored Procedure** field, select the Stored Procedure that you want to use from the selected schema.

   After you selects all the required fields, the list of input parameters will be loaded if there are any, for the selected stored procedure.

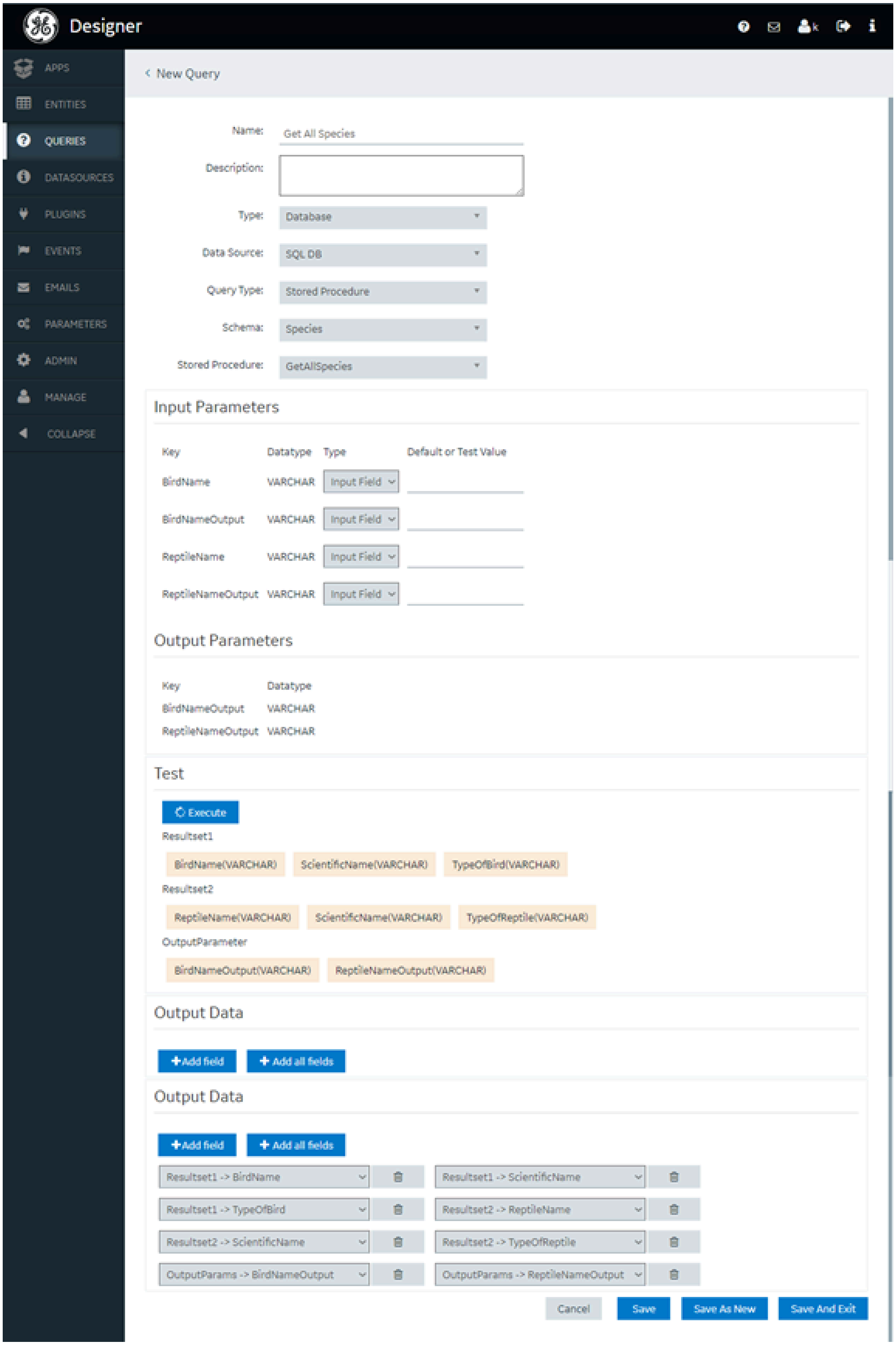
   The value for the input parameters can be configured either while creating the query or while consuming the query in the page builder page.
10. To assign the value for an input parameter while creating the query, select the type drop-down in the input parameter list. It has two options:

    - Fixed Value: If this option is selected, the value given will be taken as the input to the Stored Procedure. The input parameter will not be shown in the page builder page.
    - Input Field: If this option is selected, the value given will be taken as the default input to the Stored Procedure. The input parameter will be shown in the page builder page and if there is any input provided to while execution, the default value will be overridden.
11. After the default values for input parameters are provided, click the **Execute** button under the Test category. You will then be presented with the various fields in Result Sets and Output Parameters sent out of the Stored Procedure.

    Note:
    Currently we do not support dynamic responses from the Stored Procedures. Meaning, the fields that we see while building the query after clicking the Execute button, should match the fields returned by the stored procedure while using the application.

12. Add the required fields.

    The following figure displays an example:


Designer
APPS
ENTITIES
QUERIES
DATASOURCES
PLUGINS
EVENTS
EMAILS
PARAMETERS
ADMIN
MANAGE
COLLAPSE
New Query
Name: Get All Species
Description:
Type: Database
Data Source: SQL DB
Query Type: Stored Procedure
Schema: Species
Stored Procedure: GetAllSpecies
Input Parameters
Key Datatype Type Default or Test Value
BirdName VARCHAR Input Field
BirdNameOutput VARCHAR Input Field
ReptileName VARCHAR Input Field
ReptileNameOutput VARCHAR Input Field
Output Parameters
Key Datatype
BirdNameOutput VARCHAR
ReptileNameOutput VARCHAR
Test
Execute
Resultset1
BirdName(VARCHAR) ScientificName(VARCHAR) TypeOfBird(VARCHAR)
Resultset2
ReptileName(VARCHAR) ScientificName(VARCHAR) TypeOfReptile(VARCHAR)
OutputParameter
BirdNameOutput(VARCHAR) ReptileNameOutput(VARCHAR)
Output Data
Add field
Add all fields
Output Data
Add field
Add all fields
Resultset1 -> BirdName
Resultset1 -> ScientificName
Resultset1 -> TypeOfBird
Resultset2 -> ReptileName
Resultset2 -> ScientificName
Resultset2 -> TypeOfReptile
OutputParams -> BirdNameOutput
OutputParams -> ReptileNameOutput
Cancel
Save
Save As New
Save And Exit

13. Select **Save** or **Save And Exit**.

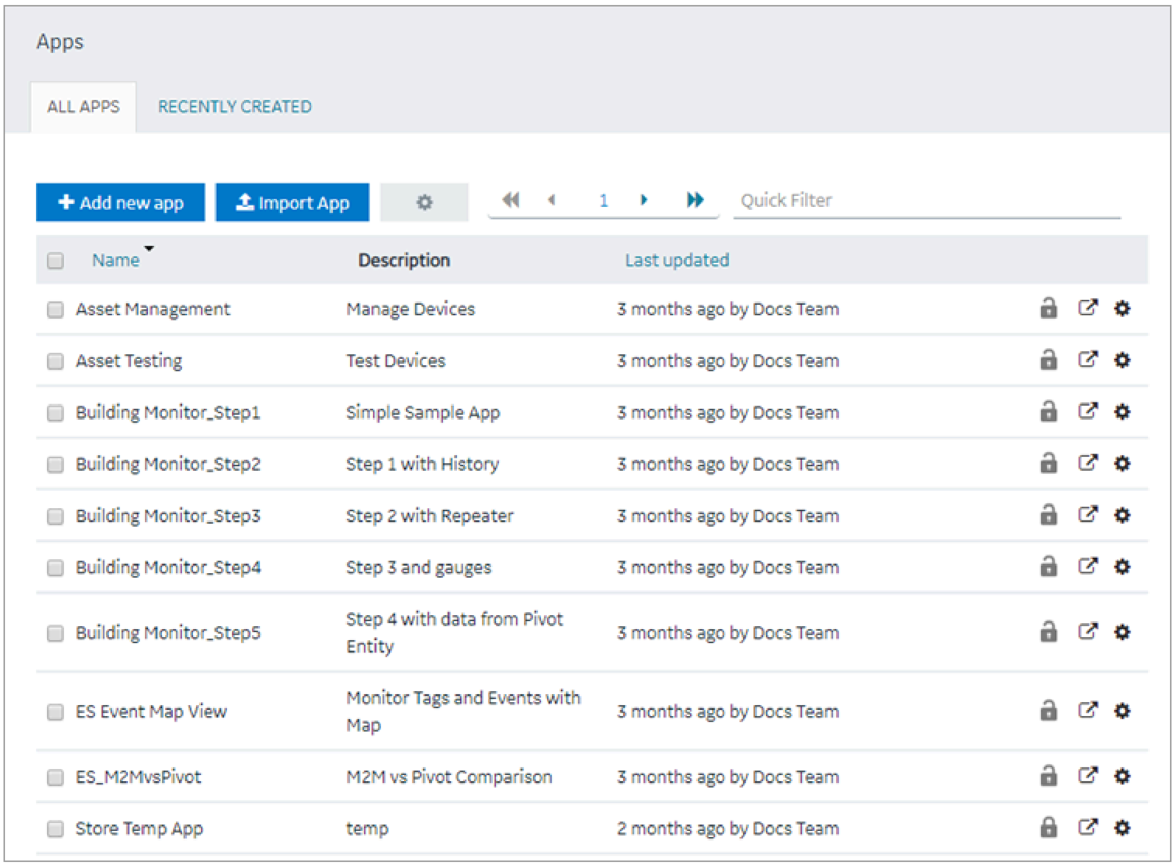
    The query is created.

Use the Relational Database Query in the Designer

This topic describes how to apply SQL queries to a page.

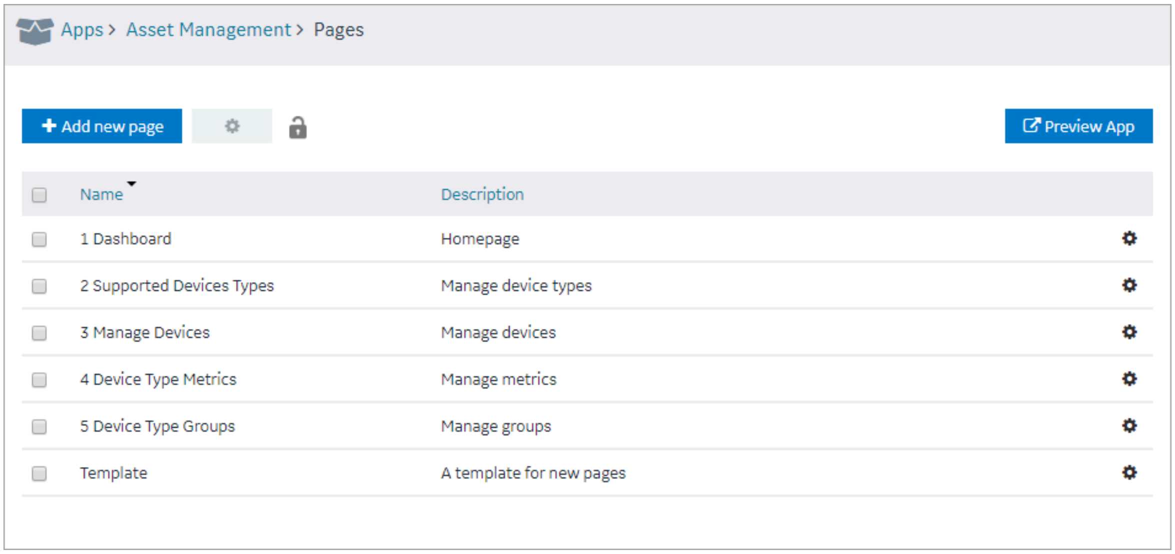
1. In the main navigation menu, select **APPS**.

   The **APPS** workspace appears, displaying a list of applications created in Operations Hub.



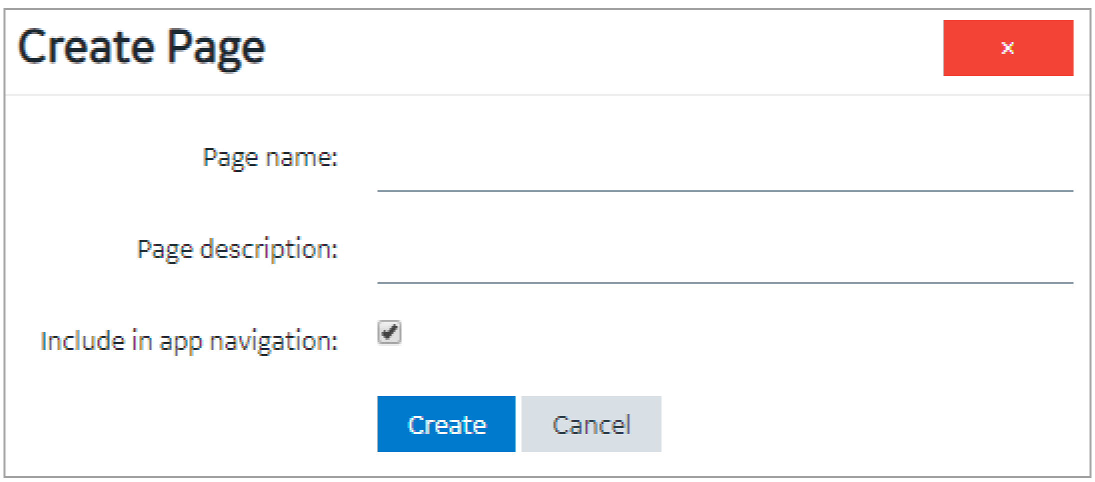
2. In the **Name** column, select the application in which you want to create a page.

   The **PAGES** workspace appears.



3. Select **Add new page**.

   The **Create Page** screen appears.

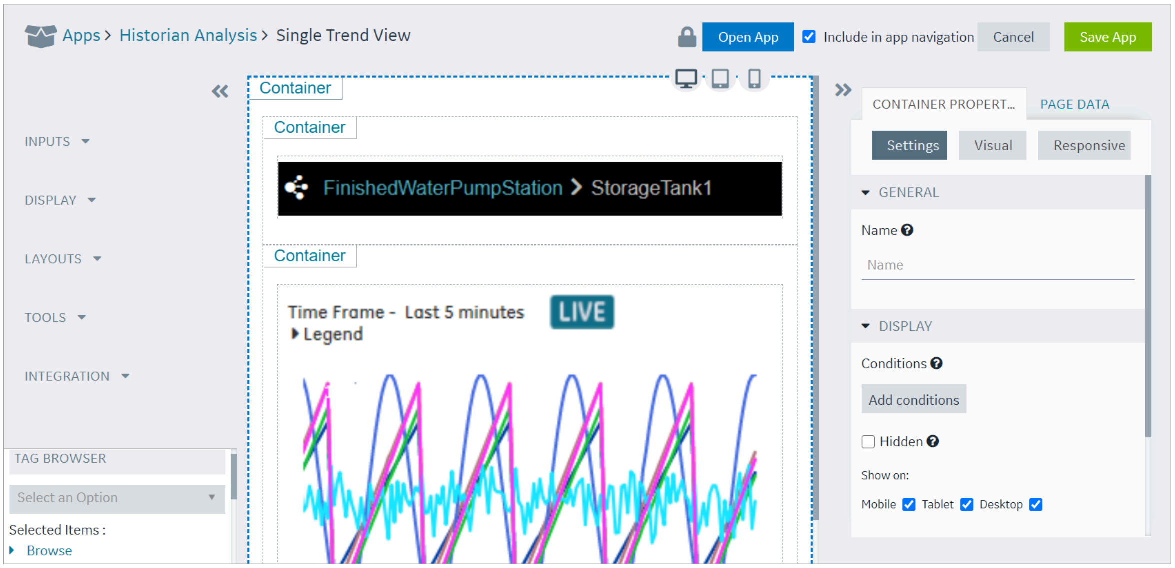


4. Enter or select values as described in the following table.

Field	Description
Page name	Enter a name for the page. The name must contain at least one uppercase or lowercase letter.
Page description	Enter a description for the page.
Include in app navigation	Select this check box if you want this page to be included in the application navigation. By default, this check box is selected.

5. Select **Create**.

   The page is created, and the page designer appears.



6. Select **Page Data**.
7. To add a Relational Database Query to the page, do the following:

   a. Select the flow type as `Query`.

   b. Select the Data source type as `Relational Database`.

   c. Select the required data source.

   d. Select the required query.

   e. Select a result set.

   f. Select **Add**.

   The query with sub-selected result set will be added to the page. The naming convention will be `QueryName - ResultSetName`. Inputs and Outputs are assigned to components exactly like that of REST and Entity pages.

   ◦ **Applies to Operations Hub 2022 and earlier versions**:
      ▪ For SQL queries with multiple result set, if a result set is added to the page, you cannot add that result set multiple times with different inputs to the same page. You need to create a separate query each time you want to add that result set to the page.
      ▪ In case a SQL query with multiple result is added to the page, the inputs and query execution options (check boxes for auto-submit, auto-update, etc.) appear only for the first added result set. Only outputs appear for result sets added subsequently.

The selected inputs and query execution options for the first result set apply to all the query result sets.

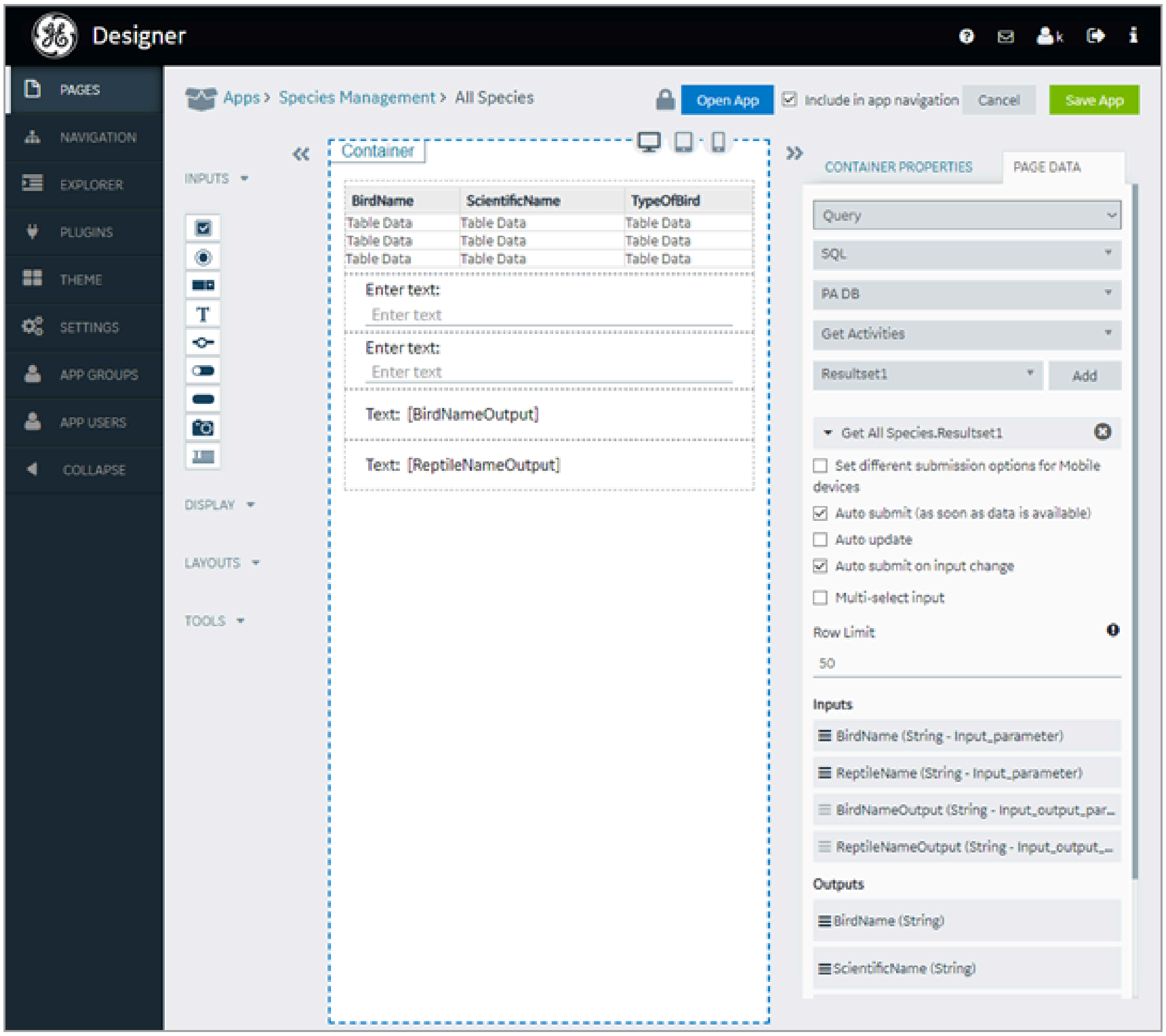
- For a query with single result set, you can add it multiple times to the page. But, if the same query output is changed to contain multiple result sets at a later time, then you must remove the second instance of the query before adding the new result set.

- **Applies to Operations Hub 2022.4.1 and later vesions**: Every ResultSet in a query is an independent query (inputs and query execution options appear for every result set). This new behavior does not impact the existing apps and queries (created in earlier versions).

> **Note:**
> As of Operations Hub 1.7, The inbuilt pagination and infinite scrolling for Grid and Table components will not work with Relational Database Queries. The pagination must be handled using the input and output parameters of the stored procedure.

8. Select **Save App**.

An example is shown in the following figure.



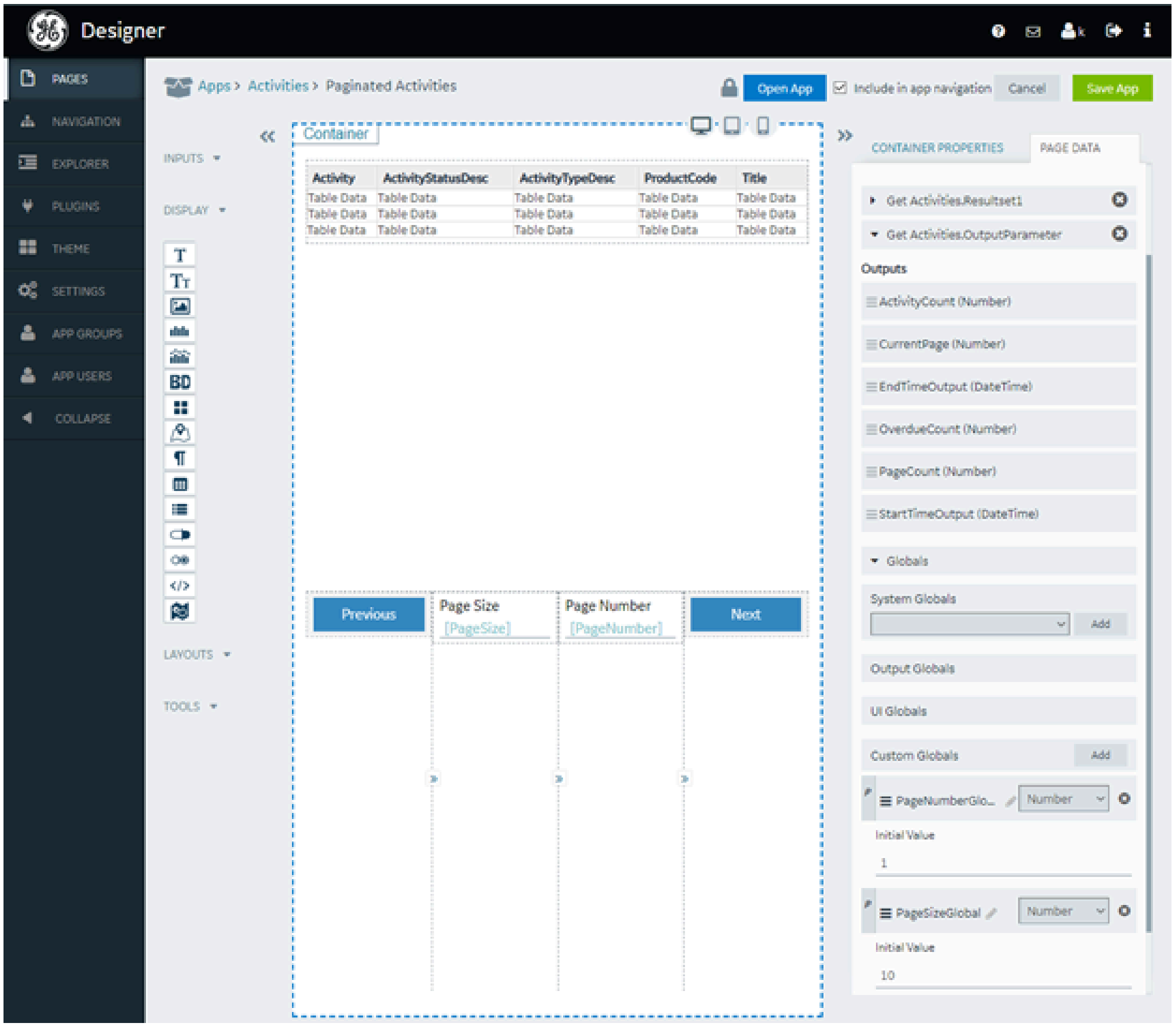
The changes made to the page are saved.

> **Note:**
> View the Page in the End app, by clicking **Open App** button.

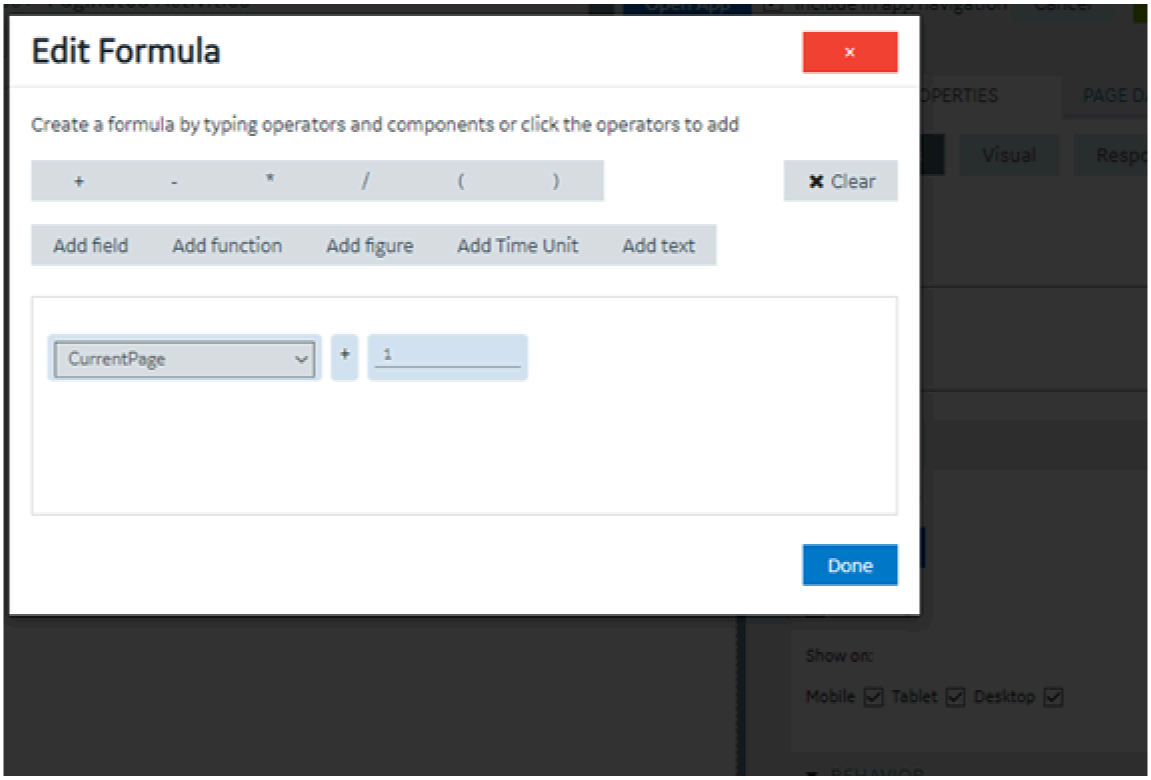
Example of Adding Relational Database Queries to a Page

In the following example, the query has two result sets. One is the result from the stored procedure and the other is from the output parameters. It also has inputs `PageNumber` and `PageSize`.

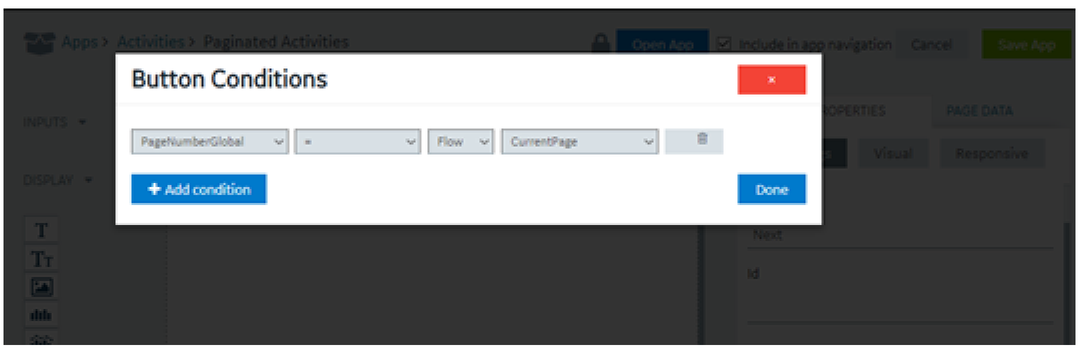
1. Design a page by adding two buttons and two input boxes, and disable the input controls.
2. Map the input parameters of the query to the input controls.
3. Create two custom globals for page number and page size and provide default values as shown in the following figure.

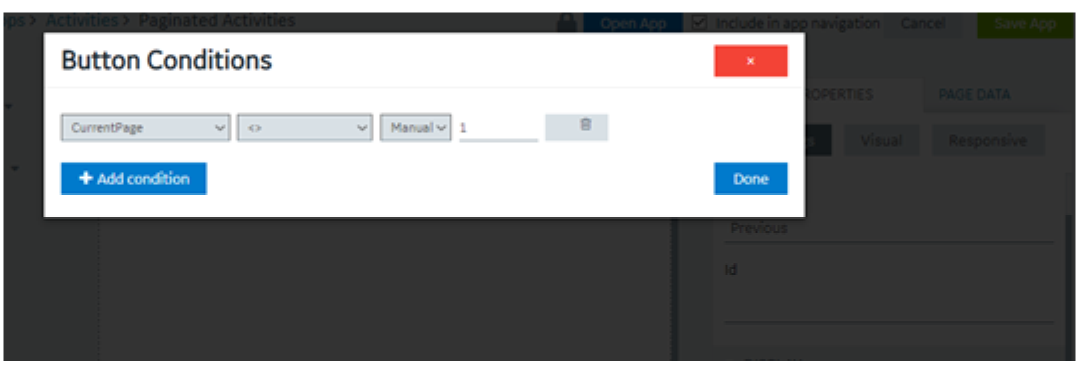


4. Select each button and set the action to set the global value using a formula as shown in the figure (+ for next, - for previous).



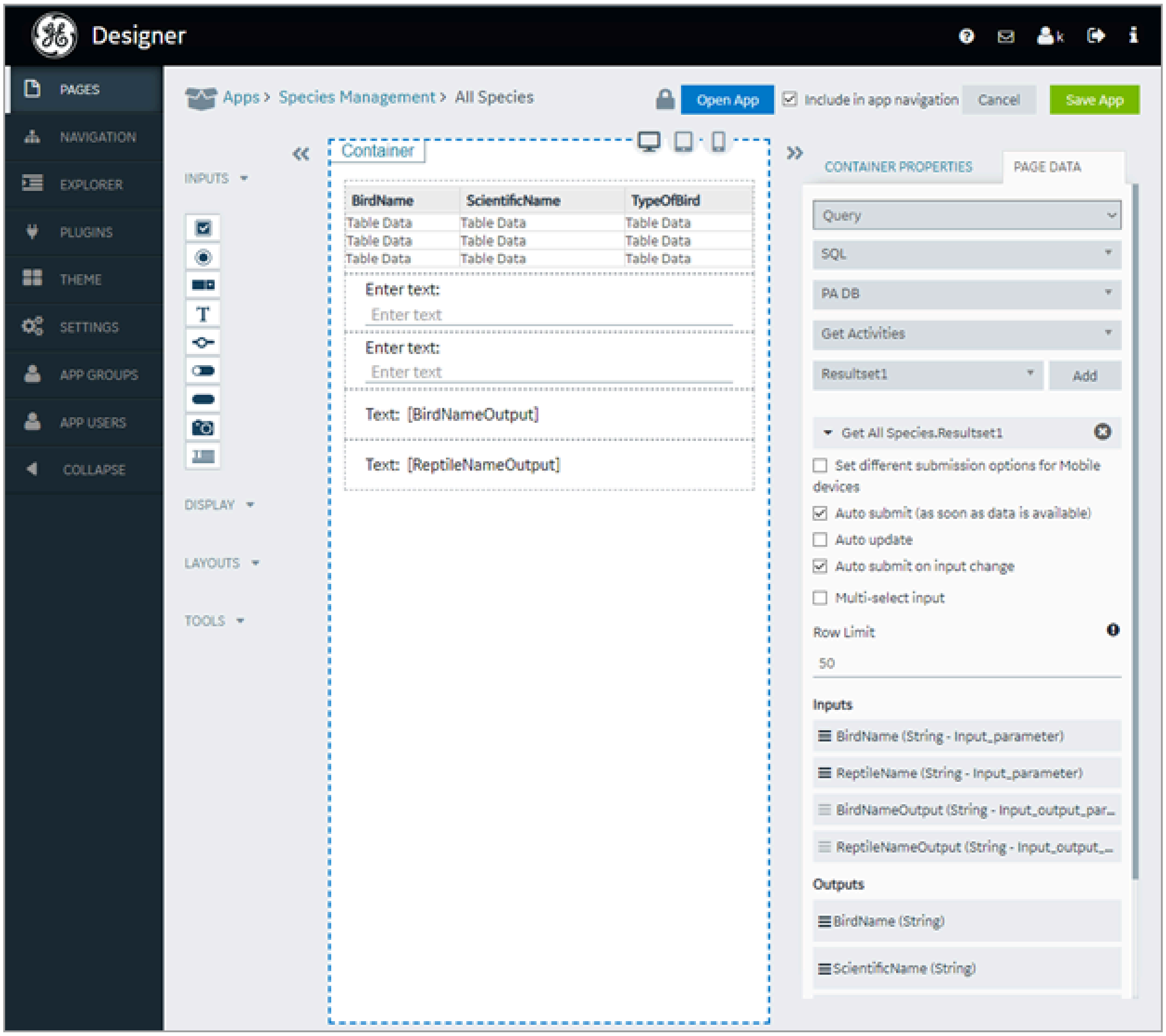
5. Select each button and set the display condition as shown in the following figures.





6. Select **Save App**.

The final page appears as shown here:



Getting Started with OPC UA

Get Started with OPC UA and Operations Hub

This topic guides you on how to configure an OPC UA data source, and build visualization.

Steps

The following sections walk you through:

1. Create a data source with OPC UA configuration in Operations Hub *(on page 293)*.
2. Build an asset model for OPC UA data sources in this order:

    - Create object types *(on page 272)* with Proficy iFIX, Proficy CIMPLICITY, and IGS data variables.
    - For the object types, create object instances *(on page 273)*.
3. Build an asset hierarchy to specify the hierarchical relationships of assets. Operators navigate through this hierarchy to select the equipment context for a given layout at runtime. Refer to Set Up Runtime Navigation *(on page 275)*.
4. Use the Trend Widget for OPC UA Data Sources *(on page 110)*.
5. To enable write operations in Proficy CIMPLICITY for Operations Hub, refer to Configure Proficy CIMPLICITY for Writes *(on page 112)*.
6. To enable write operations in Proficy iFIX for Operations Hub, refer to Configure Proficy iFIX for Writes *(on page 114)*.

Use the Trend Widget for OPC UA Data Sources

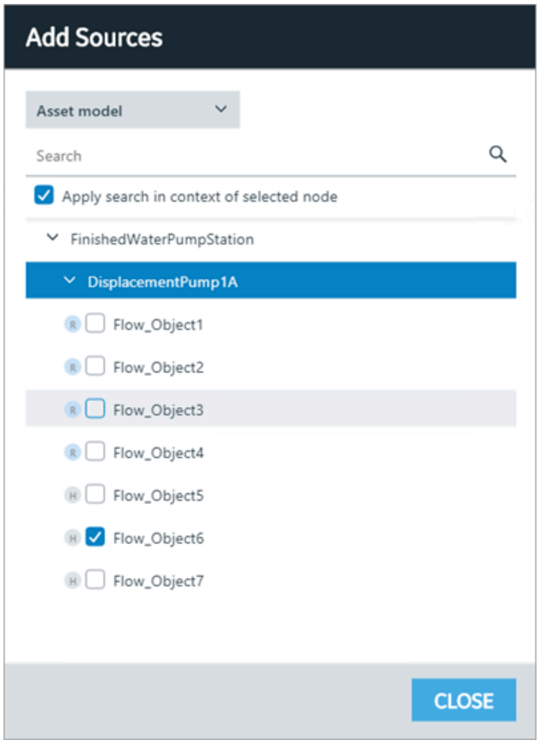
Data visualization with trend widget for OPC UA data sources.

Use the following guidelines to successfully get data flowing in the Trend widget. Refer to Configuring a Trend Chart *(on page 541)*.

Use the Trend Widget with an Asset Model

- Create a data source with OPC UA configuration in Operations Hub *(on page 293)*.
- Build an asset model for OPC UA data sources.

1. In the main navigation menu, select **APPS**.
   The **Apps** workspace appears, displaying a list of applications.
2. Open the application.
3. Select  .
   The **Trend Configuration** pane appears.
4. Select **Add Tags for Trend**.
   The **Add Sources** window appears.



5. Select **Asset Model** from the drop-down.

   A list of assets appear.
6. Browse and select the check box for the properties you want to add to the trend chart.

   Refer to Browse Data Sources *(on page 299)*.

   The live data from the data source starts displaying in a trend chart.

Use the Trend Widget without an Asset Model

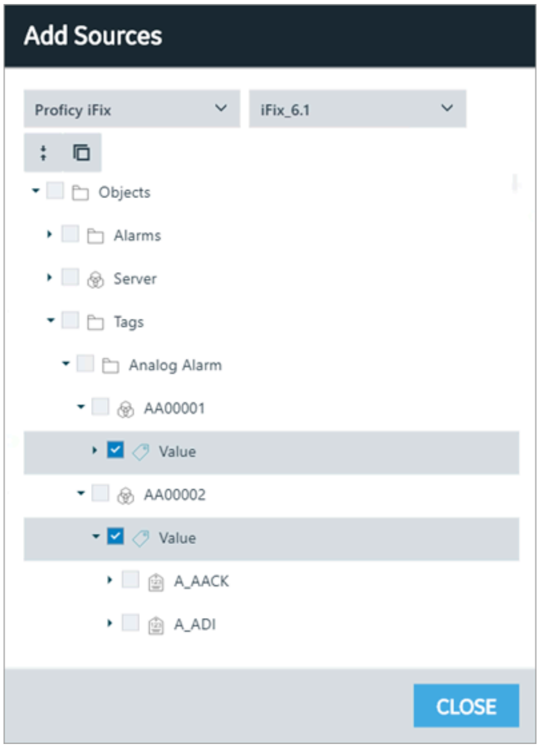
- Create a data source with OPC UA configuration in Operations Hub *(on page 293)*.

1. In the main navigation menu, select **APPS**.

   The **Apps** workspace appears, displaying a list of applications.
2. Open the application.
3. Select  .

   The **Trend Configuration** pane appears.
4. Select **Add Tags for Trend**.

   The **Add Sources** window appears.



5. Select iFIX, CIMPLICITY, or OPC UA from the drop-down, then select the server.

   The address space for the selected data source appears in a tree structure.
6. Browse and select the check box for the tags you want to add to the trend chart.

   Refer to Browse Data Sources *(on page 299)*.

   The live data from the data source starts displaying in a trend chart.

Configure Proficy CIMPLICITY for Writes

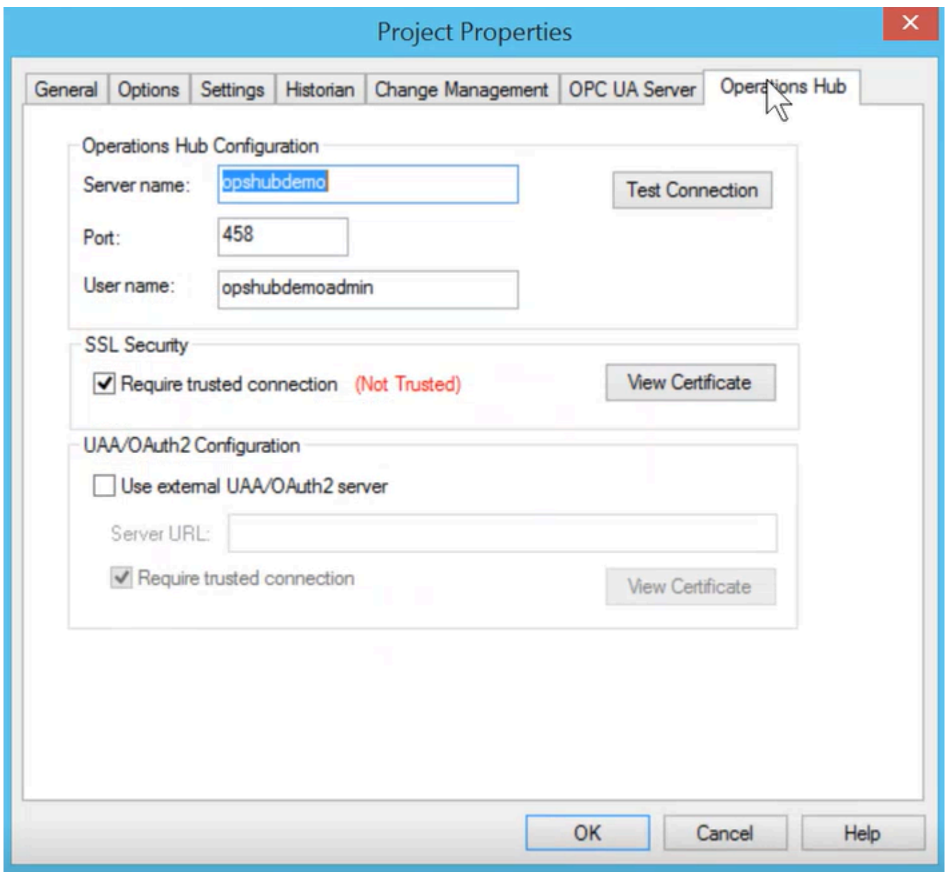
This topic describes how to configure Proficy CIMPLICITY to enable write operations.

1. Log in to Proficy CIMPLICITY.
2. From the main menu, go to **Project > Properties**.

   The **Project Properties** window appears.
3. Select **Operations Hub** tab.
4. Provide these details to set up the connection to Operations Hub.

Field	Description
Server name	Operations Hub machine name
Port	Port number for the machine

Field	Description
User name	Enter the user name for logging in to the machine. Select **Test Connection** to verify the Operations Hub machine details for establishing a connection.
Require trusted connection	Select the check box to enable SSL security for the connection. If the security appears as `(Not Trusted)`, you must trust it. To do so, select **View Certificate** for instructions on where to copy the issuer certificate on your CIMPLICITY machine.
OK	Save the details and close the window.



5. To verify the write operations, log in to Operations Hub.
6. Create a data source with OPC UA configuration *(on page 293)* in Operations Hub.
7. Set up an extension query *(on page 209)* for CIMPLICITY with these details:

Method	WRITE
Tag Source	OPC UA
Tag inputs and outputs	As required

8. Create an application page and bind the extension query with widgets.
9. Log in to the end application, and perform the write operations in runtime.

Configure Proficy iFIX for Writes

This topic describes how to configure Proficy iFIX to enable write operations.

1. Log in to Proficy iFIX.
2. Go to `C:\Program Files (x86)\GE\iFIX` and open the `secmgr.clr.dll.config` file in a notepad.
3. Save the dll file after verifying and updating these details:

   Ensure that `uaa_oauthHost` points to the UAA server that provides the authentication services. If default UAA server is installed with Operations Hub, this will generally be the hostname (short or FQDN) used during Operations Hub installation.

```
<?xml version="1.0" encoding="utf-8" ?>
<configuration>
  <appSettings>
    <add key="oauthHost" value="127.0.0.1"/>
    <add key="oauthPort" value="8443"/>
    <add key="oauthEndPoint" value="oauth"/>
   <add key="strictCertificatePolicy" value="false"/>
          <add key="ifix_oauthIssuer" value="ifix_auth_service"/>
    <add key="ifix_oauthHost" value="localhost"/>
    <add key="ifix_oauthPort" value="4857"/>
    <add key="ifix_oauthEndPoint" value="ifix-auth-service/v1/oauth"/>
    <add key="ifix_strictCertificatePolicy" value="false"/>
          <add key="confighub_oauthIssuer" value="ConfigHubAuthService"/>
    <add key="confighub_oauthHost" value="localhost"/>
    <add key="confighub_oauthPort" value="5678"/>
    <add key="confighub_oauthEndPoint" value="confighub-auth/v1/oauth/"/>
    <add key="confighub_strictCertificatePolicy" value="false"/>
    <add key="uaa_oauthHost" value="localhost"/>
    <add key="uaa_oauthPort" value="443"/>
    <add key="uaa_oauthEndPoint" value="uaa"/>
    <add key="uaa_strictCertificatePolicy" value="false"/>
  </appSettings>
</configuration>
```

4. To verify the write operations, log in to Operations Hub.
5. Create a data source with OPC UA configuration *(on page 293)* in Operations Hub.
6. Set up an extension query *(on page 209)* for iFIX with these details:

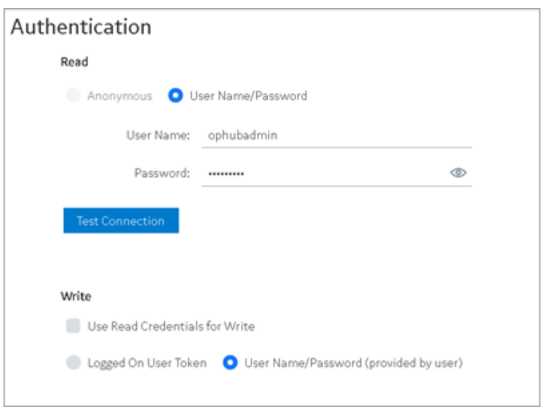
Method	WRITE
Tag Source	OPC UA
Tag inputs and outputs	As required

7. Create an application page and bind the extension query with widgets.
8. Log in to the end application, and perform the write operations in runtime.

Configure Third Party OPC UA Servers for Writes

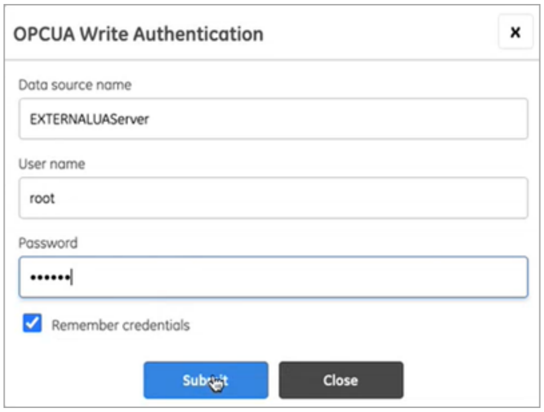
If you are using third party OPC UA server configuration for data to update any value, you must provide user name and password credentials to perform write operations. In case of alarm card or a mimic card receiving data from a third party OPC UA server, a pop-up dialog prompts for user name and password credentials to perform write operations.

1. Create a third party data source with OPC UA configuration *(on page 293)* in Operations Hub.
2. In the data source, under **Authentication > Write**, select **User Name/Password (provided by user)**.

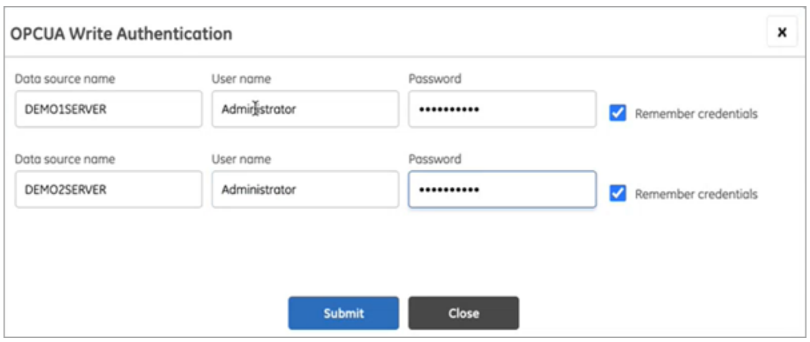


3. Create an application *(on page 146)*.
4. Create application pages *(on page 308)* for Alarm card *(on page 458)* and Mimic Card *(on page 470)*.
5. Acknowledge alarms *(on page 469)* at runtime to verify alarm write operations.

   A pop-up dialog appears requesting for user name and password to perform write operations.



If you choose to acknowledge multiple alarms from multiple sources, then enter the credentials for all the data sources listed in the authentication popup.



6. Similarly perform set point operation on mimics at runtime to verify mimic write operations.
7. Select the **Remember Credentials** check box to save the user name and password.
   When data source credentials are saved, the authentication popup for that data source does not appear again to acknowledge additional alarms.
   In case you selected this check box and entered invalid credentials, the invalid data gets saved. You must clear the saved data source credentials to be able to enter the valid user name and password.
   Select  to clear all the saved data source credentials.

Get Started with Proficy Plant Applications

This topic guides you through how to get started integrating Proficy Plant Applications and Proficy Operations Hub.

Ensure that system requirements for Plant Applications and Operations Hub are met.

Overview

1. Install Proficy Operations Hub.
2. To install Proficy Plant Applications, choose your installation type:
    - Standard Edition *(on page 117)*
    - Enterprise Edition *(on page 117)*
3. Work with Web Client applications *(on page 117)*.
4. (Optional) Refer to the API documentation to customize applications.

Steps for Installing Standard Web Client

1. Configuring Apache CouchDB Settings
2. Standard Edition Web Client Requirements
3. Install Plant Applications Standard Web Client
4. Run Message Bridge Configuration Utility
5. Run Operations Hub Posting Utility
6. Verify the Installation

Steps for Installing Enterprise Web Client

1. Configuring Apache CouchDB Settings
2. Enterprise Edition Web Client Requirements
3. Review the files provided by GE
4. Pre-Installation Checklist
5. Install Enterprise Edition Web Client
6. Run Message Bridge Configuration Utility
7. Run Operations Hub Posting Utility
8. Verify the Installation

Work with Web Client Applications

> **Note:**
> These applications appear based on user privileges.

- Unit Operations
- Non Conformance
- Work Order Manager
- Route Editor

- Work Queue
- Time Booking
- Property Definition
- Security
- Configuration
- Approval Cockpit
- Downtime
- OEE Dashboard
- Reports
- My Machines
- My Machines
- Analysis
- OEE Aggregation Store
- Activities
- Process Orders
- Alarm Event Notification
- Waste
- Receiving Inspection
- BOM Editor
- Genealogy

Data Binding to Widgets

This topic describes the options you can use to bind values to widgets.

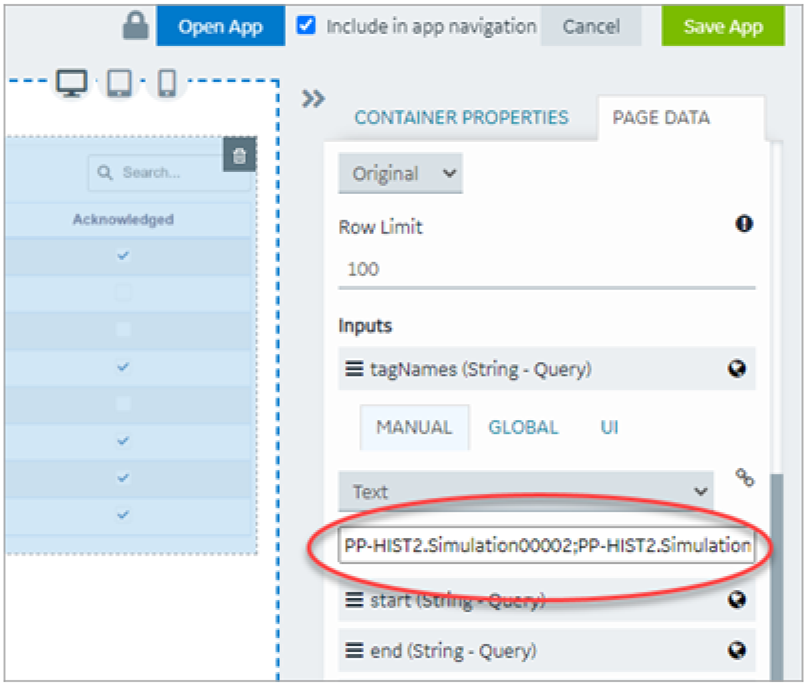
> **Attention:**
> In case you modified the data source alias (machine name), then all references to the data source (Historian or OPC UA) server are lost. You must rebuild queries for all your widgets in use.

Tag Browser

A list of out-of-the-box (OOTB) queries of 'Extension' type are available with the tag browser.

1. Select the OOTB query that you want to apply to the widget.
2. Browse the data source and select tags *(on page 299)*.
3. Drag-and-drop the query on your widgets. This automatically populates the data fields for the query under **PAGE DATA**.
4. Save the page with the default data from the query, (OR) modify the data fields to your requirement.

Note:
The tag browser does not apply to REST or SQL queries. It works only with Extension queries. If you want to configure tags in a REST query, then enter them as Text. You can also enter multiple tags separated by a semicolon.



Refer to:

- Create Extension Query *(on page 209)*
- About Queries *(on page 180)*

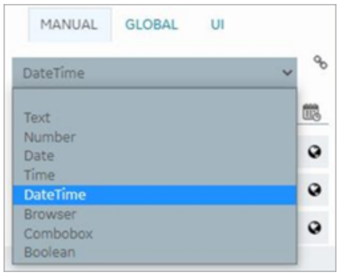
Example: Refer to Sample Page with Historical Data *(on page 584)*.

Inputs

Queries have input values. On drag-and-drop from tag browser, these inputs are bound to the widget, and appear under **PAGE DATA**.

Each input has these options that are populated with default values as per the query:

- Manual: Allows to use a variety of components to provide manual values for query inputs - text, number, date, time, datetime, browser, combo box, and boolean.



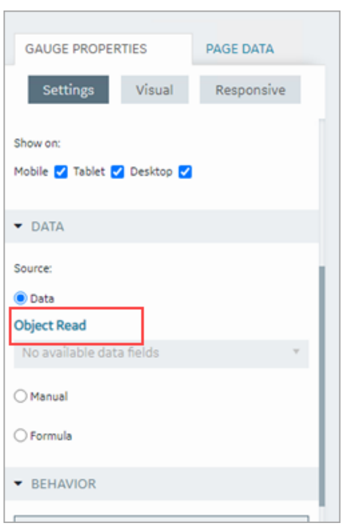
- Global
- UI

Note:
At any point in time, ensure that only one binding exists for the query inputs. For example, there should be no manual or global binding if you have already bound the query input to UI through a widget or plugin. To remove a binding from the query input, select the unlink icon next to the binding.

Link to Access the Query

If you changed the **Asset Context** for the page, access a direct link to the query to update or modify it.

On selecting the widget, a link to the associated query appears under the widget properties. Select the link to directly jump to the query on the **PAGE DATA** tab.

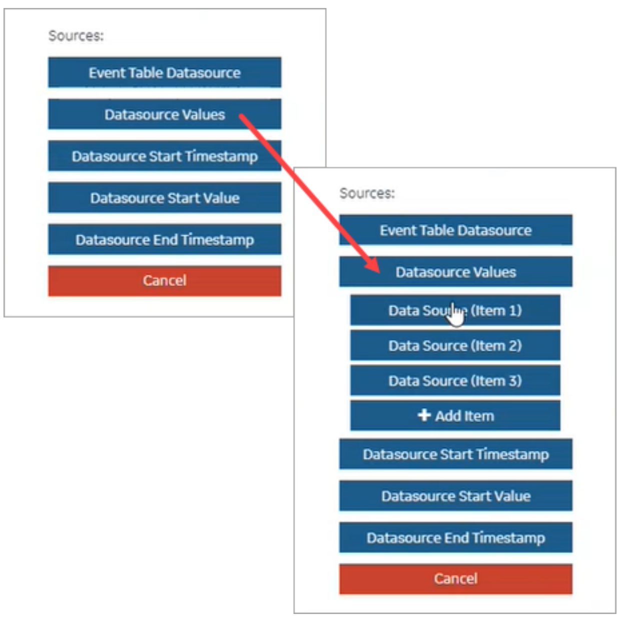


Drag-and-Drop Data

This feature is applicable when configuring widgets in Operations Hub. You have the option to drag-and-drop selected tags/properties (from the tag browser) directly on to the widgets. The data is quickly bound to the widget without the need to manually configure its value fields. After you drag and drop data on the widget, go to the widget properties tab to verify. The source value fields are auto-filled with the data that you dropped on the widget.

For widgets with multiple array fields to bind to, the drag-and-drop feature shows the available value fields. A menu appears, where you can drill down and select the specific item to bind data. Items in the menu are arranged according to their sequence order.

To bind the drag-and-drop data to a new item, select **+ Add Item**. A new item is created and data is bound to it.



HMI

Work with Alarms

- Configure iFIX for Alarms *(on page 462)*
- Configure CIMPLICITY for Alarms *(on page 464)*
- Alarm Card *(on page 458)*
- Alarm Count *(on page 470)*

- Apply Filters to View Alarms *(on page 467)*
- Acknowledge Alarms *(on page 469)*

Related reference

Work with Mimics *(on page 122)*

Work with Mimics

- Configure iFIX for Mimics *(on page 472)*
- Configure CIMPLICITY for Mimics *(on page 480)*
- Import Mimics *(on page 281)*
- Assign Mimics to Assets *(on page 281)*
- Override an Assigned Mimic *(on page 282)*
- Set Up Mimic Target Zones *(on page 283)*
- Mimic Card *(on page 470)*

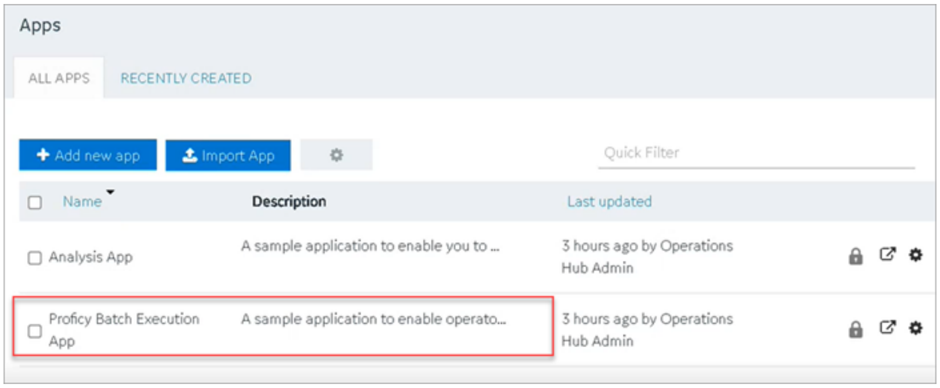
Related reference

Work with Alarms *(on page 121)*

Get Started with Proficy Batch

This topic describes how to get started with batch execution process.

1. Set up Batch *(on page 123)*.
2. Add a Batch Data Source *(on page 298)* in Operations Hub.
3. Import and start using the sample application.
    a. Open your installation ISO, and navigate to the `Installation Content\Apps` folder.
    b. Copy `Proficy Batch Execution App` to a temporary folder on your hard drive.
    c. Import *(on page 151)* the sample batch application to Operations Hub.



d. After import, navigate to your Batch data source, and modify the **Endpoint URL** to reflect the host name of your Batch Server.

Alternatively, you may skip step 3 and proceed to creating your own application *(on page 146)*.

4. Configure properties for batch widgets *(on page 562)*.
5. Create and execute batch instances at runtime.

Perform these steps if your Batch Server uses a self-signed certificate. Ignore the following for digitally signed certificates.

a. Open your browser console.
b. Right-click any of the URLs and open in a new tab.

The **Your connection is not private** error screen appears on the new tab.

c. To bypass the error, select **Advanced > Proceed to <BatchServerName> (unsafe)**.
d. Close the tab.

6. Restart the Batch Server. After restart, make sure `BatchRestService` is up and running.

Set up Batch

This topic describes how to set up Proficy Batch REST API.

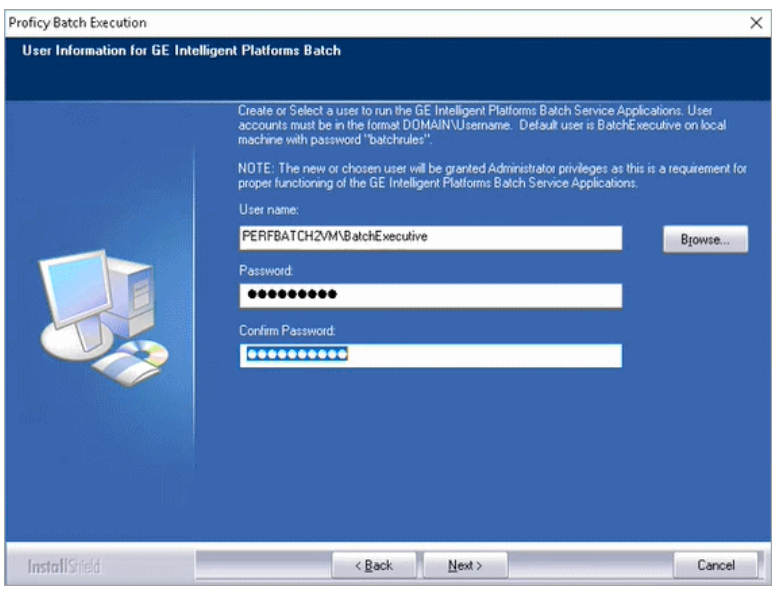
Download these files from GE Salesforce.

- Proficy Batch Execution ISO file
- Batch REST API zip file
- Latest Batch SIM file

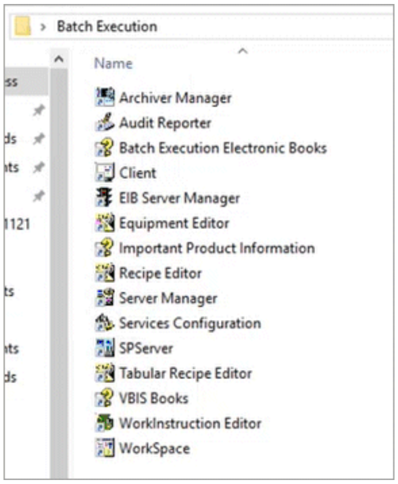
> **Note:**
> You also require a GE Digital Batch License Key with Batch Integration Services and Electronic Signatures for the Batch computer.

With Proficy Batch, operators can oversee batch processing using a set of batch widgets *(on page 562)*. Operator views and controls are provided in the form of Batch list, Batch control, etc. to execute batches efficiently. A sequential flow chart (SFC) widget presents a graphical view of the batch flows. For more information, refer to Proficy Batch Execution.

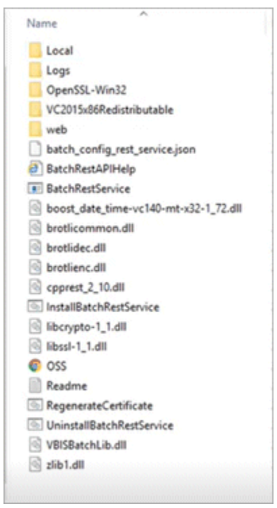
1. Log in to the machine where Operations Hub is installed.
2. Run the ISO file to install the Proficy Batch Execution application with default settings.
   To create a Windows user account for the batch executive, provide the **User name** and **Password** details.



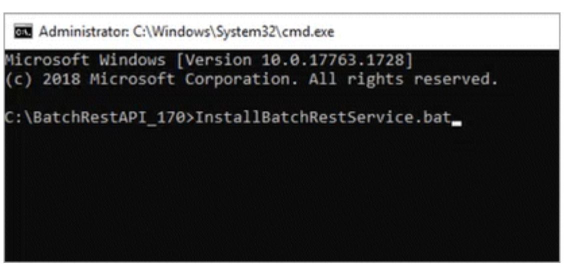
   After installation, `Batch Execution` folder is created on your desktop.



3. Install the latest Batch SIM.
4. Restart your machine.
5. Unzip the `BatchRestAPI` file and place the folder in your C drive.



6. From the command prompt, run the installation for `BatchRestAPI` service.



7. Access the Readme file in the unzipped `BatchRestAPI` folder and follow the instructions for installation.

   For example,

Country Name	US
State or Province Name	Massachusetts
Locality Name	Boston
Organization Name	GE
Organization Unit Name	Digital
Common Name	Enter your server name
Email Address	ophubuser@gmail.com
Enter Export Password	Enter a password. You must modify the `batch_config_rest_service.json` file to reflect this password.

8. From the unzipped `BatchRestAPI` folder, open `batch_config_rest_service.json` in a text editor. For example, Notepad.
   Refer to the BatchRestAPI `Readme.txt` for more details.
9. Verify and update these parameters:

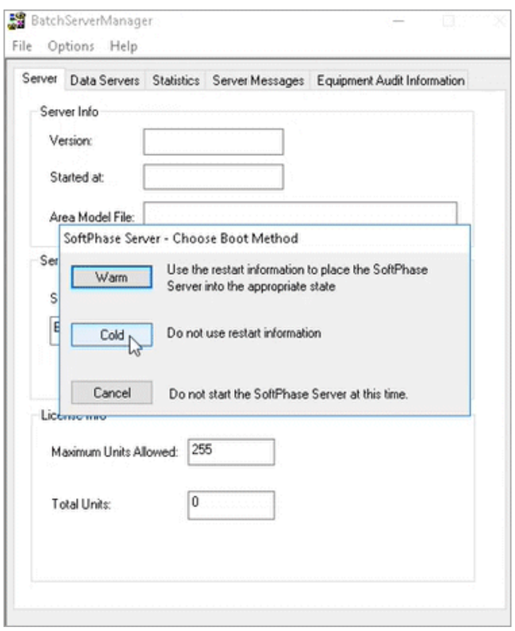
`serverCertificatePassword`	Enter the export password.
`basicAuthWindowsGroupValidation`	If `true`, then the Windows user (used for basic auth and for bearer token security) should be a member of the Windows user group indicated by the property `basicAuthWindowsGroup`. This is initially set to `PROFICY_BATCH_REST_USERS`. You must create this Windows group on the Batch REST Service computer, and add the corresponding Windows users to this group. Set this to `false` if you do not want to use Windows Group validation.
`basicAuthWindowsGroup`	`PROFICY_BATCH_REST_USERS`
`uaaServers`	Enter the URL for Operations Hub Proficy Authentication (UAA).

	Note: Only one UAA server is supported.


```
{
"basicAuthWindowsGroupValidation" : false,
"basicAuthWindowsGroup" : "PROFICY_BATCH_REST_USERS",
"uaaServers" : [
                {"url": "https://qabatch.htclab.ge.com/uaa",
                "skipCertificateValidation" : true}
                ],
"portnumber" : "4868",
"serverCertificateName": "Local\\pki\\batchrestservice.pfx",
"serverCertificateStoreName": "batch_rest_serviceRoot",
"serverCertificatePassword": ",
"lockout_retries": 0,
"lockout_timeout": 15,
"batchlist_refresh_interval": 3,
"recipelist_refresh_interval": 60,
"log": {
        "enable": true,
        "name": "batch_rest_service.log",
        "level": "info",
        "max-size": 5242880,
        "max-files": 3,
        "flush-seconds": 10
        }
}
```


10. Ensure that the Operations Hub user is also a domain user or a local Windows user on the batch computer system. Refer to Configuring Windows User Accounts on the Batch REST Service Computer *(on page 129)*.
11. From the `Batch Execution` folder, launch `Server Manager`.

    The **BatchServerManager** application screen appears.
12. Select **Start Server > Cold**.



> **Important:**
>
> - Use the Windows Services to start/restart the `BatchRestService` after you start/restart the Batch Server.
> - If `BatchRestService` fails to start, stop the VBIS service and try again. If it still fails, check for error messages in the `logs\batch_rest_api.log` file. Look for a syntax error in the `batch_config_rest_service.json` file, which may be responsible for the `BatchRestService` to not start.
> - Remember to restart `BatchRestService` if you make changes to the `batch_config_rest_service.json` file.
> - You can also start your Batch Client if you want to compare the data screens with the batch widgets.
> - After the Batch REST Service starts, it can take a minute before it is available to receive REST calls.
>
> For additional information on the UI screens of the batch widgets, refer to https://www.ge.com/digital/documentation/batch/Operations_Manual.pdf.

13. From the `Batch Execution` folder:

> **Note:**
> You can perform this step right after installing the ISO file as well.

a. Launch `Equipment Editor` and define your equipment models.
   Refer to https://www.ge.com/digital/documentation/batch/Equipment_Configuration_Manual.pdf.
   In case you modify the equipment model:
   - Make sure to validate your recipes.
   - If the Batch Server was running, you must restart the Batch Server and the Soft Phase Server.
   - If the VBIS Service was running, you should stop it. Then start/restart the Batch REST Service (this will automatically start the VBIS Service).

b. Launch `Recipe Editor` and create your recipes.

A recipe contains a series of automated steps to execute a particular batch instance. The steps may also contain prompts that request for permission to proceed ahead, and trigger alarms that need your attention.
Refer to https://www.ge.com/digital/documentation/batch/Recipe_Development_Manual.pdf.

Configuring Windows User Accounts on the Batch REST Service Computer

The batch widgets send a bearer token to the Batch Rest Service containing the currently logged in Ophub User account name. This account name must exist on the Batch Rest Service computer as a local Windows user, or as a domain user.

- If using local Windows user accounts, create the corresponding local Windows user accounts on the Batch REST Service computer that match the Ophub user account names.
- If you are using a domain user, the domain name can be a part of the Operations Hub user name (for example: `ophubuser@DomainName`). You can also use an Ophub account name without domain as part of the Operations Hub username. For example, `ophubadmin`.
- If you use an Operations Hub user name without domain, for example `ophubadmin`, the Batch REST Service will first look up this user to see if it is a valid local Windows user on the Batch REST Service computer. If it is not found, then it will look up this user on the Domain used by the computer. The order of the user lookup can be customized with the `UAAUserDomainLookupOption` property and is described in more detail the Batch Rest API `readme.txt`.
- As an extra security feature, if the `basicAuthWindowsGroupValidation` property is `true`, the Batch REST Service will validate that this user is a member of the `basicAuthWindowsGroup`. This group is initially set to `PROFICY_BATCH_REST_USERS`. If this is set to `true`, then be sure to add the windows user accounts to this Windows User Group.

Use e-Signatures

To use e-Signatures for batch widgets, do the following:

1. Create Windows user groups on the Batch REST Service computer that correspond to the e-Signature Requirement `Performed By` and `Verified By` group names in the batch widgets.

   For example, `Operator` and `Supervisor` group names are used in the Batch widgets sample application.

2. Create Windows users on the Batch REST Service computer and add them to the appropriate Windows user group used for e-Signature. Or if you are using Domain users, add the domain users to the appropriate Windows user groups used for e-Signature.

3. Be sure that the Windows User accounts `full name` is not blank.
4. If using Domain users, be sure to set the `GE Intelligent Platforms Security Server (iSecurity.exe)` Windows Service to run under a Domain user account, and restart this service.

About Dataflow Editor

A lightweight flow-based programming tool.

Use Dataflow Editor to interact across the Proficy portfolio via. REST or connect to third party data sources via SQL, MQTT or OPC-UA, etc. (requires additional downloads) to orchestrate real-time data transformation based on your business or process requirements. Refer to https://nodered.org/ for additional downloads and help.

You have the option to install Dataflow Editor when installing Operations Hub *(on page 24)* on your machine. Access the Dataflow Editor plugin either from within the Configuration Hub application, or via. its independent URL. To access the Dataflow Editor user interface, you should be a member of `iqp.nodered` group.

The URL to access Dataflow Editor independently is case-sensitive after the hostname:

`https://<hostname>/Node-RED/admin`

Manually Register Dataflow Editor with Configuration Hub

This topic describes how to manually register and unregister Dataflow Editor with Configuration Hub.

- Ensure that security authentication source is configured for Configuration Hub.
- You should be an administrator to perform this task.

Perform these steps if you did not register Dataflow Editor with Configuration Hub during Operations Hub install.

1. On the Operations Hub machine, open Windows Command Prompt.
2. Change the directory to the path where Operations Hub is installed on your system: `\Program Files \GE\Operations Hub\ node-red\`
3. Run the following command replacing placeholder with actual values:

```
node.exe ch_reg_plugin.js  <OPHUB_HOST>   <HTTPS_PORT>  <configHubContainerServiceBaseUrl>
 =<clientId>:<clientSecret>    nodered
```

Placeholder	Replace With
<OPHUB_HOST>	The primary host name you selected during install.
<HTTPS_PORT>	The port assigned to https protocol for Operations Hub. Typically it is `443`.
<configHubContainerServiceBaseUrl>	The base URL of the Configuration Hub Container Service.
<clientId>	Identifier of a client that has permission (authority) to register with Configuration Hub.
<clientSecret>	Client secret used to authenticate the client.

For example,

```
node.exe  ch_reg_plugin.js  ophubhost1.test.net   443  https://chhost:5000/container-svc/
 =confighubadmin:itsSecret   nodered
```

4. To unregister manually, you must run the following command before uninstalling Operations Hub:

> **Note:**
> If you registered manually, then you should also manually unregister. Uninstalling Operations Hub does not unregister if you did not choose to register during installation.

Replace placeholder with actual values:

```
node.exe ch_reg_plugin.js  <OPHUB_HOST>   <HTTPS_PORT>  <configHubContainerServiceBaseUrl>
 =<clientId>:<clientSecret>    nodered  unreg
```

Enable Windows Auto-login in an Active Directory Environment

This topic describes how to enable Windows Auto-login in an Active Directory Environment.

> **Note:**
> Windows Auto-login authentication is not supported on a local client browser if Proficy Authentication is installed on the same machine.

1. Install Proficy Authentication.
   During installation (standalone or as part of Operations Hub), use a FQDN that has a proper record on the DNS server as the primary host name. A local name will not work. IP address is not recommended either.
2. Log in to Proficy Authentication, and configure LDAP identity provider using the domain's LDAP server.
   Test the LDAP login to make sure it works for LDAP users.
3. Create a user account on the Active Directory domain.
   Proficy Authentication (UAA) uses this account for validating Windows domain credential (Kerberos service tickets) presented by browser on user's behalf.
4. Build the Service Principal Name (SPN).
   The SPN is formed based on the host's canonical domain name, not any other aliases. It is in the form of`HTTP/fqdn@REALM`, where HTTP is literal. The *fqdn* should be replaced by the actual FQDN of the host, typically in lower case, and *REALM* be replaced by the Active Directory domain name, typically in upper case.
   For example, if the Active Directory domain name is `test.net`, the host's FQDN is`uaa.test.net`, then the full SPN is `HTTP/uaa.test.net@TEST.NET`
5. Create a keytab file for this account.
   The keytab file contains the cryptographic keys that are private to this account. Each key is specific to an encryption algorithm, so all the algorithms allowed for the account must be accounted for in the keytab file. It is recommended to specify `All` for the crypto parameter `Crypto`. The following is an example of how `ktpass.exe` command is used to generate a keytab file on a domain server:

   ```
   ktpass.exe -out xyz.keytab -mapUser xyz@TEST.NET +rndPass -mapOp set +DumpSalt -crypto All
   -ptype KRB5_NT_PRINCIPAL -princ HTTP/xyzuaa.test.net@TEST.NET
   ```

6. Copy the generated keytab file to the machine where Proficy Authentication is installed.
   For convenience, it is recommended to place the keytab file under the same directory as `uaa.yml` file, which is found in either of these locations:
   - `C:\ProgramData\GE\Operations Hub\uaa-config`
   - `C:\ProgramData\GE\Proficy Authentication\uaa-config`

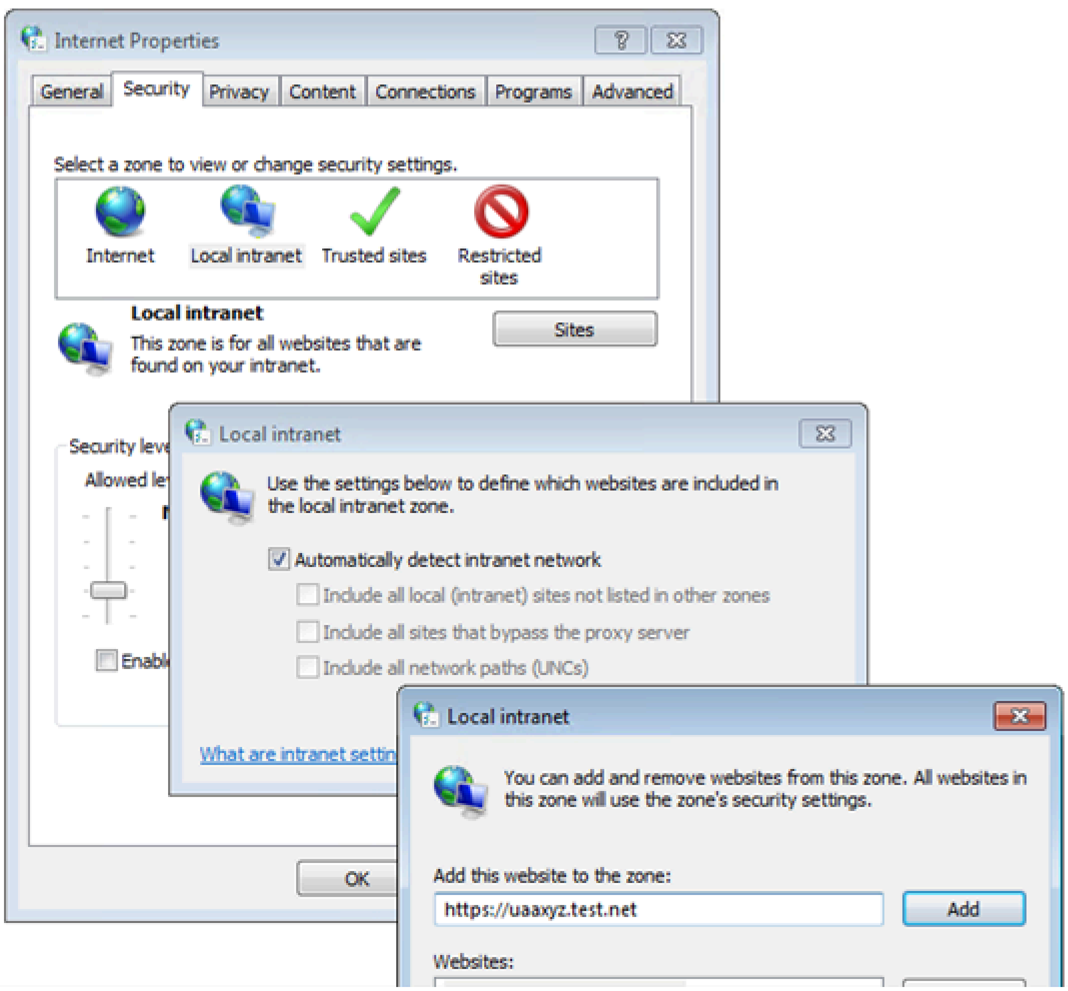
   The keytab file contains crypto information, So it is strongly recommended to set a security for the file. The file should not be readable by non-privileged user accounts, except for the service account `NT SERVICE\uaaTomcat`.
7. Configure UAA with the SPN and keytab file.

a. Create a new file `kerberos.yml` (or use a different name but with `.yml` extension) under the `sec` subdirectory of the `uaa-config` directory, with the following code:

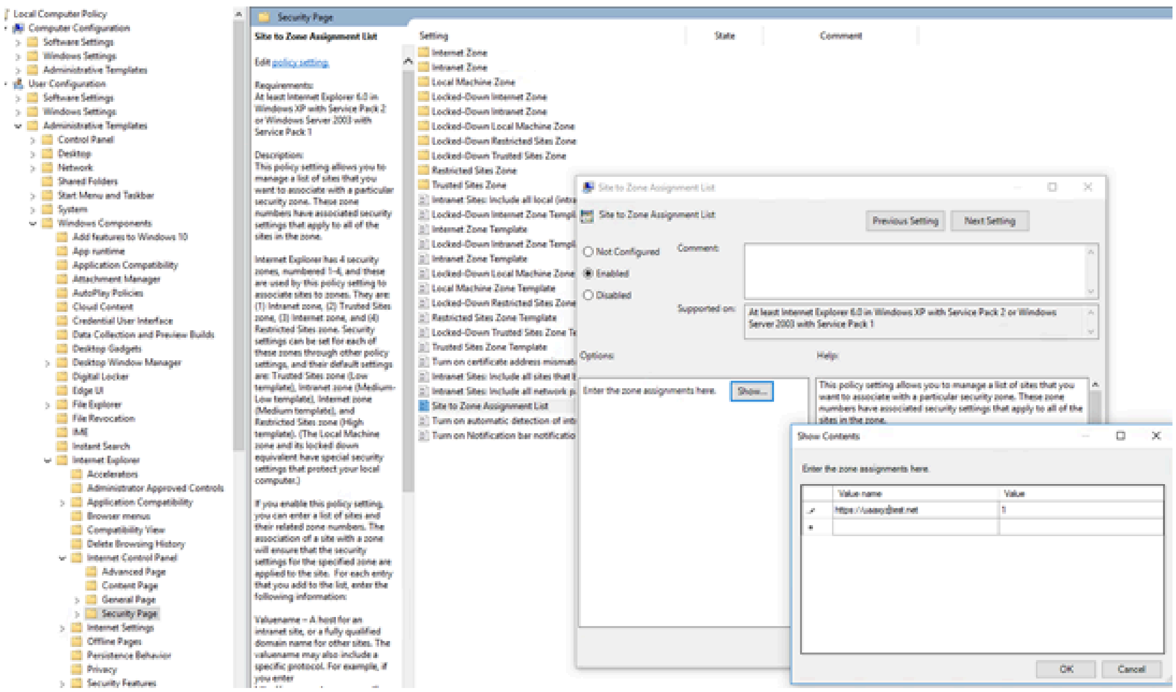
```
kerberos:
  service-principal: HTTP/xyzuaa.test.net@TEST.NET
  keytab-location: 'file:///C:/ProgramData/GE/Operations Hub/uaa-config/xyz.keytab'
```

b. Open `uaa.yml` file under `uaa-config` directory and copy the kerberos section at the end of the file as a template (the SPN and the full path to the keytab file as referenced in the above code).

8. On client machines, make sure that the Proficy Authentication host is recognized on the Local Intranet zone or as a Trusted Site.
   If not recognized, the Chrome browser will not request a Kerberos ticket to send to Proficy Authentication. For test/staging purposes, it can be done via Control Panel as shown here:



If the setting is configured interactively using Control Panel, then it is effective only for one user on one client machine. To configure for all users on one client machine, use local group policy. In an enterprise setting, an administrator should configure client machines via group policy. You can access the policy from **User Configuration > Administrative Templates > Windows Components > Internet Explorer > Internet Control Panel > Security Page > Site to Zone Assignment List**, as shown here:

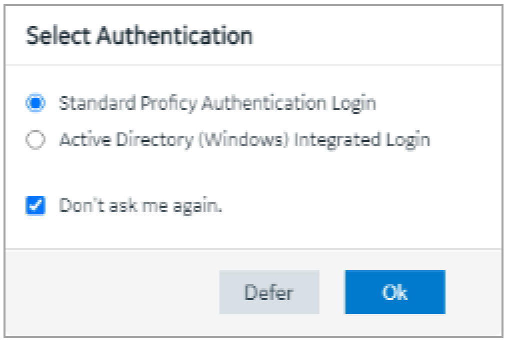


9. If Operations Hub is installed on a different machine than Proficy Authentication (i.e., in case of External Proficy Authentication or External UAA), then only the external UAA host name matters.
10. As an administrator, you may allow users to interactively choose an authentication option, or you may set it in the URLs you distribute to users.

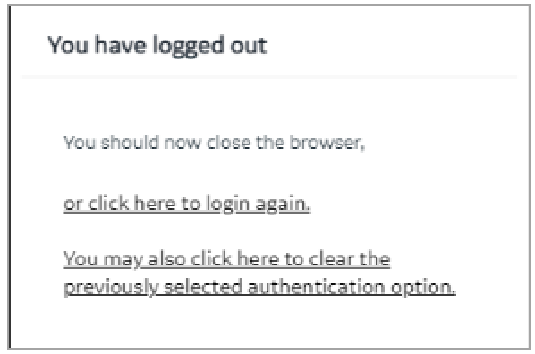
    a. Use a query parameter in Operations Hub Designer app or End app's URL.
    For example, if a regular Designer app's URL is `https://xyz.test.net/iqp`, then a URL that enables Windows Auto-login would be: `https://xyz.test.net/iqp?authOption=kerberos`

    This addition of `authOption` query parameter enables Windows Auto-login for the session.

    b. If the authentication is not included in the URL, then the following screen appears:



Standard Proficy Authentication Login	Choose this option if you want to use the standard login (username/password or SAML), or if Windows Auto-login has not been configured with Proficy Authentication. This is a regular login, which is based on username/password, including LDAP, or SAML.
Active Directory (Windows) Integrated Login	Choose this option only when it is set up with Proficy Authentication. This allows for autologin, wherein a user's domain login session is used to log in to Proficy Authentication.
Don't ask me again	Select this check box, if you don't want to display the **Select Authentication** screen every time you login. The system remembers the last selected authentication (between regular and autologin) and applies it for future logins. With **Don't ask me again** enabled, you can clear the last selected authentication only during logout.

	 Select **You may also click here to clear the previously selected authentication option** to clear the saved selection. Once cleared, the clearing option is hidden from the logout screen. Select **click here to login again** to return to the login page.
Defer	Select to dismiss this screen, and skip selecting an authentication. You have the choice to select authentication next time you login.

Note:

- It is *not* necessary for Proficy Authentication (or Operations Hub if different) host to be a domain member; it only needs to have a valid DNS record. However, both the user and the client machine that the user has logged into must be of a domain user/domain member respectively, in order to produce a Kerberos ticket to authenticate with Proficy Authentication.
- For Administrator's Console, the only way to use Windows Auto-login is to use the additional query parameter in the URL: `https://xyz.test.net/site/adminconsole?authOption=kerberos`

Chapter 3. User Guide

Overview

Overview of Operations Hub

Operations Hub is an end-to-end solution for developing, managing, and delivering applications to leverage the capabilities of big data analytics and the internet of things.

Using Operations Hub, you can create applications that will collect and analyze data from a machine or a server, and trigger actions based on certain events.

Operations Hub provides you with a user-friendly interface to create components of an application such as queries *(on page 180)*, database tables *(on page 159)* (called entities), events *(on page 228)*, email templates *(on page 239)*, users *(on page 250)*, and so on without the need to use your programming skills. You can also design pages and dashboards using these components.

Advantages of using Operations Hub:

- Operations Hub is quick, easy, and cost-effective. You do not need programming skills to develop an application.
- The Operations Hub applications use HTML5 and CSS3, and hence, they are platform-independent.
- You can access an application using a computer or a mobile device.
- You can provide controlled access to an application and data based on user roles.
- You can create entities and queries for a relational database.

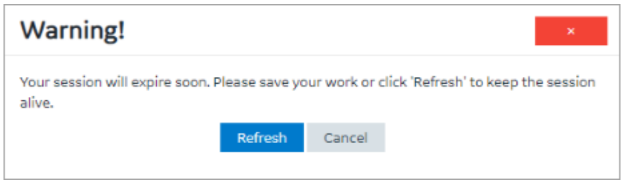
> **Note:**
> If you have installed only the Operations Hub add-on for Historian, you cannot create, modify, or delete an application or a component of an application. You can only access the Historian analysis application.

Refresh Session Timeout

Refresh the session to reset its expiration time.

Operations Hub login session expires based on the configured timeout settings *(on page 57)*. When the session is close to expiration, an alert appears requesting to save your work.

Select **Refresh** to reset the session timeout settings, and continue with your work.



The session expires if the warning is left unacknowledged. You must log back in to Operations Hub to start a new session, and resume your work. Any unsaved work prior to a session timeout will be lost.

Applications

About Applications

Operations Hub provides a user-friendly interface to create application components such as database tables (called entities), queries, events, email templates, users, and so on, without the need to write code.

You can then develop applications using these components. To develop an application, you will perform the following tasks:

1. Create all the components that are required for the application.
2. Create the pages and dashboards for the application.
3. Apply themes, define the navigation details.
4. Access and test the application.
5. Provide users access to the application.

> **Note:**
> If you have installed only the Operations Hub add-on for Historian, you cannot create an application or components of an application. You can only access the Historian analysis application.

Suppose you want to create an application that will send an email notification if the temperature recorded by a sensor exceeds 40 degrees Celsius. In this case, you will perform the following tasks:

1. Create an email template, which will contain the text and event parameters that you want to send in the email.
2. Create an event that will be triggered when the temperature recorded by the sensor exceeds 40 degrees Celsius.
3. Add an action to the event to define the recipients and send an email using the email template that you have created.

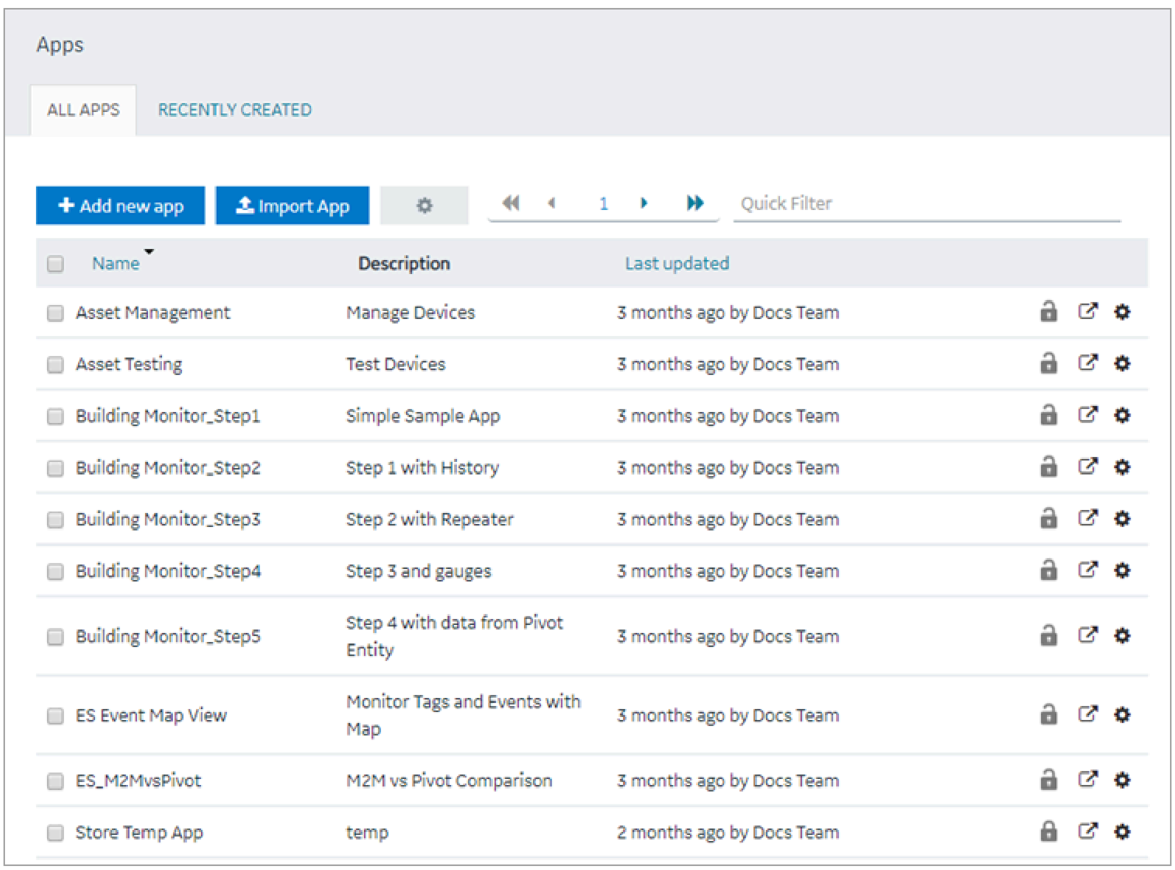
4. Create a page to display the sensor data. You can display the data using components such as text, gauges, or historical trend charts.
5. Add an event settings component to the page to allow application users to turn the event on or off.

Grant Access to an Application for an Individual User

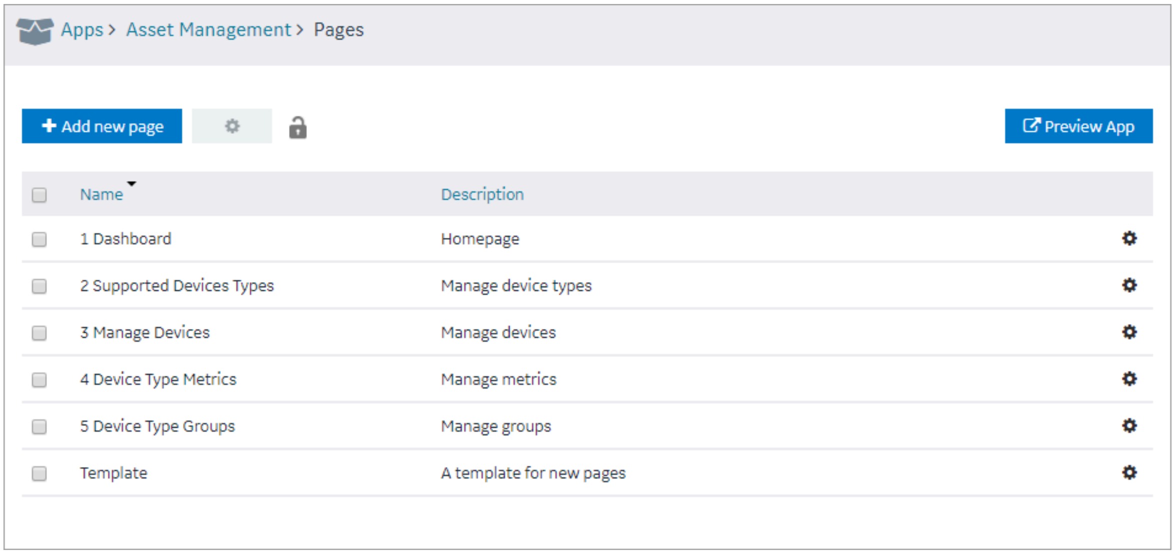
By default, all the developers can access all the applications that they have developed. Application users, however, can access only the applications to which they are granted access. This topic describes how to grant access to an application for individual users. You can also grant access to a role *(on page 139)*

> **Note:**
> A user must be a member of the iqp.user group in order to be assigned to an App.

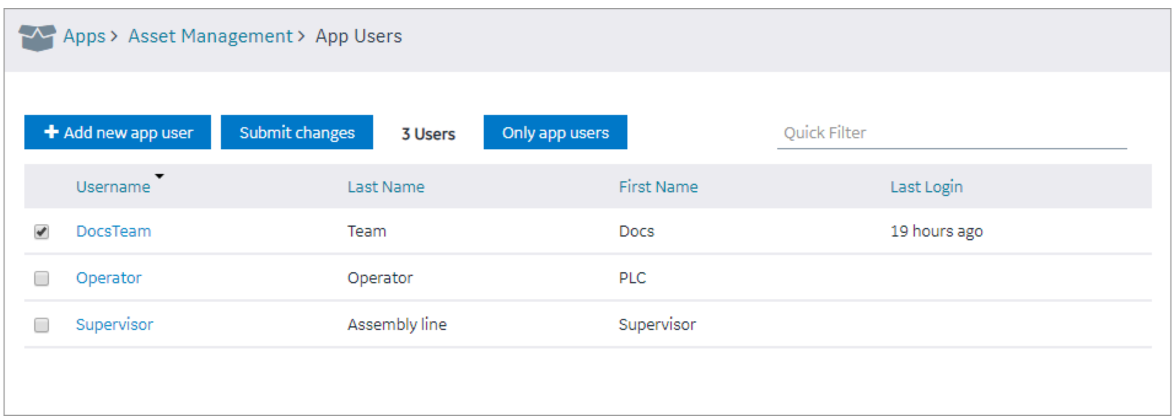
1. In the main navigation menu, select **APPS**.
   The **APPS** workspace appears.



2. In the **Name** column, select the application to which you want to grant access.
   The **PAGES** workspace appears.



3. In the main navigation menu, select **APP USERS**.
   The **APP USERS** workspace appears, displaying a list of application users created in the site.



4. In each row containing an application user to whom you want to grant access, select the check box, and then select **Submit changes**.
   The selected users can now access the application.

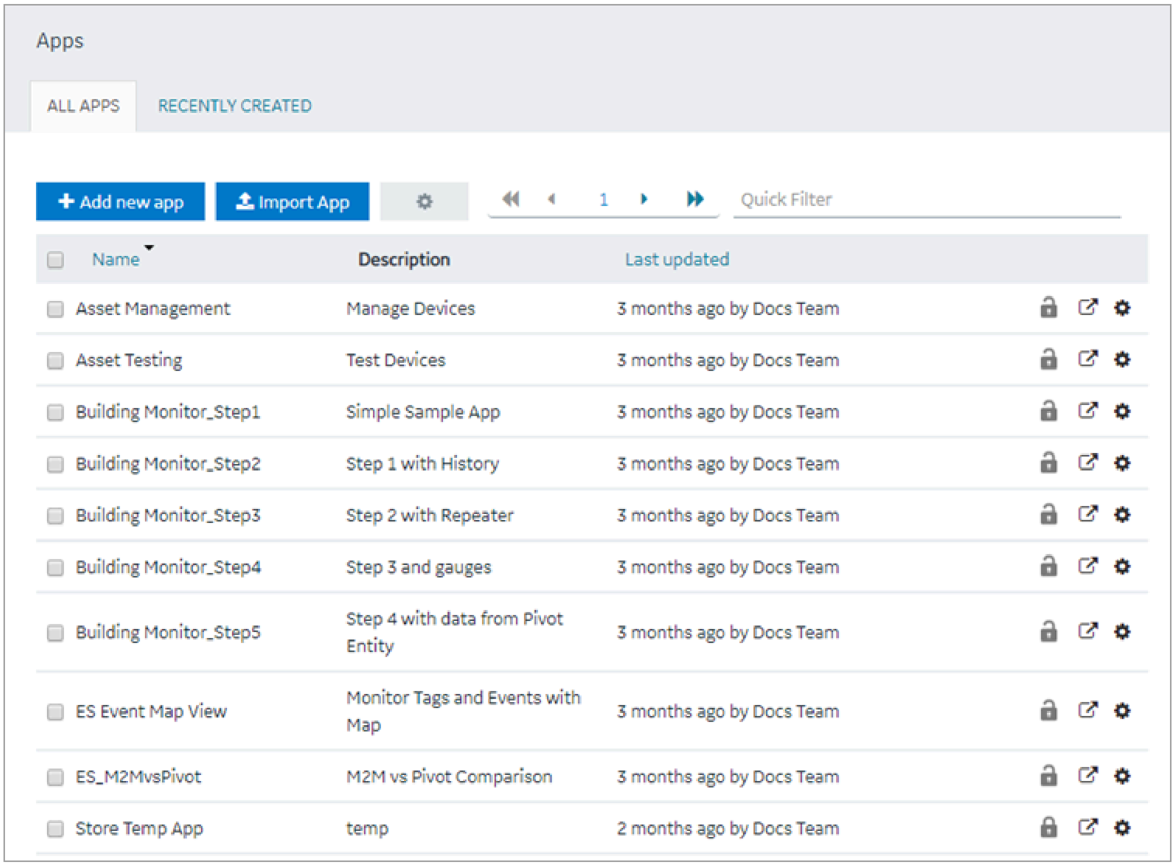
Grant Access to an Application for a Group

By default, all the developers can access all the applications that they have developed. Application users, however, can access only the applications to which they are granted access. This topic describes how to grant access to an application for user groups. You can also grant access to a role.

> **Note:**
> A user must be a member of the iqp.user group in order to be assigned to an App.

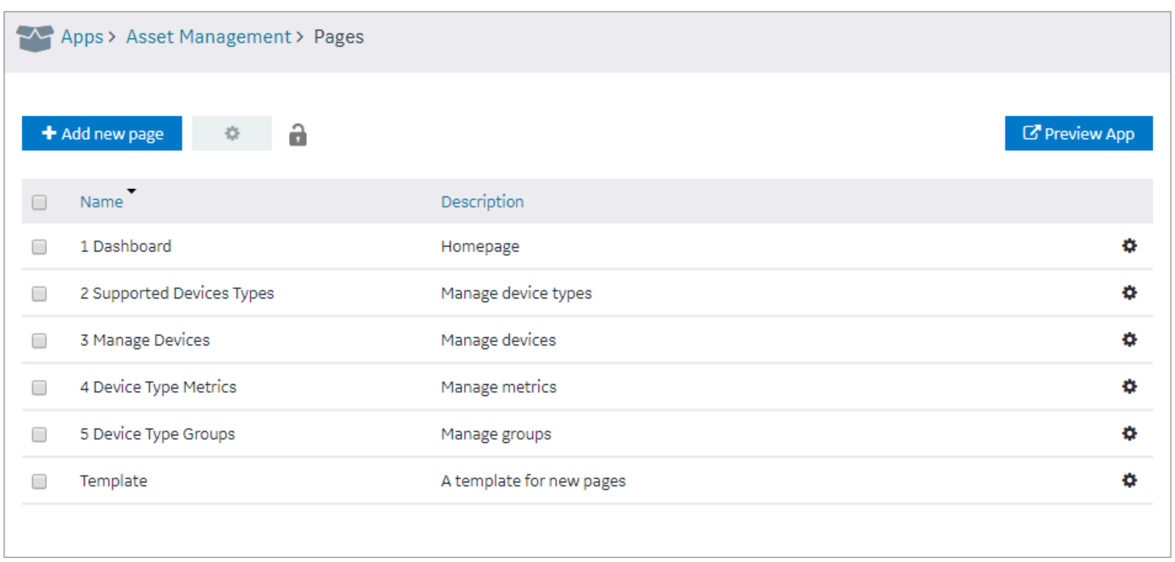
1. In the main navigation menu, select **APPS**.

   The **APPS** workspace appears.



2. In the **Name** column, select the application to which you want to grant access.

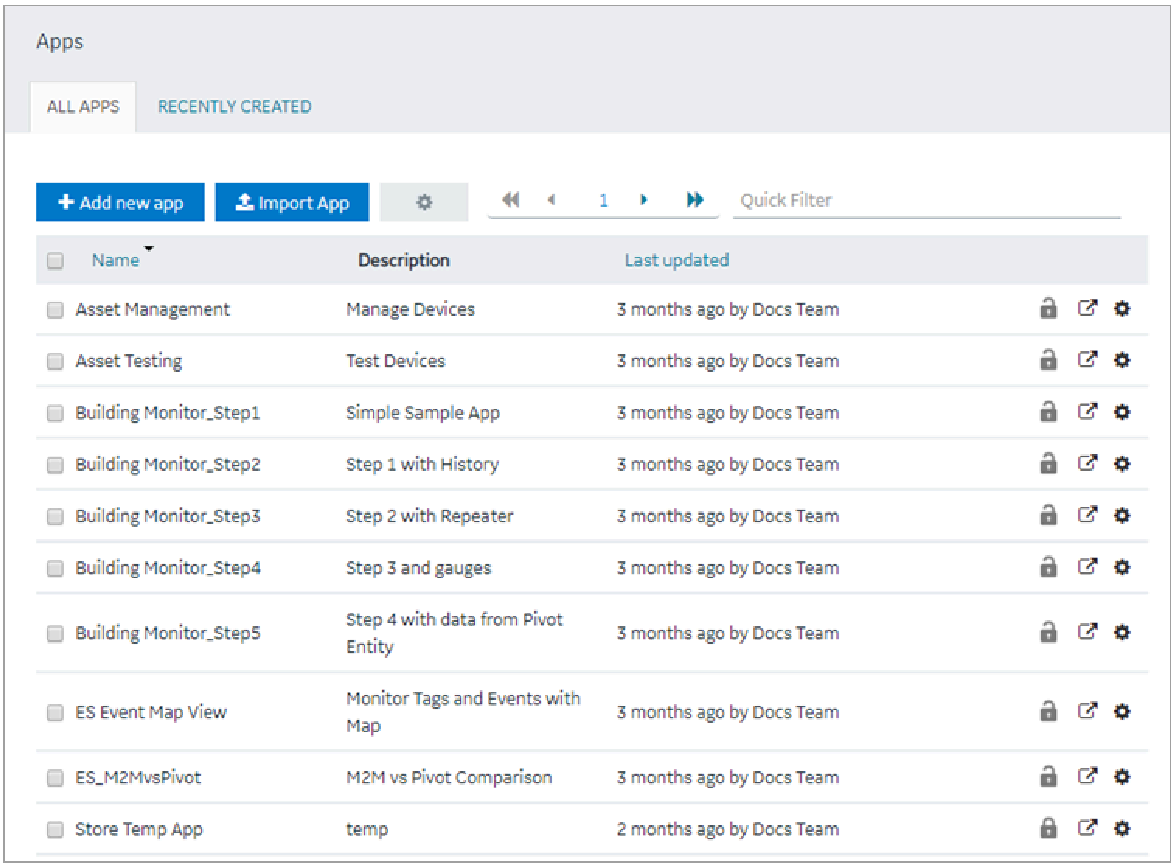
   The **PAGES** workspace appears.



3. In the main navigation menu, select **APP GROUPS**.
   The **APP GROUPS** workspace appears, displaying the list of UAA groups for the UAA connected to this instance Operations Hub.
4. In each row containing an application user to whom you want to grant access, select the check box, and then select **Submit changes**.
   The selected groups can now access the application.

Access an Application

1. In the main navigation menu, select **APPS**.
   The **APPS** workspace appears.

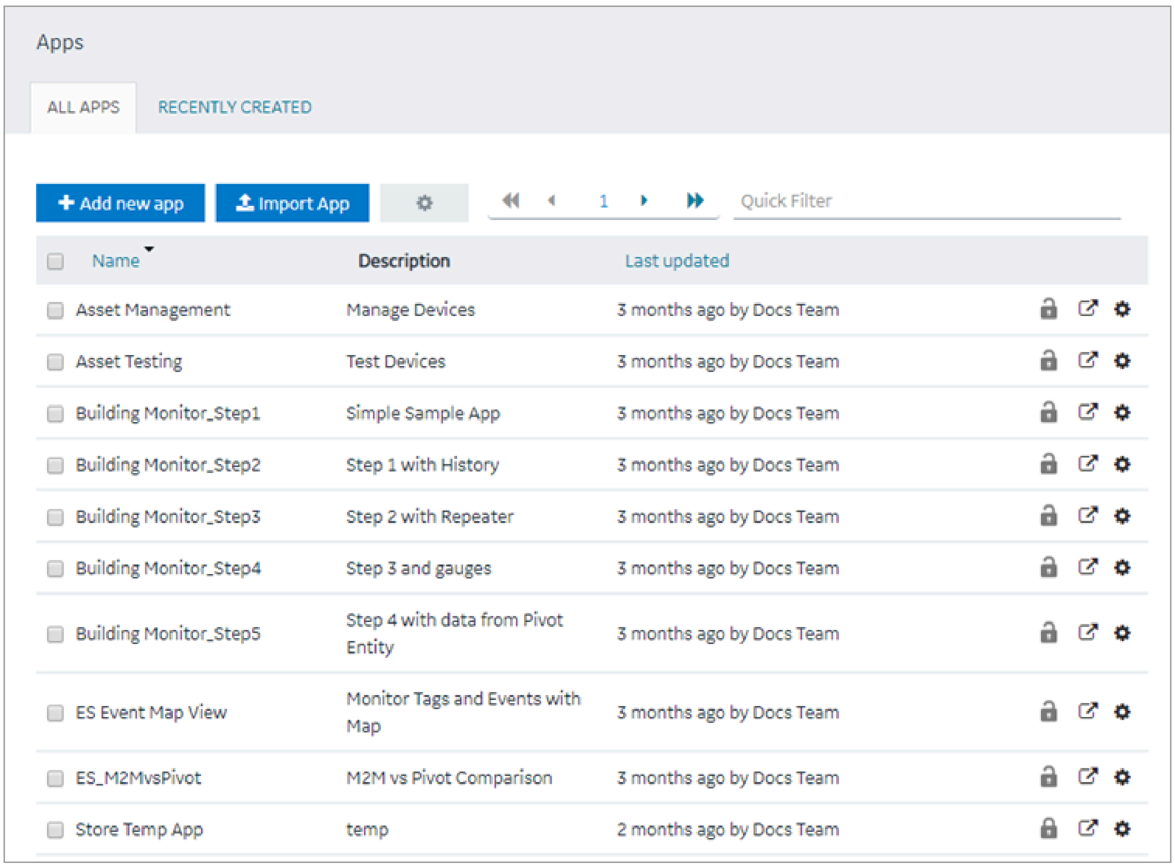


2. In the row containing the application that you want to access, select  .
3. If you want to access the application in a web browser, select **Open**. If, however, you want to access the application on a mobile device, scan the QR code using the device.
   The application appears in a new browser tab or on your mobile device.

If upgrading to Operations Hub 2.0, please note that every application can be referenced by an URL. All hardcoded links to applications must be updated with the new URLs.

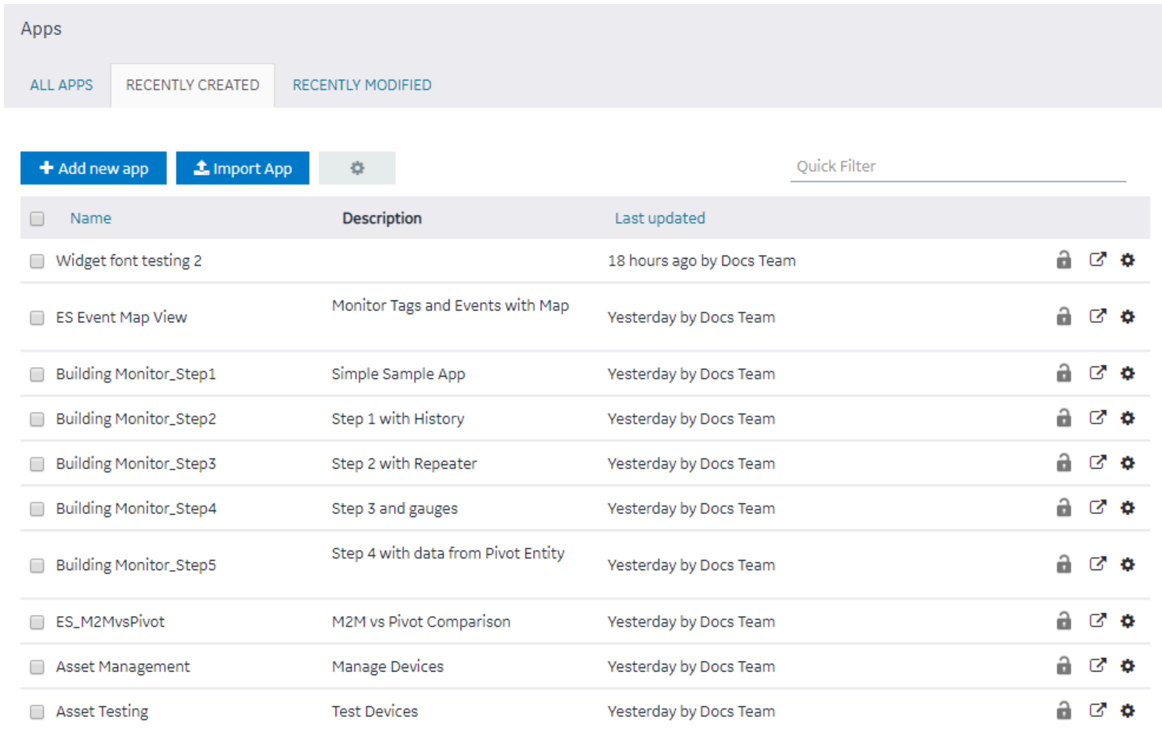
Access a Recently Created Application

1. In the main navigation menu, select **APPS**.
   The **APPS** workspace appears.



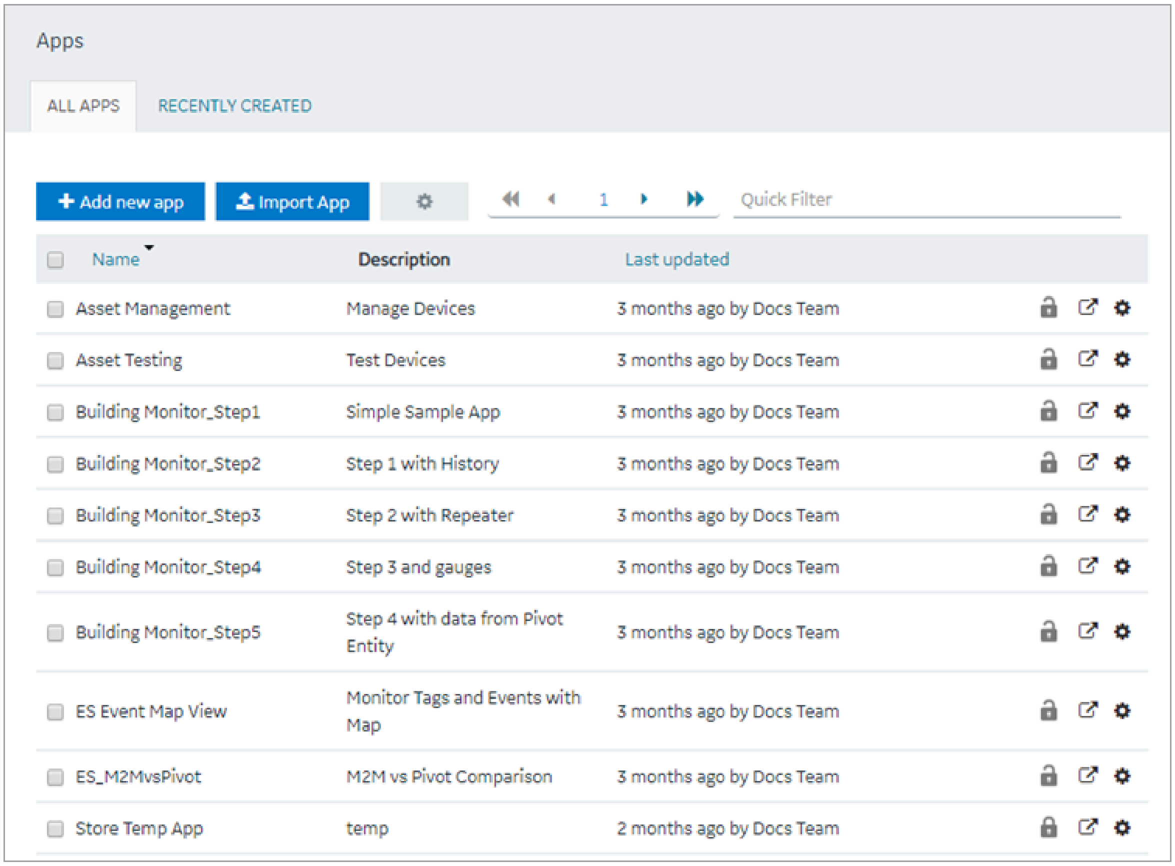
2. Select **RECENTLY CREATED**.

A list appears with the ten most recently created applications.



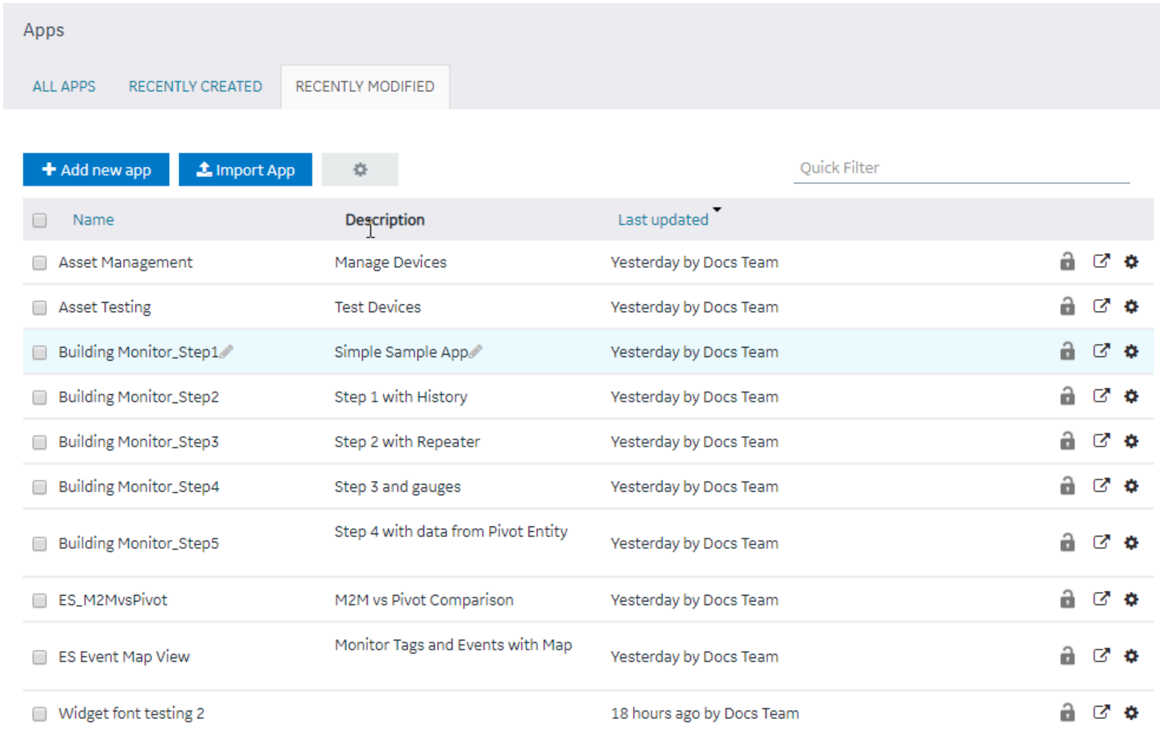
Access a Recently Modified Application

1. In the main navigation menu, select **APPS**.
   The **APPS** workspace appears.



2. Select **RECENTLY MODIFIED**.

A list appears with the ten most recently modified applications.

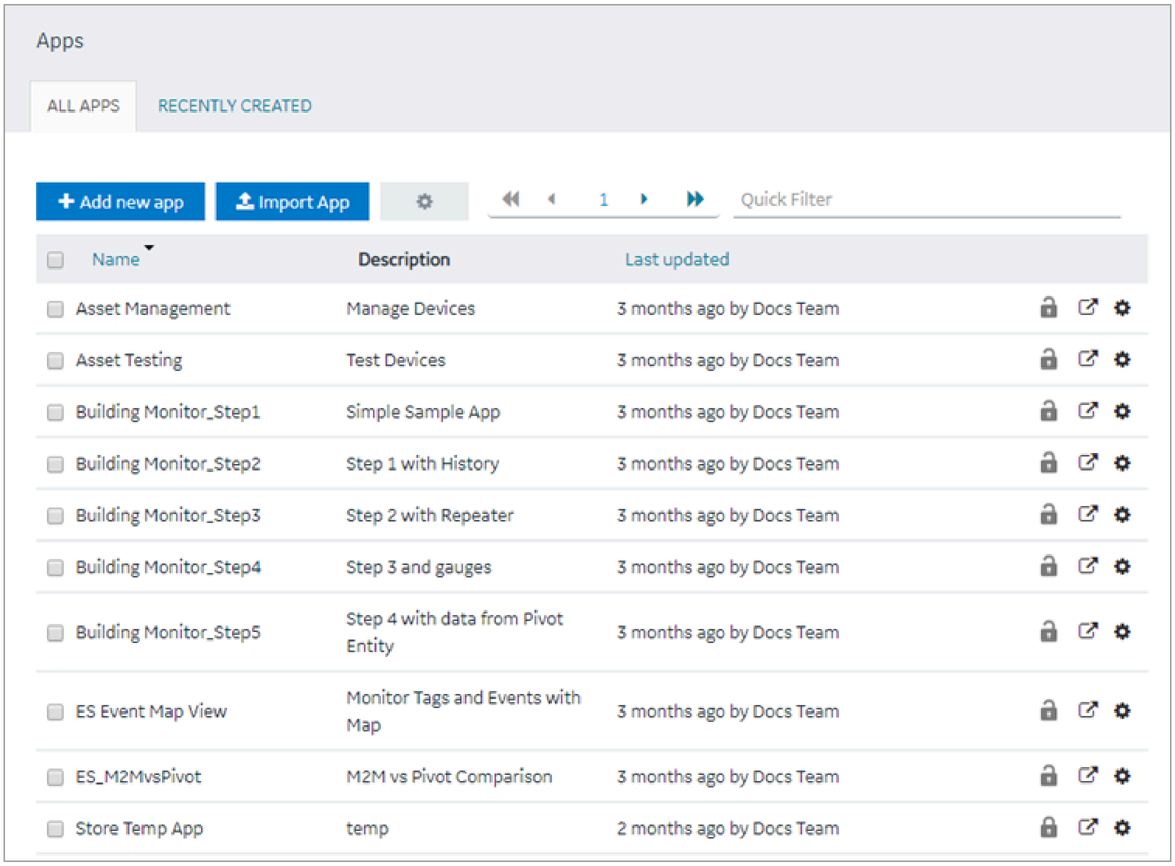


Create an Application

This topic describes how to create an application. You can also copy an application *(on page 148)*.

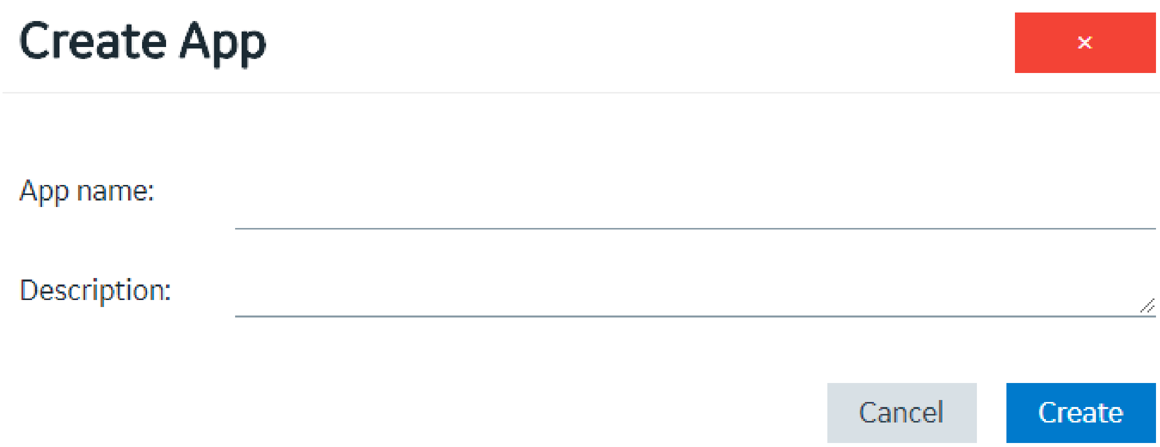
1. In the main navigation menu, select **APPS**.

   The **APPS** workspace appears.



2. Select **Add new app**.

   The **Create App** window



   appears.

3. In the **App name** and **Description** boxes, enter values, and then select **Create**. The name must contain at least one uppercase or lowercase letter.

   The application is created.

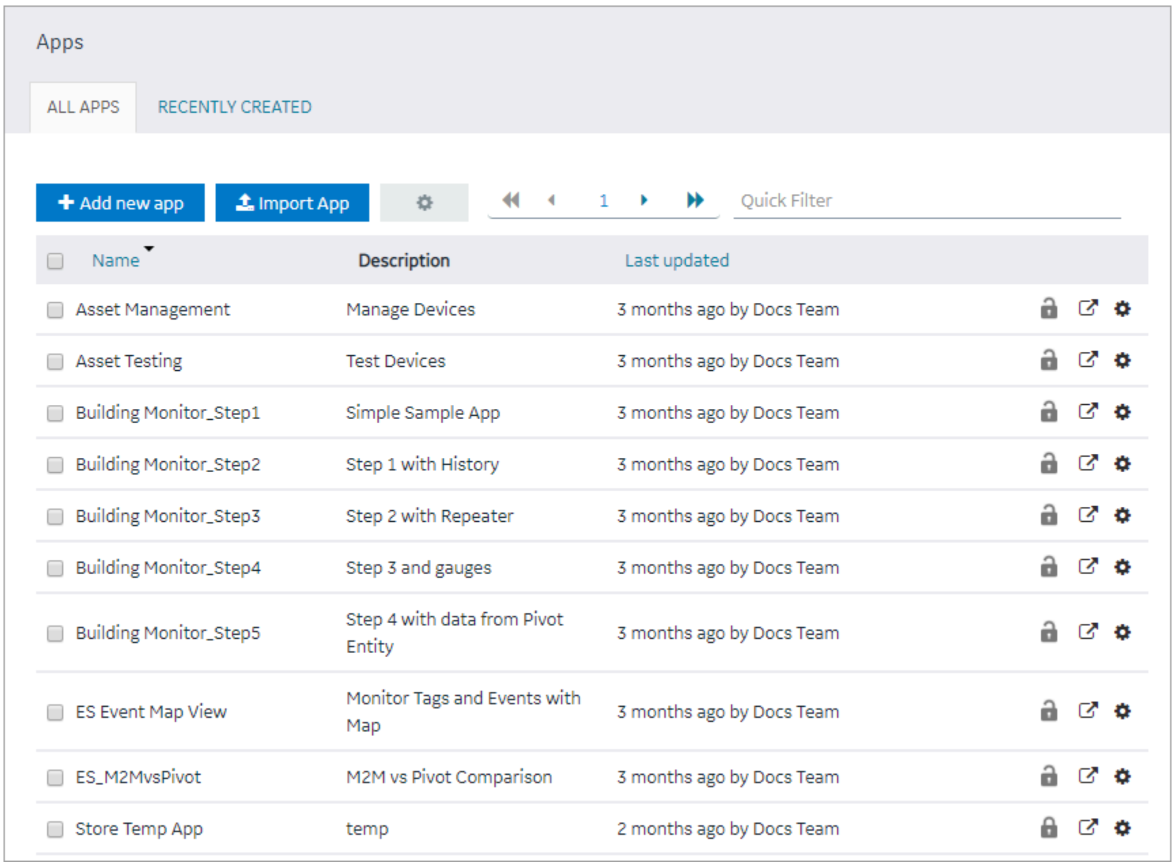
Create a page *(on page 308)*.

Copy an Application

This topic describes how to copy an application. You can also create an application *(on page 146)*.

You can copy an application only if it was created in the same site. If, however, you want to copy an application that was created in a different site, you must export the application *(on page 149)*, and then import *(on page 151)* it.

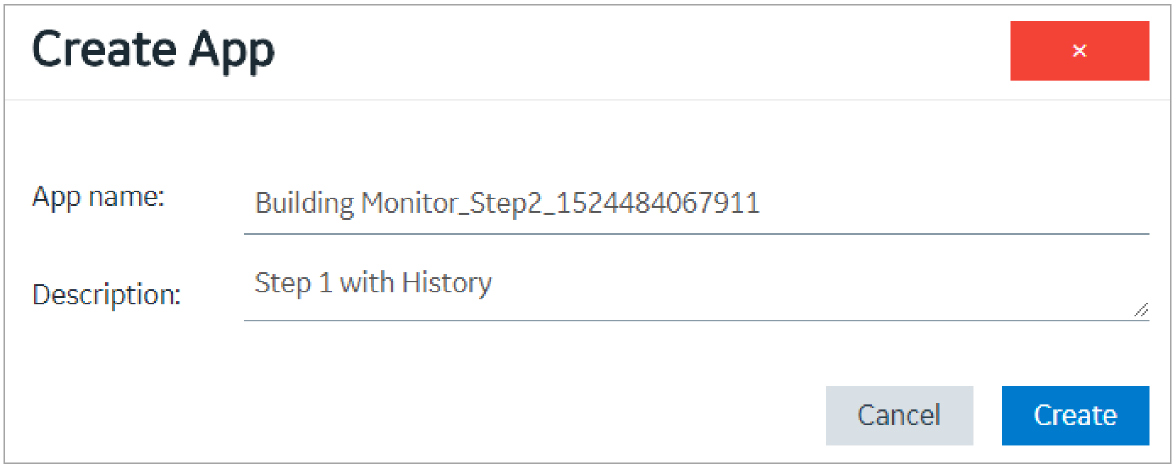
1. In the main navigation menu, select **APPS**.
   The **APPS** workspace appears.



2. In the rows containing the applications that you want to copy, select the check boxes.
3. In the workspace heading, select , and then select **Duplicate apps**.
   A message appears, asking you to confirm that you want to duplicate the applications.

> **Tip:**
>
> Alternatively, in the row containing each application that you want to copy, select , and then select **Duplicate app**.

4. Select **OK**.
   The **Create App** window appears. The **App name** box contains the name of the application that you want to copy, along with a system-generated value. The **Description** box contains the description of the application that you want to copy.



5. For each application that you have selected, modify values in the **App name** and **Description** boxes as needed, and then select **Create**.
   The applications are copied. The **Pages** workspace for the first application that you have copied appears, displaying a list of pages copied from the original application.

Export an Application

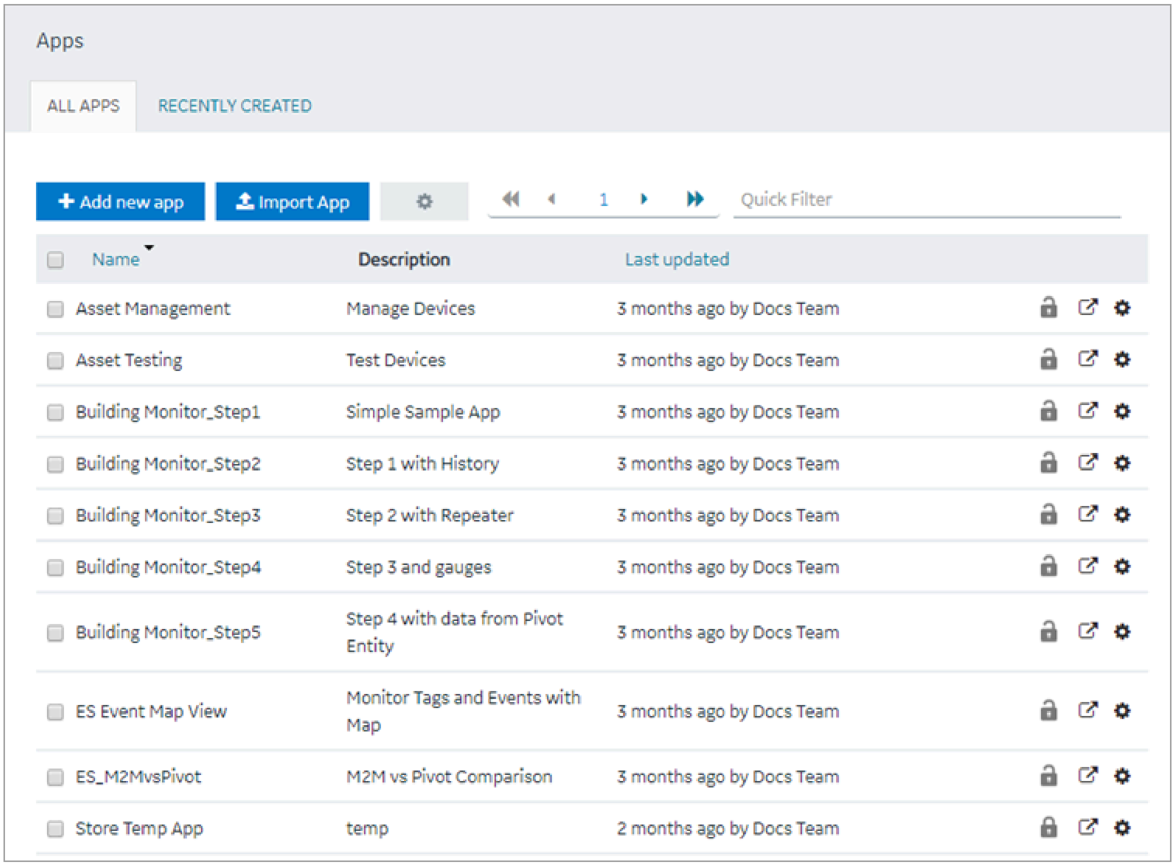
Export and save applications to your local system.

If you want to use or copy an application that was created using a different site, you must export the application, and then import *(on page 151)* it.

> **Tip:**
> If you want to export multiple applications that use the same entities and queries, export them together (instead of exporting them individually).

Default applications are excluded from the export operation. To export a default application, duplicate *(on page 148)* and export it.

1. In the main navigation menu, select **APPS**.
   The **APPS** workspace appears.



2. In the rows containing the applications that you want to export, select the check boxes.
3. In the workspace heading, select , and then select **Export apps**.
   A message appears, indicating that the application will be saved in the default download location of the browser.

> **Tip:**
>
> Alternatively, in the row containing each application that you want to export, select , and then select **Export app**.

4. Select **OK**.
   The **Select Datasources** screen appears, if the application being exported contains queries that work with multiple data sources.
5. Select the compatible data sources, then select **Export**.
   Each application is exported as a .zip file, which contains:

- a .zip file for each plug-in used in the application.
- an .xml file for the rest of the components used in the application.

> **Important:**
> To avoid system related errors, do not modify original exported zip files and repackage them for import.

Import the application *(on page 151)*.

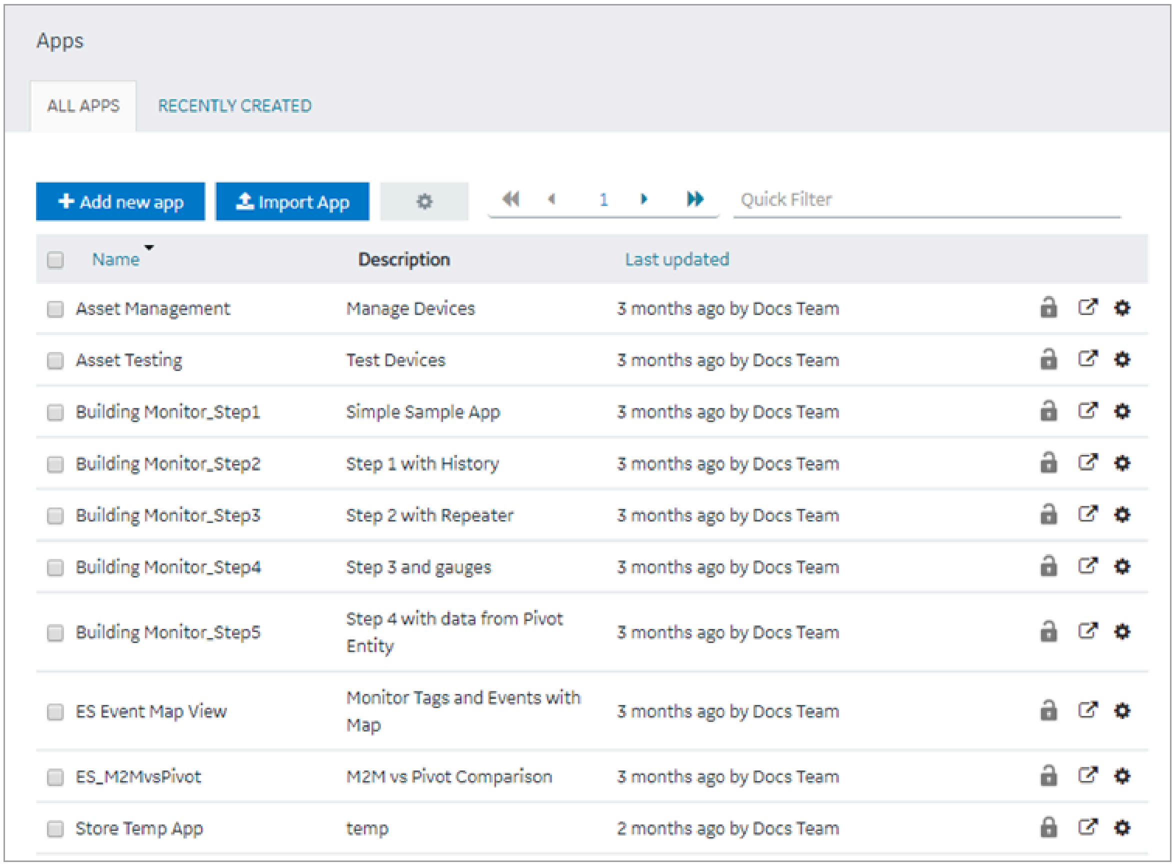
Import an Application

Import and save applications to Operations Hub.

When you import an application, a copy of the application and its components (that is, plug-ins, pages, entities, queries, events, themes, and settings) is created. If an application or a component with the same name exists in the current site, then a system-generated number is appended to the name of the imported application or component. However, if a plug-in with the same name exists, the plug-in is not imported. Instead, the plug-in that already exists in the site is used in the application.

Export the application *(on page 149)* that you want to import. Default applications are excluded from the import operation.

1. In the main navigation menu, select **APPS**.
   The **APPS** workspace appears.



2. Select **Import App**.
   A message appears, indicating that if there is already an application or a component with the same name, the imported application or component will contain a new name.
3. Proceed to import the application.
4. Navigate to the application (stored as a .zip file) that you want to import, then select **Open**.

> **Important:**
> To avoid system related errors, do not modify original exported zip files and repackage them for import.

5. If the application being imported already exists in Operations Hub with the same name, select one of the following:

Option	Description
Duplicate	Creates a duplicate copy of the application and imports to Operations Hub.

Option	Description
Replace	Deletes the existing application in Operations Hub and replaces with the one from the import file.

If duplicate data source records are found, you may be asked to confirm before importing the file to Operations Hub. Refer to Handling Duplicate OPC UA Data Sources *(on page 153)*.

6. If the system detects that the imported application has widgets/plug-ins eligible for upgrades, then they are automatically updated to their latest versions. See Configure Plug-in Upgrades *(on page 154)*.

A copy of the selected application is created. The **Pages** workspace appears, displaying a list of pages copied from the original application.

Handling Duplicate OPC UA Data Sources

OPC UA data sources are identified as duplicates if they contain identical server endpoint values.

If duplicate OPC UA data sources are detected during application import, select one of the following:

Option	Description
Use Existing	Maintains the data source record that currently exists in Operations Hub. Does not import the duplicate from the file.
Replace	Deletes the data source record that currently exists in Operations Hub. Imports the duplicate from the file to replace the deleted record. **Note:** This option is enabled only for duplicate data source records sharing the same name and endpoint connection value (URI). Details such as security policy, authentication, etc. may vary in these records.

Duplicate Apps in Operations Hub: During import conflict, if you opt for duplicating the application, the relevant data sources are also duplicated.

To resolve any OPC UA data source server endpoint (URI) conflict when duplicating apps:

- Select **Use Existing** to avoid deleting the existing OPC UA record in Operations Hub. This record will not be imported from the file.
- Select **Replace**, to replace the existing OPC UA record in Operations Hub with the record from the import file.

The data source records that do not have a conflict get duplicated.

Replace Apps in Operations Hub: During import conflict, if you opt for replacing the application, Operations Hub data source records having the same name as the imported records, are deleted before being replaced with the imported ones.

> **Note:**
> Any OPC UA data source record in Operations Hub that shares the same name with a record from the import file will get replaced in this scenario. Such records are not considered to be duplicates.

To resolve any OPC UA data source server endpoint (URI) conflict when replacing apps:

- Select **Use Existing** to avoid deleting the existing OPC UA record in Operations Hub. This record will not be imported from the file.
- Select **Replace**, to replace the existing OPC UA record in Operations Hub with the record from the import file.

The data source records that do not have a conflict get replaced.

> **Note:**
> Duplicate OPC UA data sources that existed in older versions are not removed after upgrading to 2.1 or later. It is recommended to manually delete such duplicate records, or modify them to use a unique server endpoint connection.

Configure Plug-in Upgrades

A pre-requisite for successful custom plug-in upgrade in Operations Hub.

Plug-in developers can choose to write a specification, or use any transformation mechanism to get an EXE, JAR, or BAT file.

1. Prepare a data transformation specification for plug-in upgrade using any of these methods:

Transformation File Type	Description
Jolt	Open-source JSON-to-JSON transformation library written in Java. For more information, refer to https://github.com/bazaarvoice/jolt#Documentation For Jolt spec, you can use http://jolt-demo.appspot.com/ as a playground to test your transformation.
JAR	Java output using JSON transformation library such as https://mvnrepository.com/artifact/net.minidev/json-smart/2.4.7. For JAR, the plug-in upgrade infrastructure looks for the class to load. For example, `public class GEBreadcrumb_3_0_0to3_0_1` wherein, ◦ `GEBreadcrumb` is the plug-in name ◦ `3_0_0` is the breadcrumb plug-in old version. The dot is replaced with an underscore. ◦ `3_0_1` is the breadcrumb plug-in new version. The dot is replaced with an underscore. A transform instance is created for the class by invoking its static transform method: `public static String transform(String inputJSON)`
.EXE	Windows® executable file. Create a transformation project with your choice of library (C++, Node, Python, etc.), which prints the transformed output json to console. For this executable,

Transformation File Type	Description
	◦ 'FromVersion' schema input json is passed as command line argument ◦ 'ToVersion' response JSON is read from its console output produced by the executable

> **Note:**
> Naming convention for the transformation file is `<PluginName>-<FromVersion>-<ToVersion>-spec.json`. For example `GETrendCard-3.0.1-3.0.2-spec.json|jar|exe|bat`.

2. Log in to the machine where Operations Hub is installed.
3. Place the plug-in transformation files in this location folder `..\ProgramData\GE\Operations Hub\iqp-config\plugin-transform-spec`.

When Operations Hub administrator imports applications with old plug-ins, they are successfully upgraded to their latest versions.

- The transformation engine looks for an incremental path of intermediatory transformation that can migrate a plug-in from a specific version to a desired version. For instance, `GETrendCard-3.0.1-3.0.2-spec.json` `GETrendCard-3.0.2-3.0.4-spec.json` `GETrendCard-3.0.4-3.0.5-spec.json` are used consecutively to upgrade plug-ins.
- If incremental upgrades were not performed between Operations Hub versions, then the plug-in version may not remain subsequent for upgrade. For example, consider:
    - Operations Hub 1.7 has 3.0.1 version of GETrendCard
    - Operation Hub 2.5 has 3.0.5 version of GETrendcard

  The `GETrendCard-3.0.1-3.0.5-spec.json` file may not be available for upgrading plug-ins. In such cases, plug-in upgrades are not performed in Operations Hub.

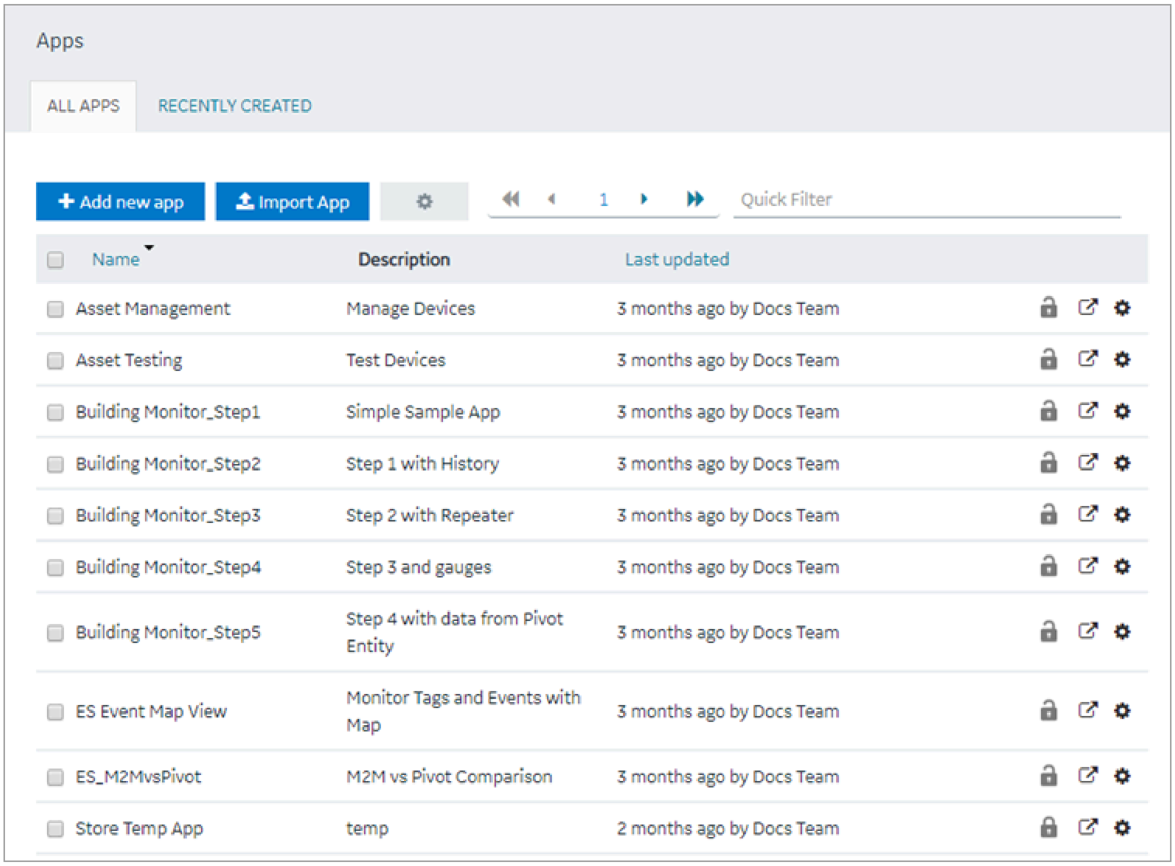
Delete an Application

Delete applications from Operations Hub.

- When you delete an application, only the application is deleted from Operations Hub. The components used by the application are not deleted.
- You cannot delete an application if it is locked.
- You cannot delete Operations Hub default applications.

1. In the main navigation menu, select **APPS**.

   The **APPS** workspace appears.



2. In each row containing an application that you want to delete, select the check box.
3. In the workspace heading, select , and then select **Delete apps**.

   A message appears, asking you to confirm that you want to delete the applications.

> **Tip:**
>
> Alternatively, in the row containing each application that you want to delete, select , and then select **Delete app**.

4. Select **OK**.

   The applications are deleted.

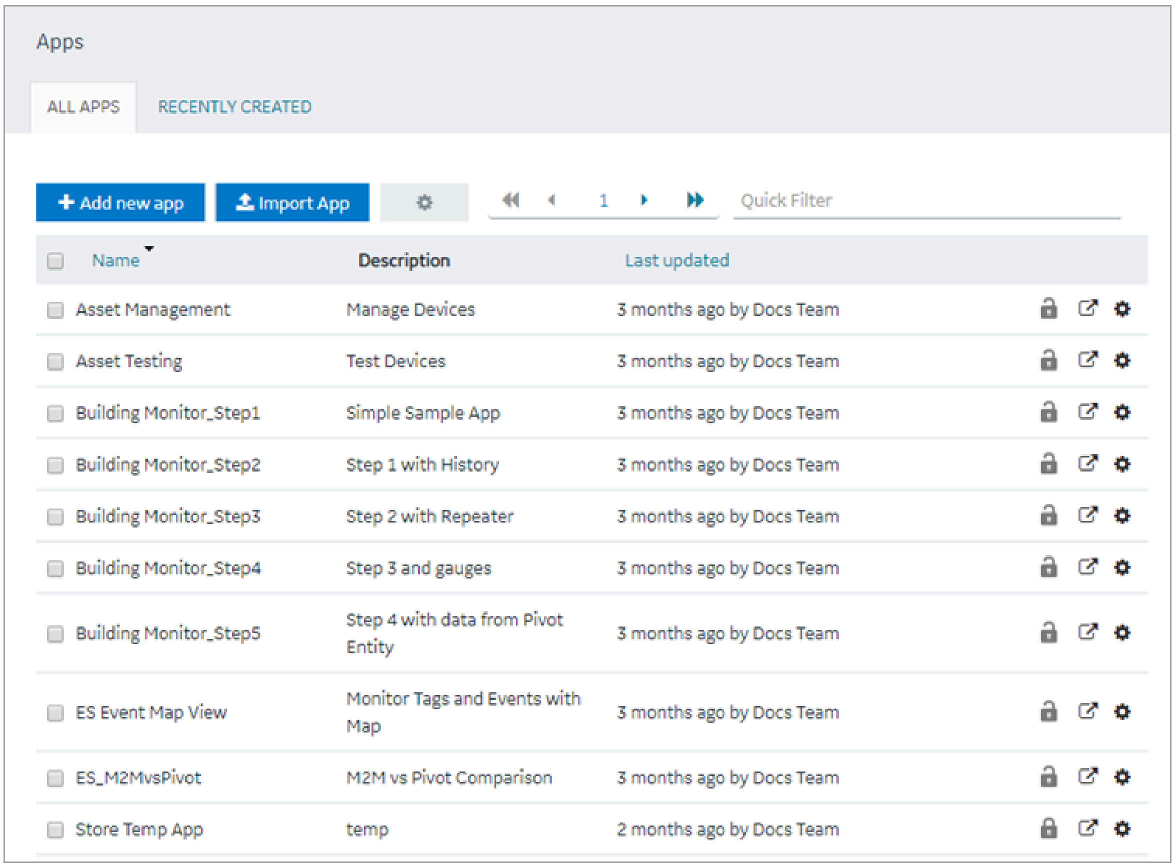
Upgrade an Application

Analyzes applications and updates app plug-ins, if required.

See also Configure Plug-in Upgrades *(on page 154)*.

As a best-practice, always upgrade your applications after upgrading to a SIM version. This allows the existing plug-ins in applications to work properly.

1. In the main navigation menu, select **APPS**.
   The **APPS** workspace appears.



2. In each row containing an application that you want to upgrade, select the check box.
3. In the workspace heading, select , and then select **Upgrade apps**.
   A message appears to confirm whether to check if the selected applications require plug-in upgrades.

> **Tip:**
>
> Alternatively, in the row containing each application that you want to upgrade, select , and then select **Upgrade app**.

4. Select **OK** to analyze and update the application plug-ins, if necessary.

A message appears to confirm the upgrade.

5. **Optional:** Select **Show Details** in the message to review a summary of application plug-in upgrades.

Entities

About Entities

An entity is a database table, which you can use to store data.

You can create queries to retrieve and manage data stored in entities. You can create events to trigger actions when data in an entity is changed. The following list provides a few examples on using entities:

- Enhance data that is used in an asset monitoring application
- Create applications related to customer relationship management
- Manage the workflow of an event-handling or a parts-ordering application
- Sort data retrieved from a maintenance or an issue-reporting application
- Store contact details of employees

Operations Hub provides a few baseline entities that you can use to manage your assets or collect machine data. You cannot modify or delete these entities; you can use them in your application directly. For baseline entities, the **LAST UPDATED** column is blank in the **ENTITIES** workspace.

When you create an entity, you must perform the following steps:

1. Define the entity structure. To do so, add fields *(on page 168)* and specify their data types (for example, Boolean, Number, String, and so on).
2. Add rows, and specify field values. To do so, enter values manually *(on page 169)* or import data from a Microsoft Excel workbook *(on page 171)*.

Pivot Entity

A pivot entity is used to automatically collect data from multiple sensors that belong to selected devices and groups of devices. You can use a pivot entity in a query, and plot it as a trend graph in your application.

For a pivot entity, one of the following icons appears in the **ENTITIES** workspace:

- : Indicates that the pivot entity is receiving data. If you want to stop collecting data in the pivot entity, you must deactivate the pivot entity. To do so, access the pivot entity, and then select Deactivate Pivot.
- : Indicates that the pivot entity is not receiving data. If you want to start collecting data in the pivot entity, you must activate the pivot entity. To do so, access the pivot entity, and then select Activate Pivot.

> **Important:**
> If you add or remove a device from a device type or group that is used in a pivot entity, you must deactivate the pivot entity, and then reactivate it for the changes to be applied.

Suppose 50 sensors are connected to a device type and 100 devices of that type send data to your application. Suppose you want to monitor the data from only five of the sensors and only 10 of the devices, which belong to a device group named EV group. You can create a pivot entity to collect data from only the selected sensors and the selected devices that belong to the EV group. This makes it easier to plot trend graphs or create tables with multiple sensor values in your application and improves performance when retrieving the data.

Relationship Between Entities

If you want to retrieve data from two or more entities in a single query, you must create a relationship (or a join) between them. When you create a relationship between entities, the two entities are joined by an inner join in SQL. The entity from which you create a relationship is called the source entity. The entity to which you create a relationship is called the target entity.

A single entity can be used both as a source entity and a target entity. A single entity can be used as a source entity in multiple relationships. A relationship can be bidirectional (that is, if there is a relationship from entity 1 to entity 2, you can also create a relationship from entity 2 to entity 1).

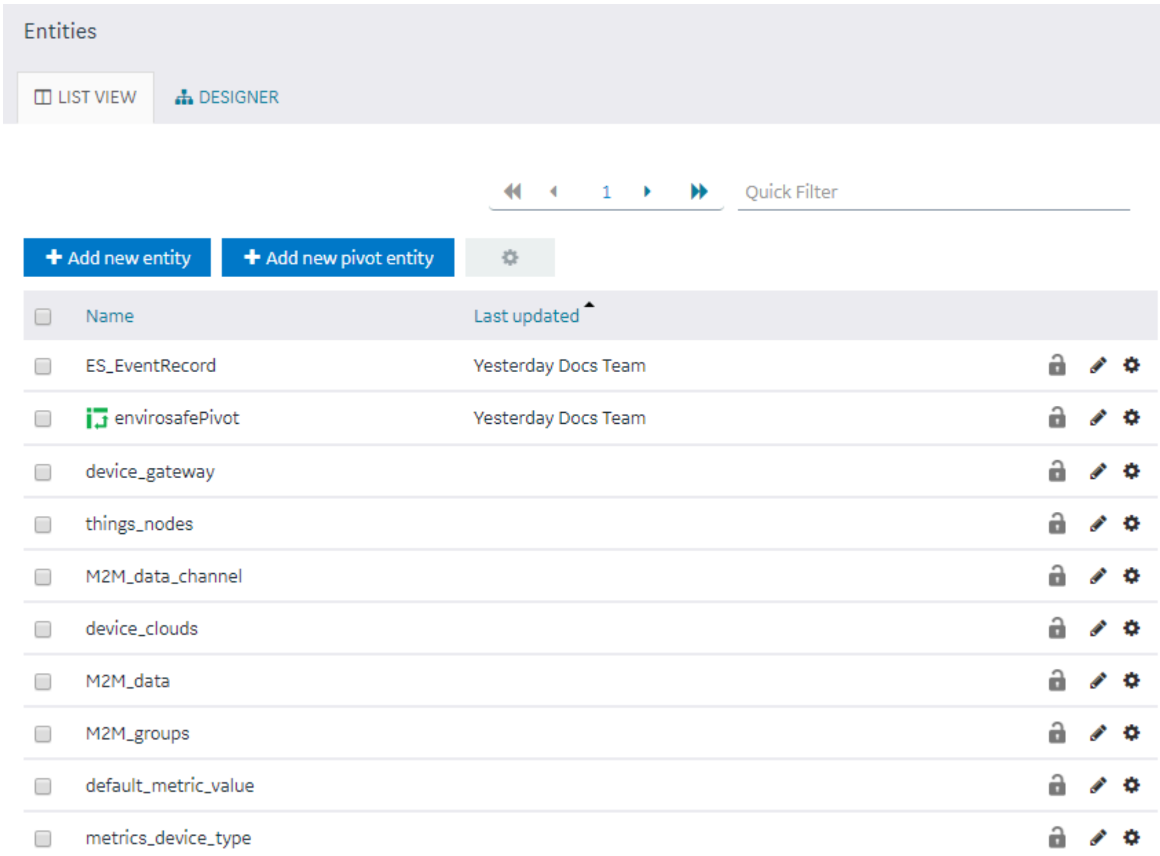
After you create a relationship, when you create a query, if you select the source entity in the **Entity** box, you can retrieve data from fields in both the source and target entities. If, however, you select the target entity, you can retrieve data only from the target entity.

> **Important:**
> You cannot use a baseline entity or a pivot entity as a source entity; you can only use it as a target entity.

Access an Entity

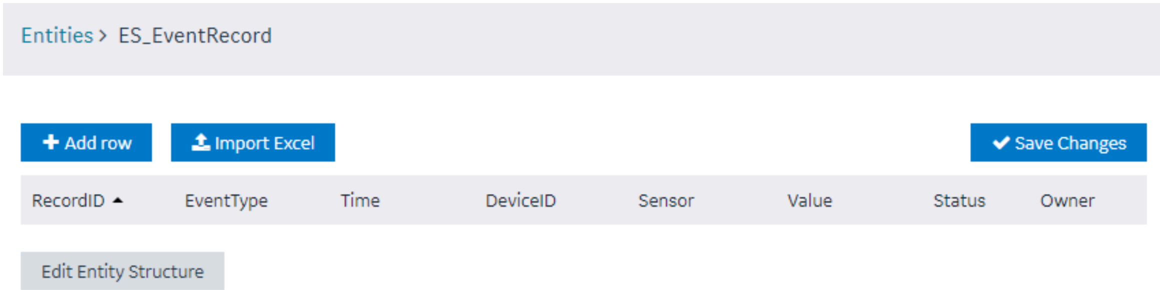
1. In the main navigation menu, select **ENTITIES**.

   The **ENTITIES** workspace appears.

2. In the row containing the entity that you want to access, in the **Name** column, select the link.

   The entity appears, displaying a list of fields in the entity.

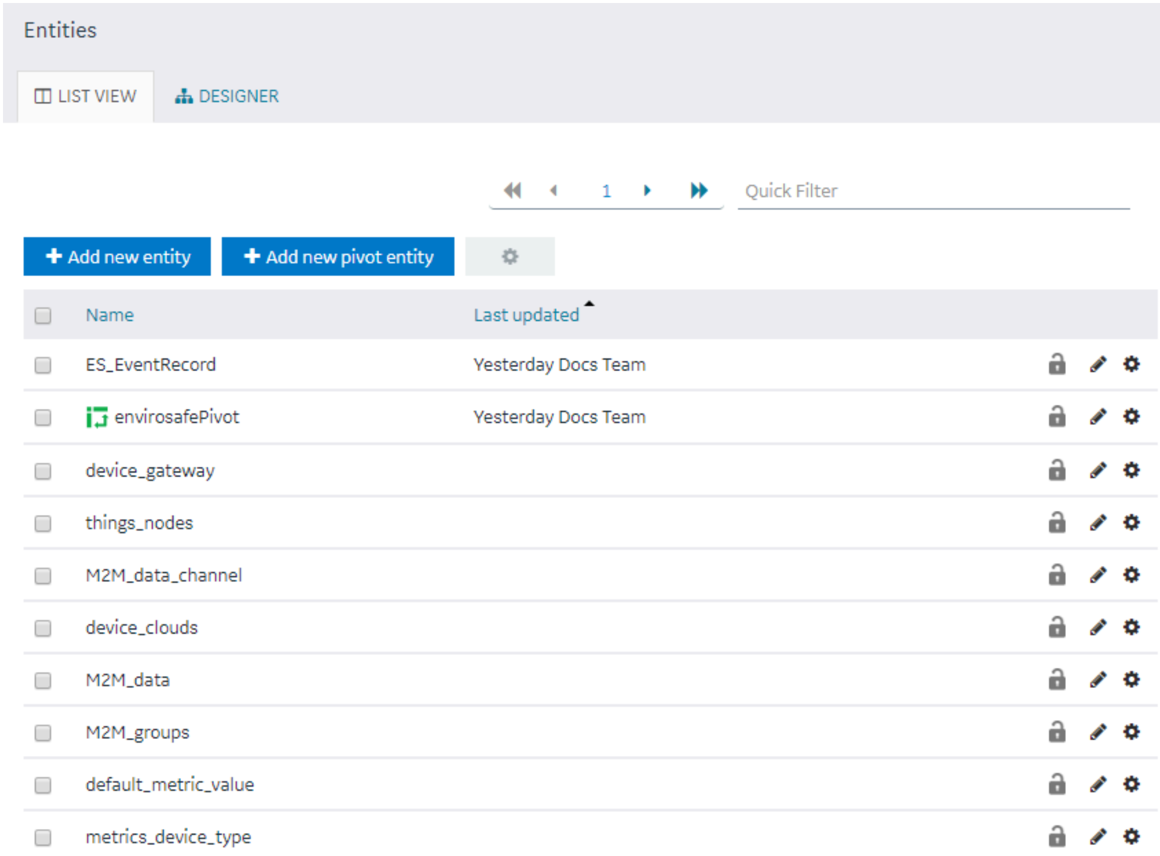


> **Tip:**
> You can modify values in the available fields, and then select **Save** or **Save and Exit** to save your changes.

Create an Entity

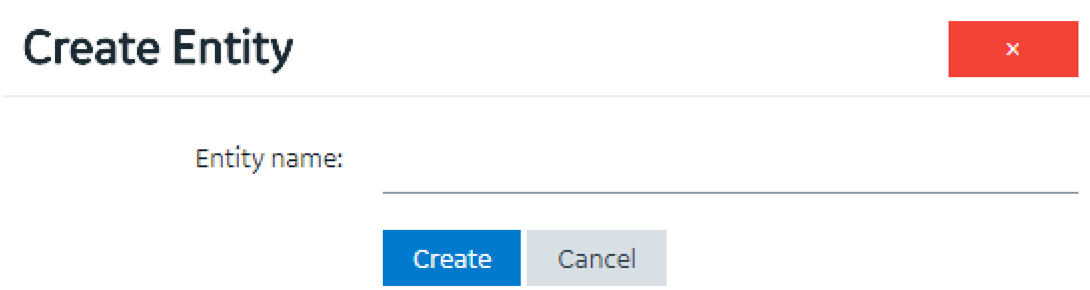
This topic describes how to create an entity. You can also copy an entity *(on page 167)*.

1. In the main navigation menu, select **ENTITIES**.
   The **ENTITIES** workspace appears.



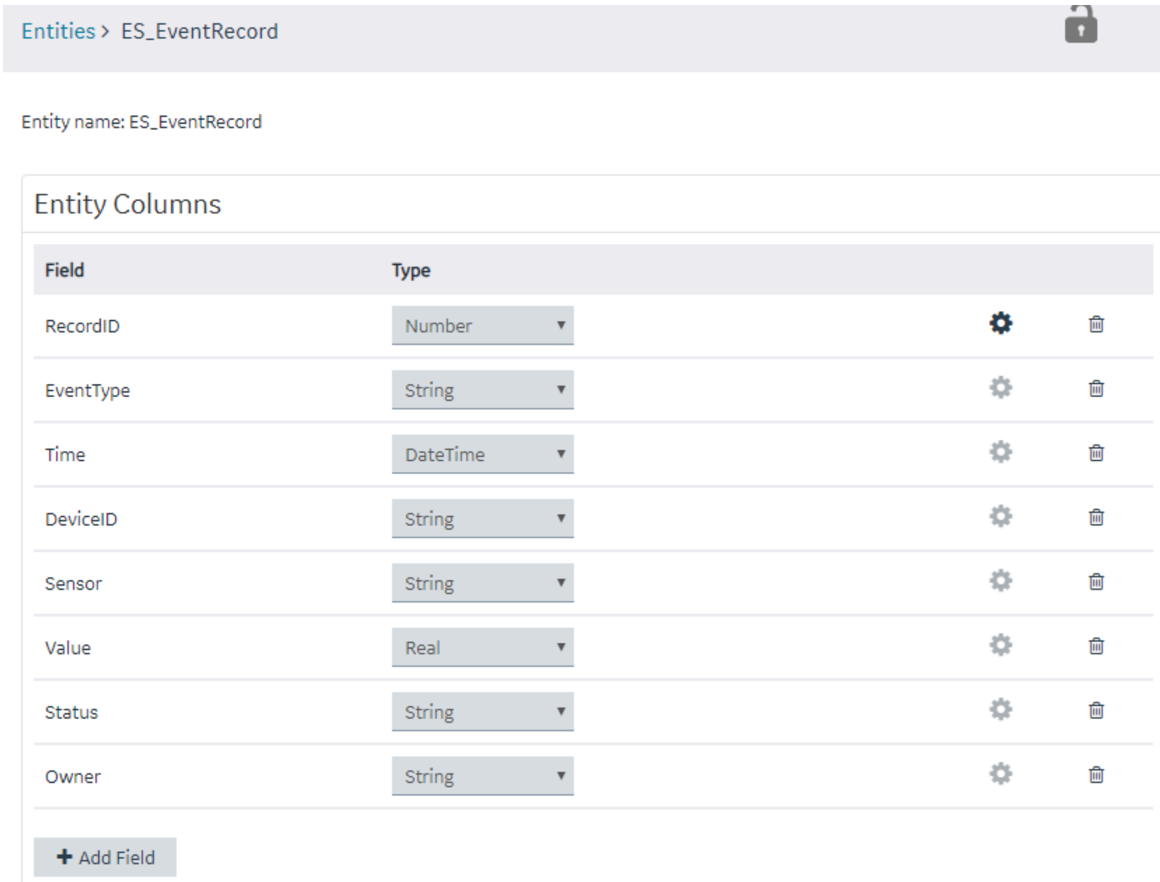
2. Select **Add new entity**.

   The **Create Entity** window appears.



3. In the **Entity name** box, enter a name, and then select **Create**.
4. Select **Edit Entity Structure**.

   A list of fields in the entity appears.



5. Select **Add Field**.

   A field is created in the entity. By default, the name of the field is Field_1 and the type is String.
6. Next to the field name, select , and then modify the name of the field. The name must contain at least one uppercase or lowercase letter.
7. In the drop-down list box in the **Type** column, modify the type of the field if needed.
8. Select **Save** or **Save and Exit**.

   The entity is created.

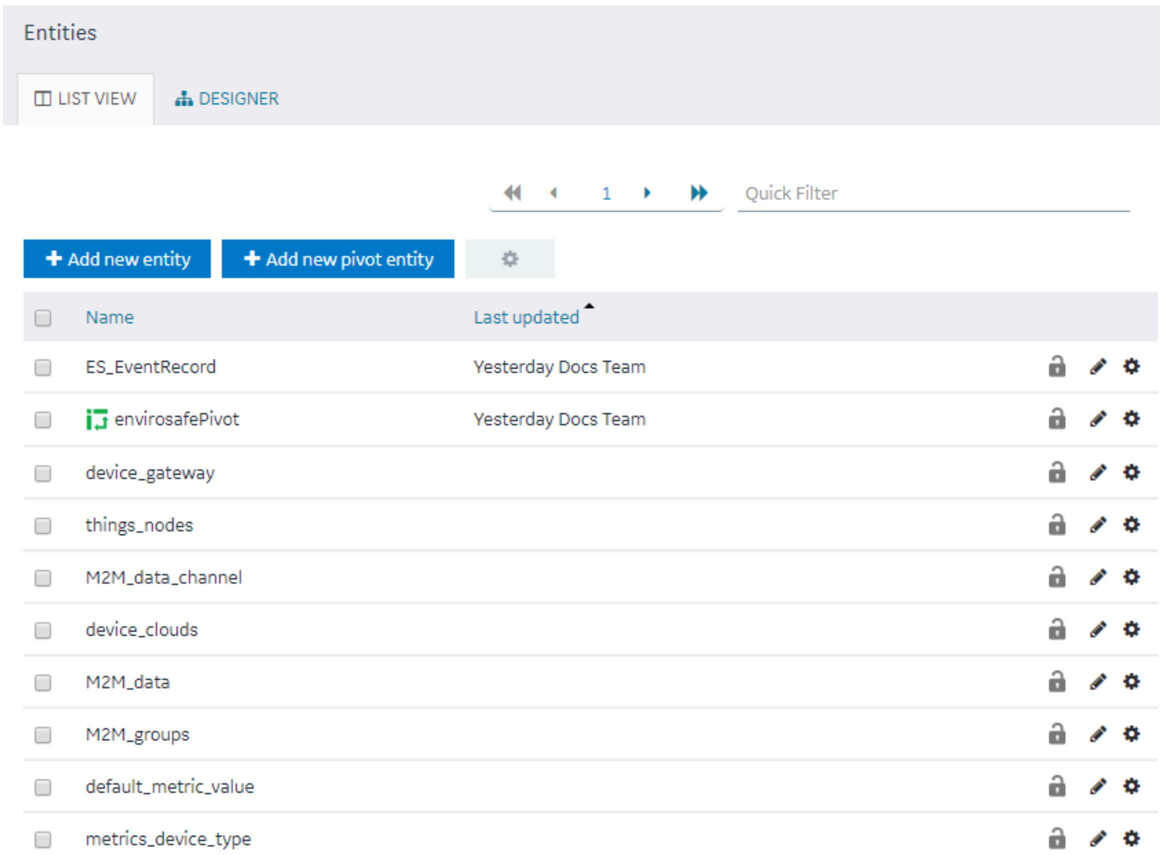
Add a row *(on page 169)* or, if needed, import data in to the entity *(on page 171)*.

Create a Pivot Entity

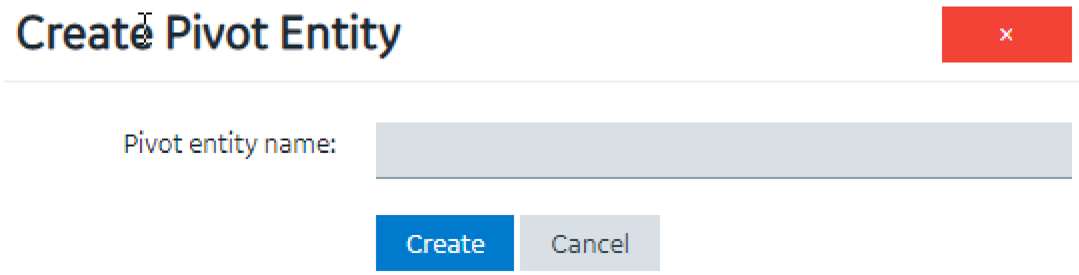
Register the device details and metrics that you want to use in the pivot entity using baseline entities.

1. Register the device types and metrics using the supported_device_gateway and the metrics_device_type entities, respectively.
2. Register the device groups for the device type using the M2M_groups entity. The group must belong to a device type that you want to use in the pivot entity.
3. Register the devices in a group that you created for their device type.

1. In the main navigation menu, select **ENTITIES**.
   The **ENTITIES** workspace appears.



2. Select **Add new pivot entity**.
   The **Create Pivot Entity** window appears.



3. In the **Pivot entity name** box, enter a name, and then select **Create**. The name must contain at least one uppercase or lowercase letter.
   The pivot entity is created. By default, a few fields such as timestamp, device_id, instance_name, and other fields are added to the pivot entity. You cannot modify or delete them. You can, however, add more fields for the metrics that you want to record in the pivot entity.
4. If you want to collect data from a specific device type:
   a. In the **Get Data By** box, select **Device type**.
      A drop-down list box appears next to the **Device type** box, displaying a list of device types that you have registered using the supported_device_gateway entity.
   b. Select the device type from which you want to collect data in the pivot entity.
5. If you want to collect data from a specific device group:
   a. In the **Get Data By** box, select **Device group**.
      A drop-down list box appears next to the **Device group** box, displaying a list of device groups that you have registered using the M2M_groups entity.
   b. Select the device group from which you want to send data to the pivot entity.
6. Create a field *(on page 168)* for each metric that you want to record (for example, pressure, temperature, and other metrics). The field name must match the metric name that you have registered using the metrics_device_type entity and the metric name that the device uses to send data. This name is case-sensitive.
7. As needed, create additional fields in the pivot entity, and then select **Save** or **Save And Exit**.
   The changes made to the pivot entity are saved.

In the **ENTITIES** workspace,  appears in the row containing the pivot entity that you have created.

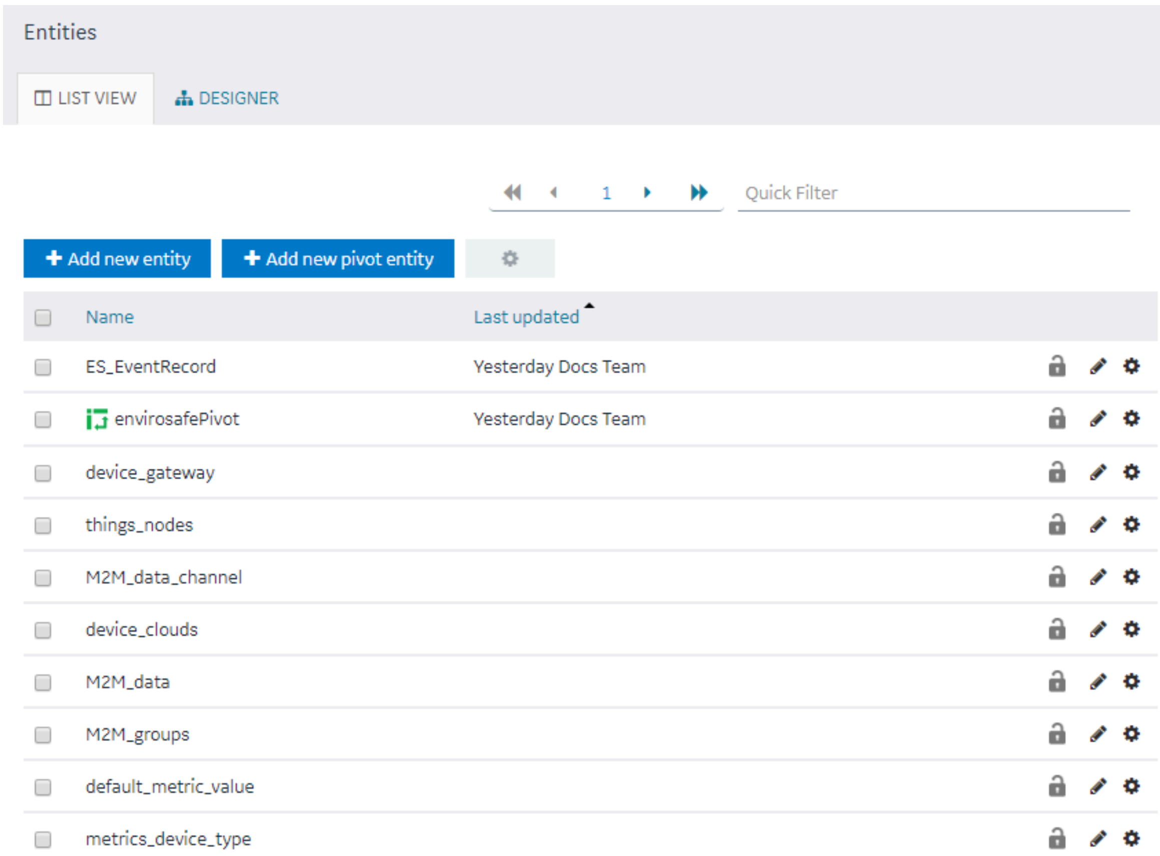
Select 

to start collecting data in the pivot entity.

Copy an Entity

This topic describes how to copy an entity. You can also create a new entity *(on page 162)*.

1. In the main navigation menu, select **ENTITIES**.
   The **ENTITIES** workspace appears.



2. Select the entity that you want to copy.
3. Select **Edit Entity Structure**.
4. As needed, add or remove fields.

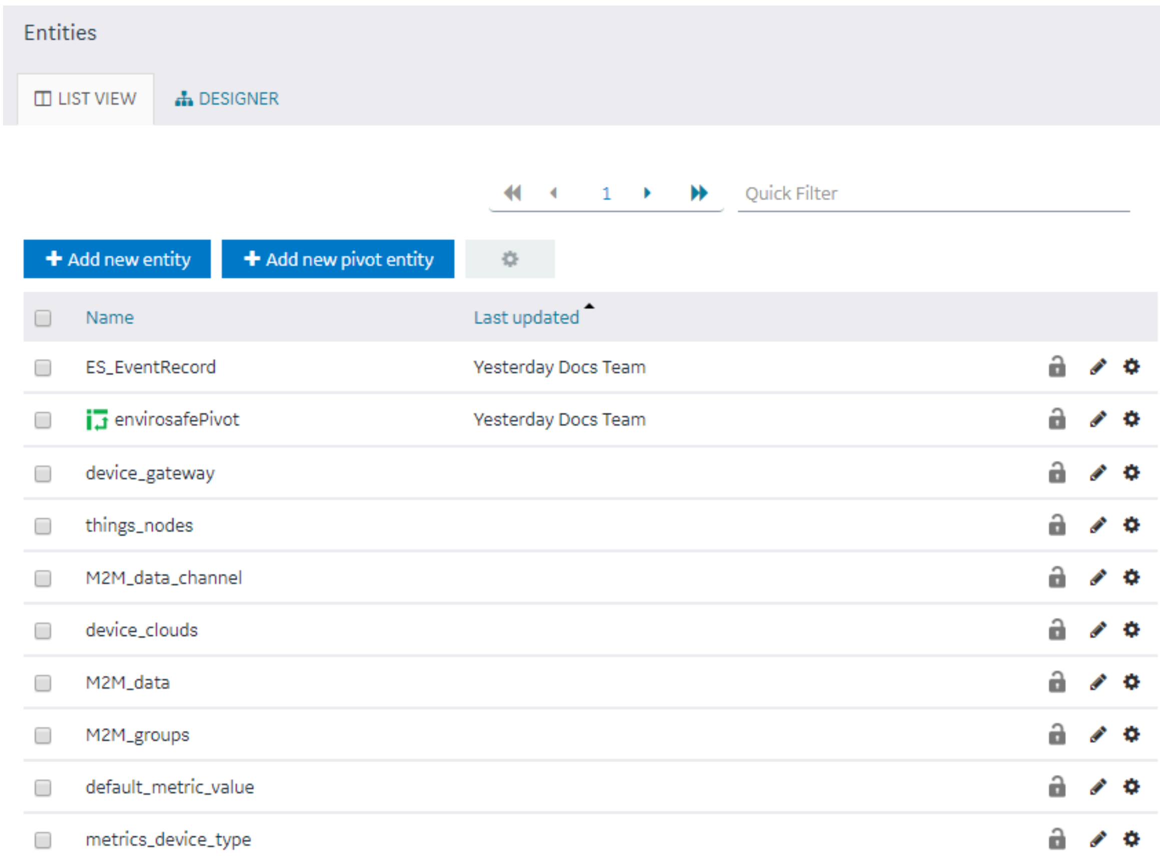
> **Tip:**
> You can also modify the type of a field by selecting a value in the **TYPE** column.

5. Select **Save As New**.
   The **Please enter new name** window appears, displaying the name of the entity that you have selected, appended with a system-generated value.

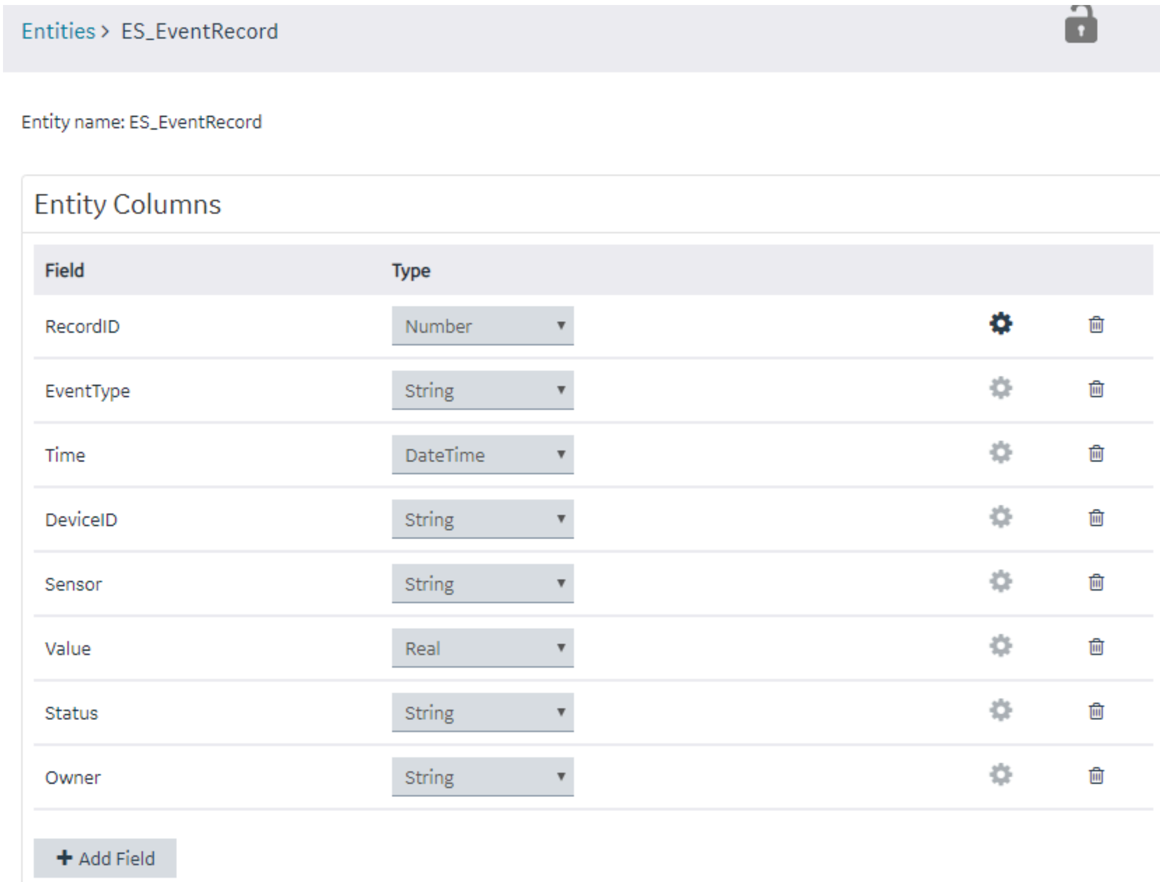
6. As needed, modify the name of the entity, and then select **OK**.
   The selected entity is copied.

Create a Field in an Entity

1. In the main navigation menu, select **ENTITIES**.
   The **ENTITIES** workspace appears.



2. Select the entity in which you want to create a field.
   A list of fields in the entity appears, along with the data in each field.
3. Select **Edit Entity Structure**.
   A list of fields in the entity appears.



4. Select **Add Field**.

   A field is created in the entity. By default, the name of the field is Field_1 and the type is String.

5. Next to the field name, select , and then modify the name of the field. The name must contain at least one uppercase or lowercase letter.
6. In the drop-down list box in the **Type** column, modify the type of the field if needed.
7. Select **Save** or **Save and Exit**.

   The field is created in the entity.

Add a row *(on page 169)* or import data in to the entity *(on page 171)*.

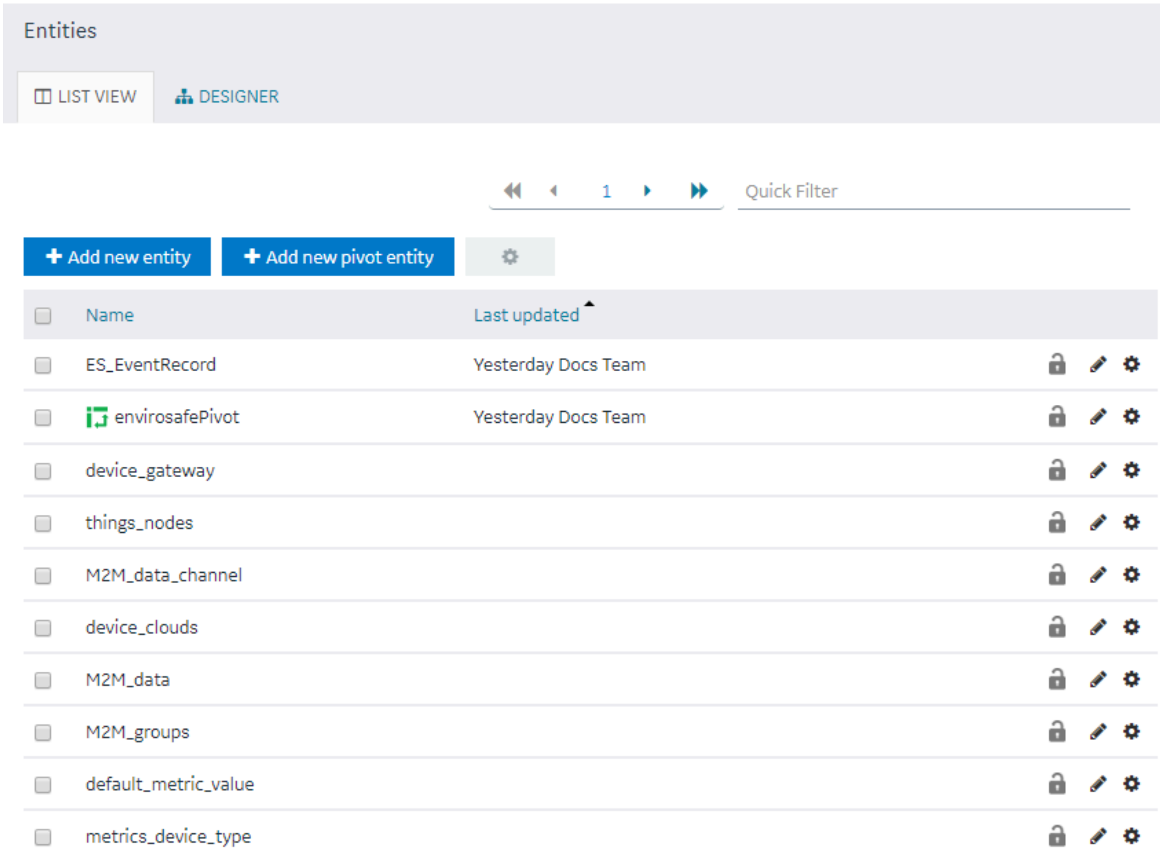
Add a Row to an Entity

As needed, add fields to the entity *(on page 168)*.

This topic describes how to add a row and enter data manually in an entity. You can also import data *(on page 171)* from a Microsoft Excel workbook. You cannot, however, add data to baseline entities or pivot entities manually. You can only insert data into these entities using an insert query in an application.

1. In the main navigation menu, select **ENTITIES**.

   The **ENTITIES** workspace appears.

2. Select the entity in which you want to add a row.
3. Select **Add row**.

   A blank row appears in the table.

   > **Tip:**
   > You can add multiple rows together by selecting **Add row** multiple times.

4. Enter values in the blank row, and then select **Save Changes**.

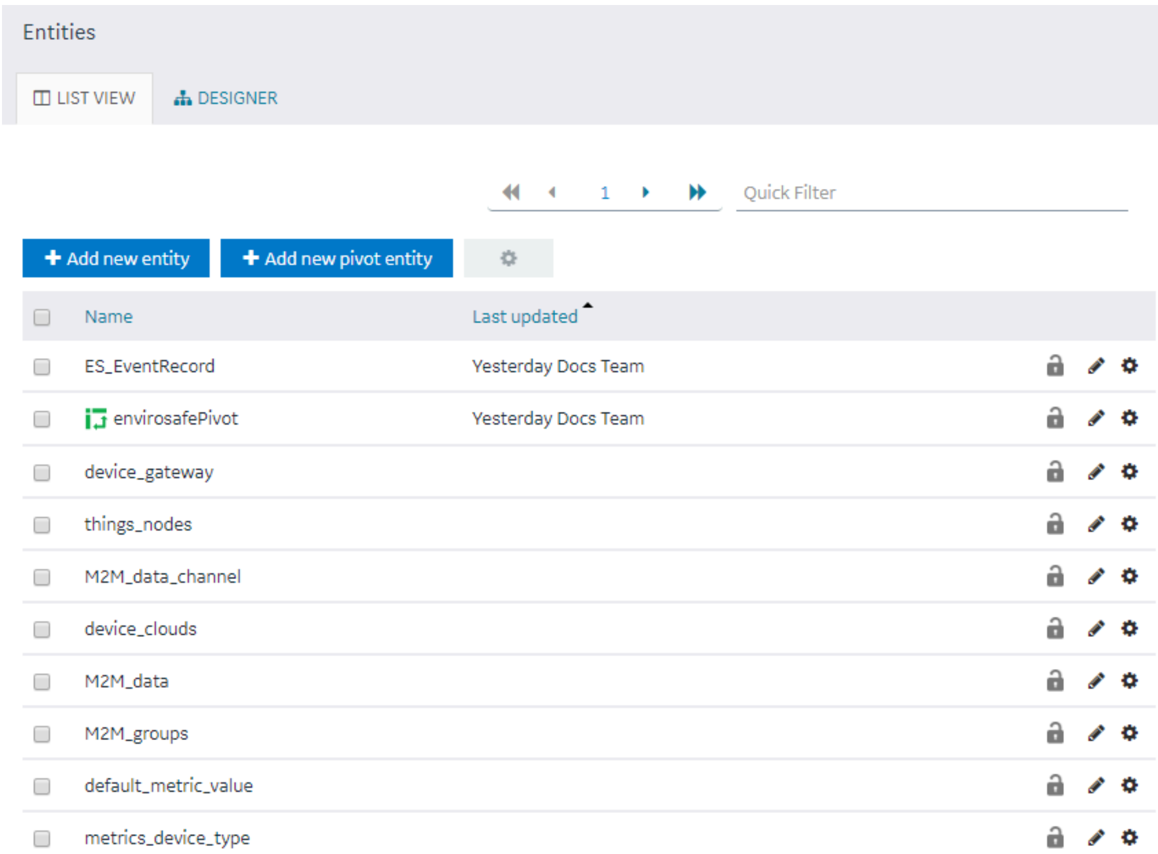
   The values that you have entered in the row are saved.

   > **Tip:**
   > If you have entered values in multiple rows, but want to save values only for a single row, select  in the row.

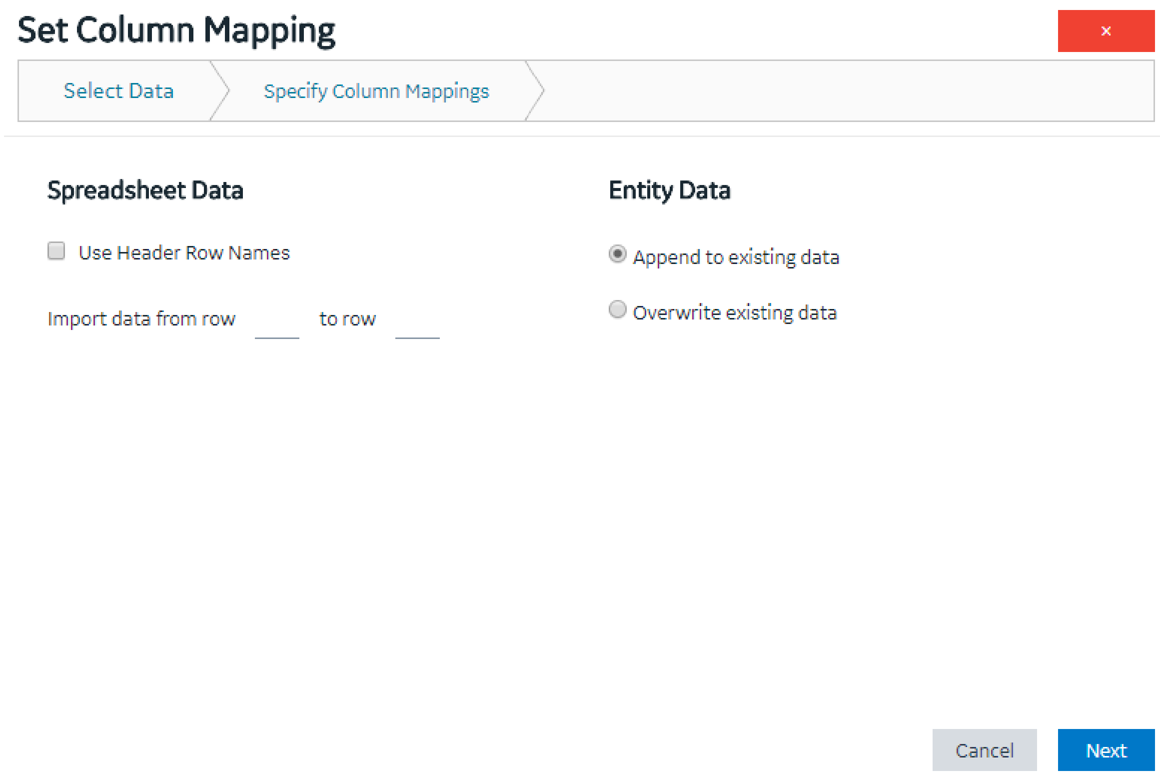
Import Data in to an Entity

This topic describes how to import data in to an entity from a Microsoft Excel workbook. You can also add a row manually in the entity *(on page 169)*.

1. In the main navigation menu, select **ENTITIES**.
   The **ENTITIES** workspace appears.



2. Select the entity in to which you want to import data.
3. Select **Import Excel**, navigate to and select the workbook that you want to import, and then select **Open**.
   The **Set Column Mapping** window appears.



4. If you want to use the names in one of the rows of the workbook as field names:

    a. Select **Use Header Row Names**.
    The **Header Row Number** box appears.

    b. Enter the row number in the workbook that you want to specify as the header row. By default, this box contains the value 1, which indicates that the first row is used as the header row.

5. In the **Import data from row** and **to row** boxes, enter the first and the last row numbers in the workbook that you want to import. For example, if you want to import data from rows 3 through 6, enter 3 and 6 respectively. By default, the **Import data from row** box contains the row number that is immediately next to the header row that you have specified.
6. If the entity already contains data and you want to add to it, select **Append to existing data**. If, however, you want to delete existing data before importing, select **Overwrite existing data**.
7. Select **Next**.
A list of fields in the entity appears. Next to each field, a text box appears in the **Column Name in Spreadsheet** column.
8. For each field, specify the column name in the header row in the workbook that you want to map, and then select **Import**.

A message appears, stating that the process is irreversible and asking you to confirm that you want to import data.

9. Select **OK**.

   A message appears, indicating that the data has been imported successfully.

10. Select **OK**.

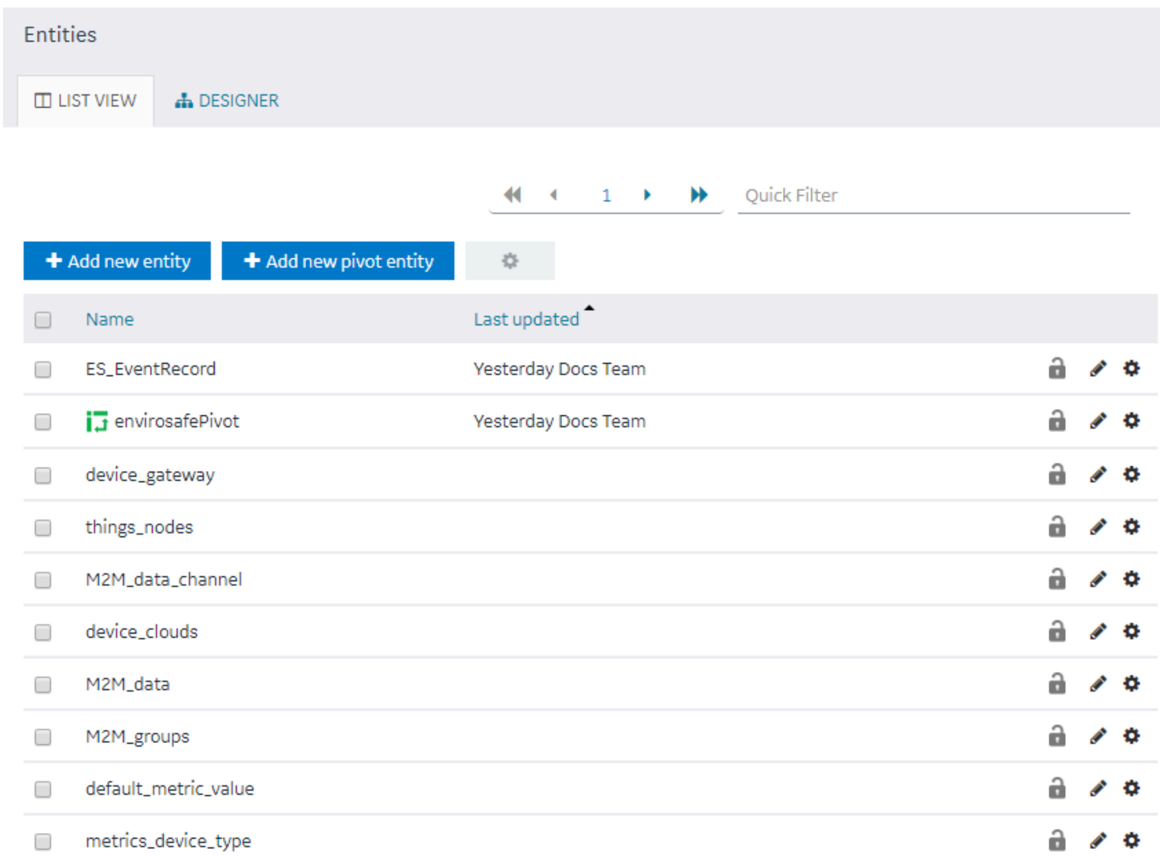
    The data is imported.

Create a Relationship Between Entities

You cannot use a baseline entity or a pivot entity as a source entity. You can, however, use it as a target entity.

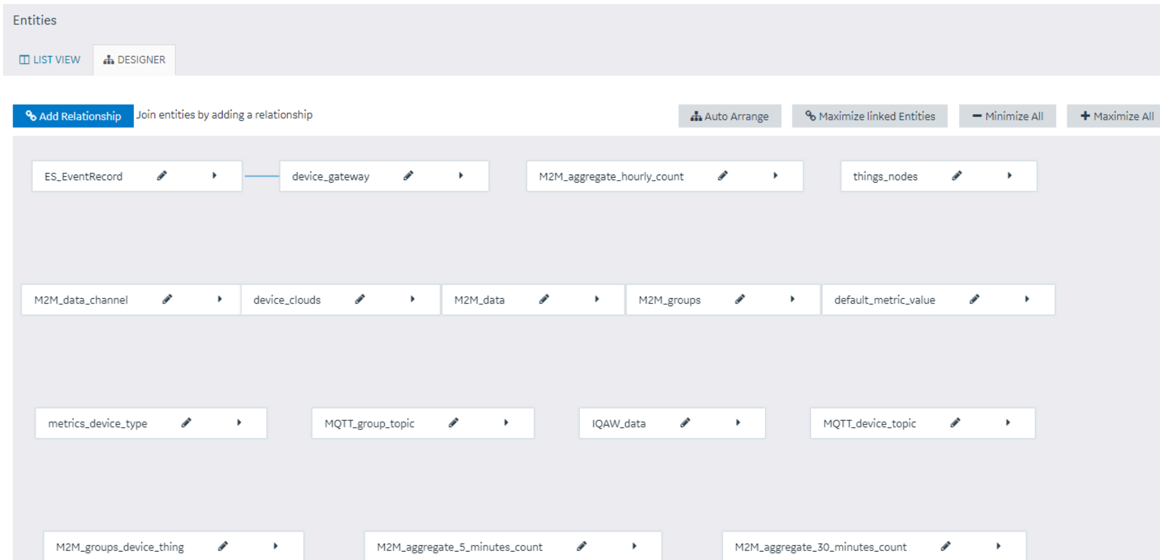
1. In the main navigation menu, select **ENTITIES**.

   The **ENTITIES** workspace appears.



2. **Optional:** Select the check boxes of the entities for which you want to create a relationship.
3. Select **DESIGNER**.

The **DESIGNER** section appears, displaying all the entities created in the site. If, however, you have selected entities in the previous step, only the selected entities appear. If a relationship exists between two entities, a line connecting them appears.

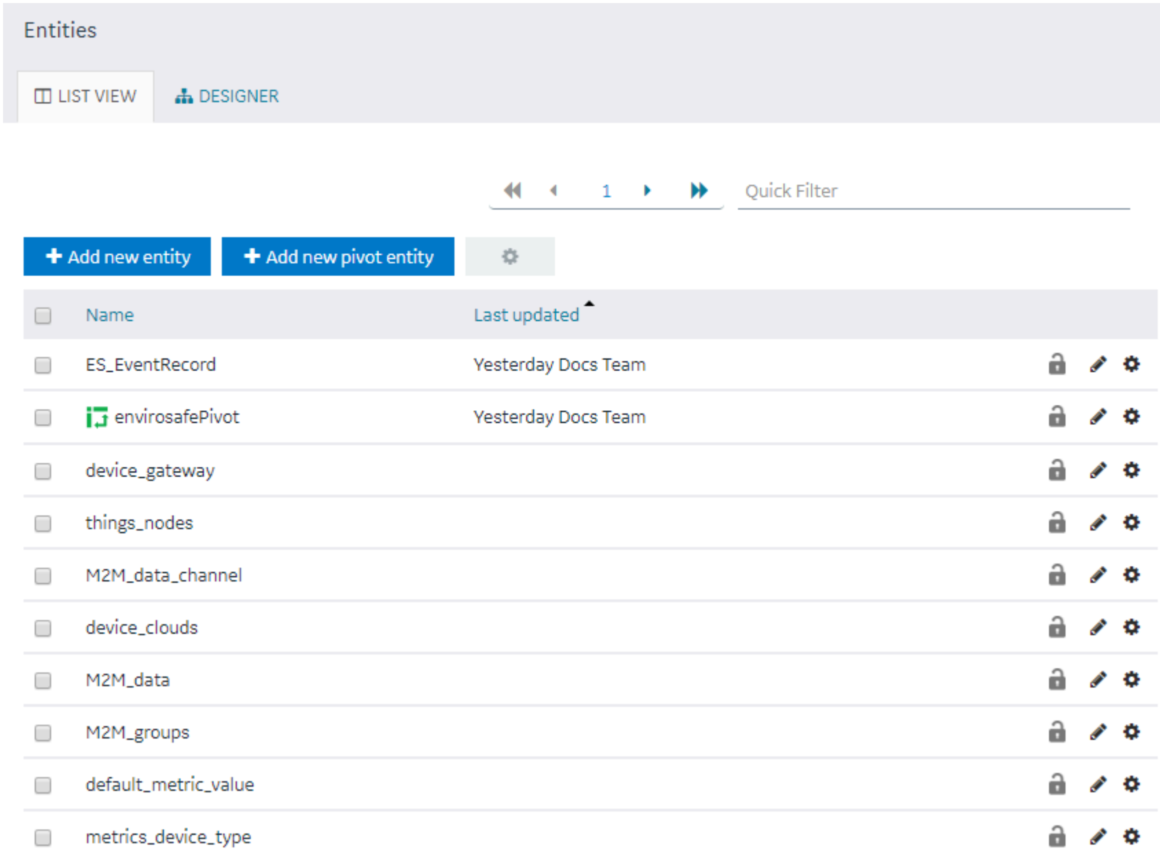


> **Tip:**
> You can arrange the entities in an order, minimize all entities, maximize all entities, or maximize only the entities in a relationship by selecting **Auto Arrange**, **Minimize All**, **Maximize All**, or **Maximize linked Entities** respectively.

4. Next to each entity for which you want to create a relationship, select .
   A list of fields in each entity appears.
5. Select **Add Relationship**, and then select a field from the source entity and then the target entity.
   A relationship is created between the entities. A line connecting both the entities appears.

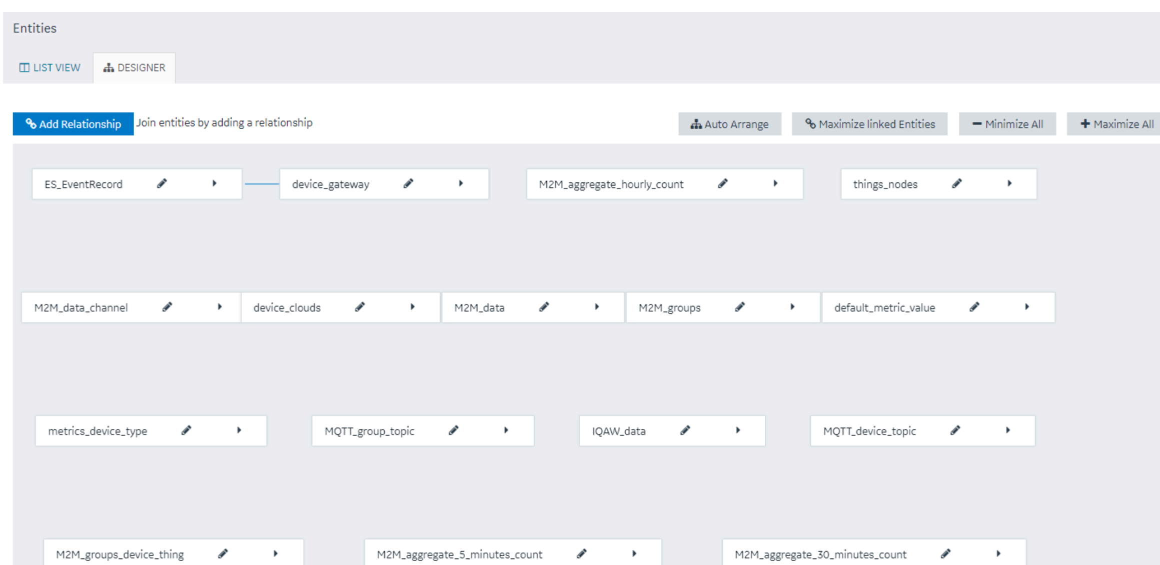
Delete a Relationship

1. In the main navigation menu, select **ENTITIES**.
   The **ENTITIES** workspace appears.



2. Select **DESIGNER**.

   The **DESIGNER** section appears, displaying all the entities created in the site. If a relationship exists between two entities, a line connecting them appears.

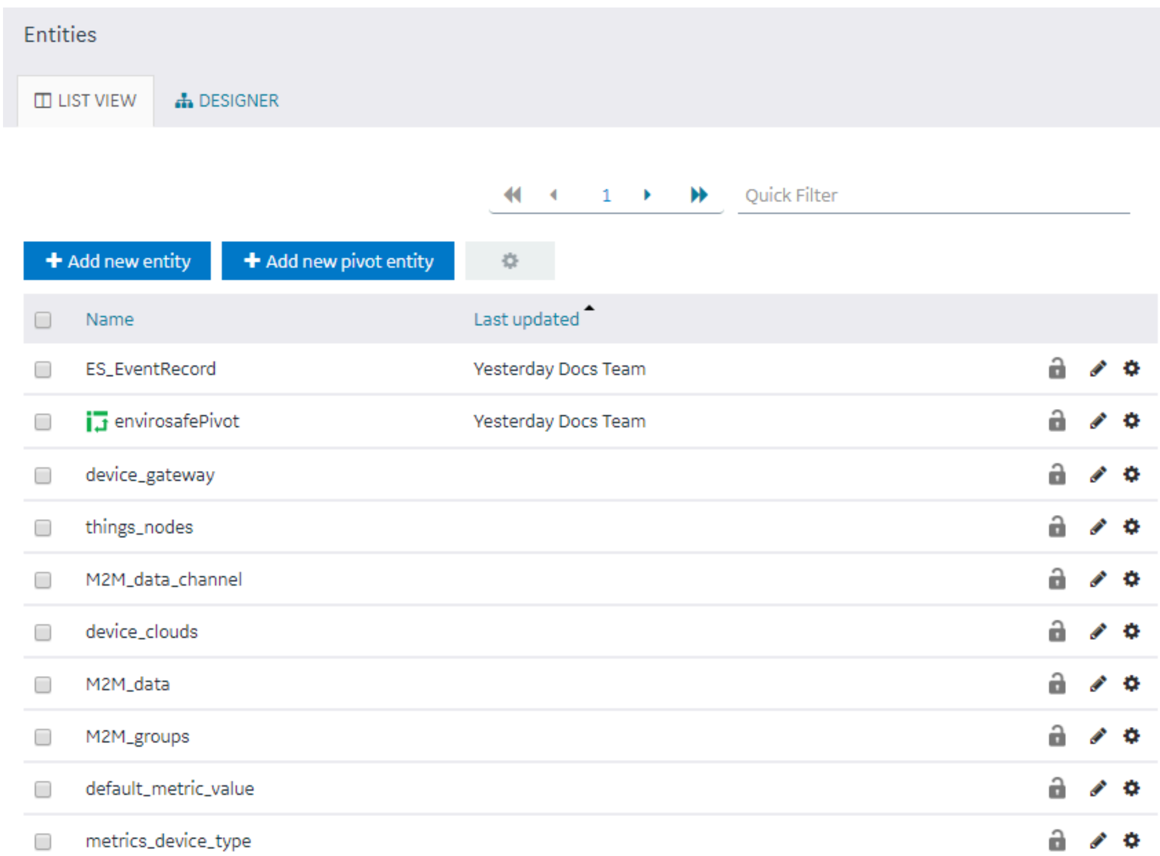


3. On the line connecting the two entities whose relationship you want to delete, select ✖.
   A message appears, asking you to confirm that you want to delete the relationship.
4. Select **OK**.
   The relationship is deleted.

Delete a Row from an Entity

You cannot delete a row manually from a baseline entity or a pivot entity; you can delete rows only using a query in an application.

1. In the main navigation menu, select **ENTITIES**.
   The **ENTITIES** workspace appears.

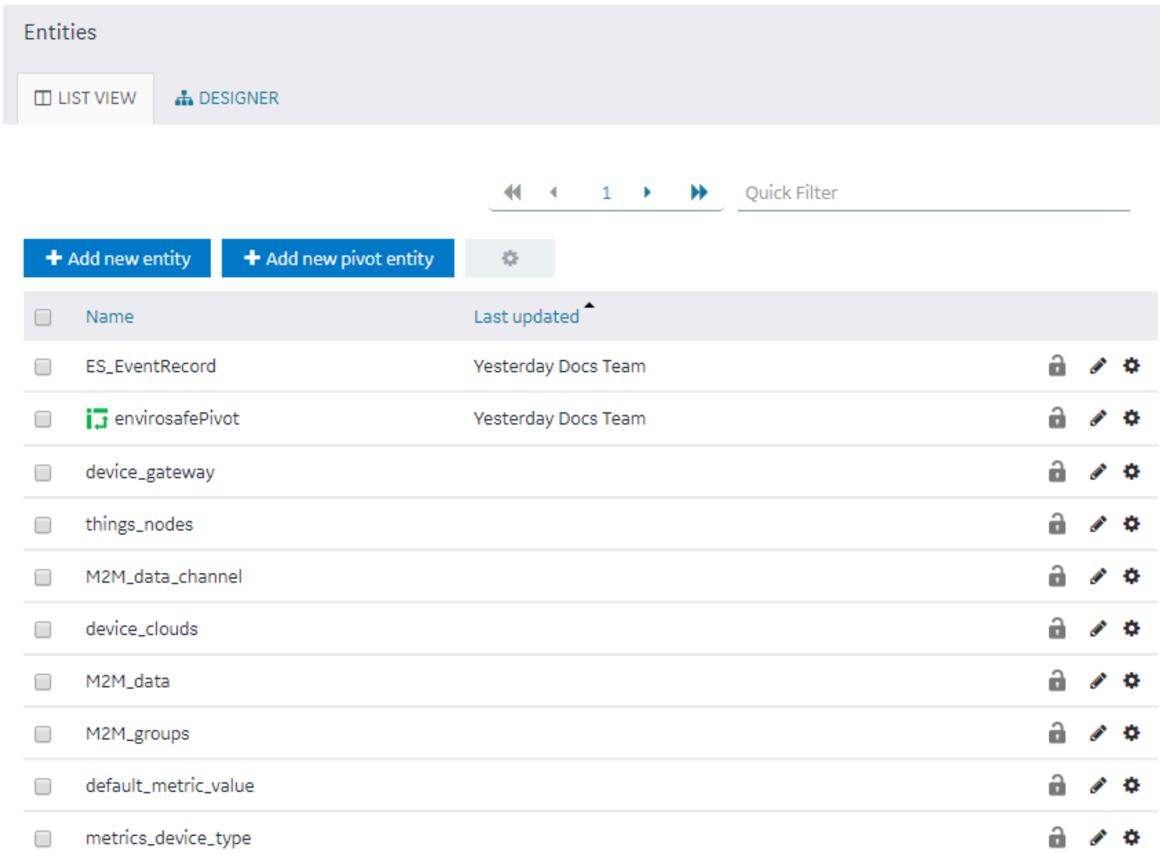


2. Select the entity from which you want to delete a row.
3. In the row that you want to delete, select 🗑 .
   A message appears, asking you to confirm that you want to delete the row.
4. Select **OK**.
   The row is deleted.

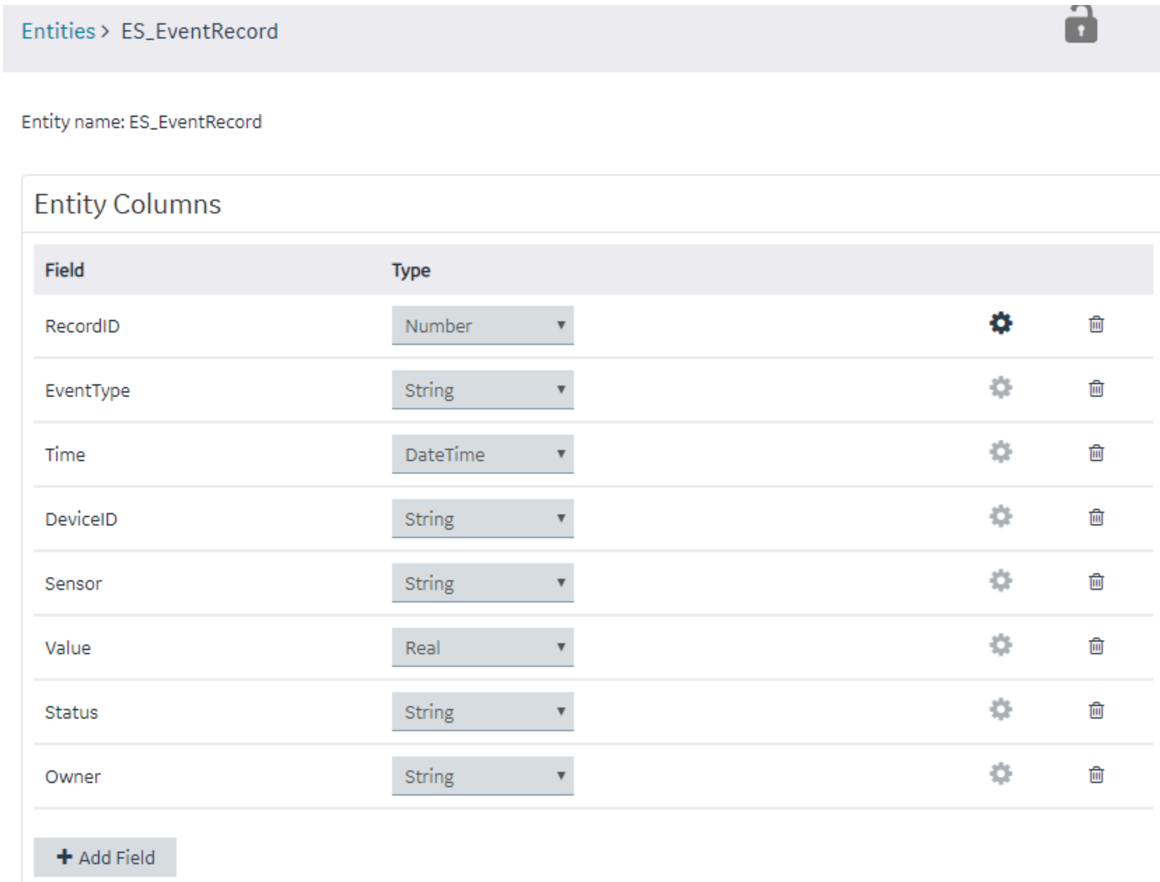
Delete a Field

An entity must contain at least one field. Therefore, if an entity contains only one field, you cannot delete it.

1. In the main navigation menu, select **ENTITIES**.
   The **ENTITIES** workspace appears.



2. Select the entity from which you want to delete a field.
3. Select **Edit Entity Structure**.
   A list of fields in the entity appears.



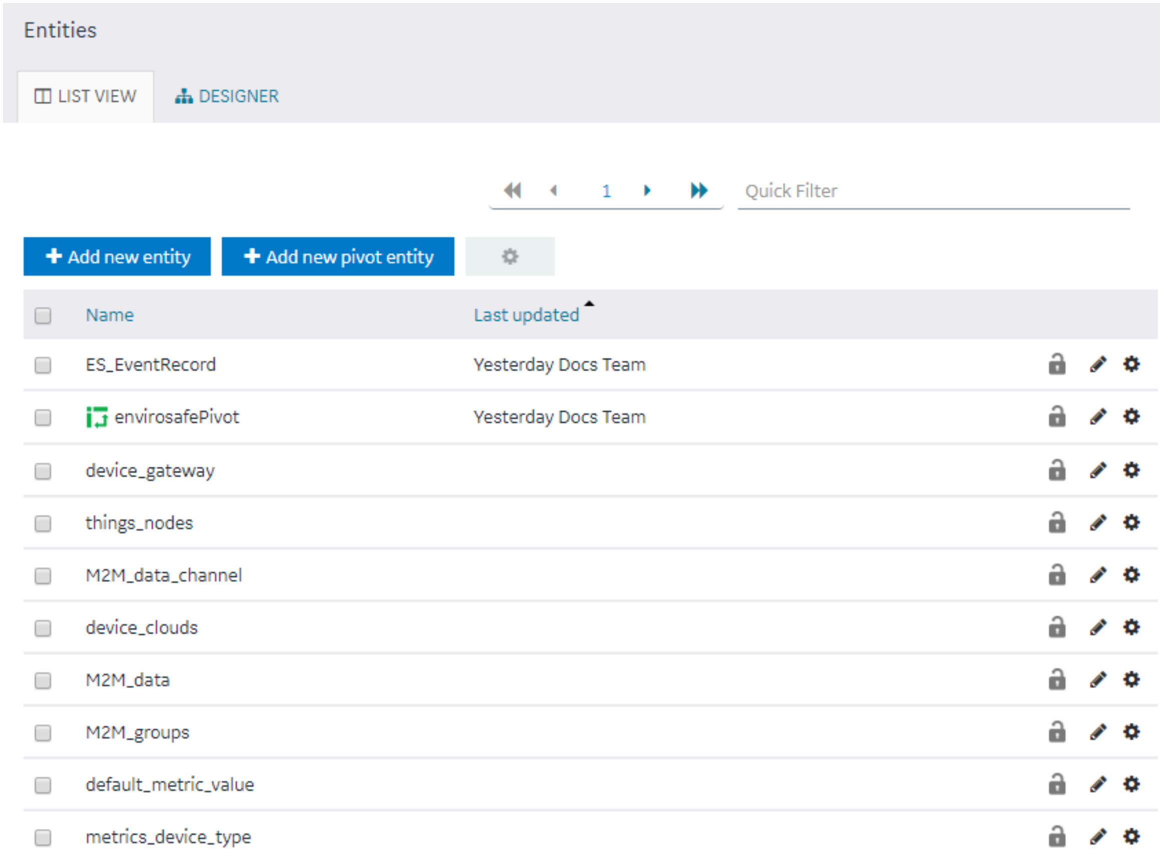
4. In the row containing the field that you want to delete, select .
   The field is deleted.

Delete an Entity

You cannot delete a baseline entity, an entity that is locked, or an entity that is used in a query.

> **Note:**
> In order to unlock an entity, you need to select the entity, click Edit Entity Structure, and then click the lock icon (in the upper right corner) of the Edit Entity Structure page. After you complete that task, you can go to entity list page to delete it.

1. In the main navigation menu, select **ENTITIES**.
   The **ENTITIES** workspace appears.



2. In the rows containing the entities that you want to delete, select the check boxes.
3. In the workspace heading, select , and then select **Delete entities**.

   A message appears, asking you to confirm that you want to delete the entities.

> **Tip:**
>
> Alternatively, in the row containing each entity that you want to delete, select , and then select **Delete entity**.

4. Select **OK**.

   The entities are deleted.

Queries

About Queries

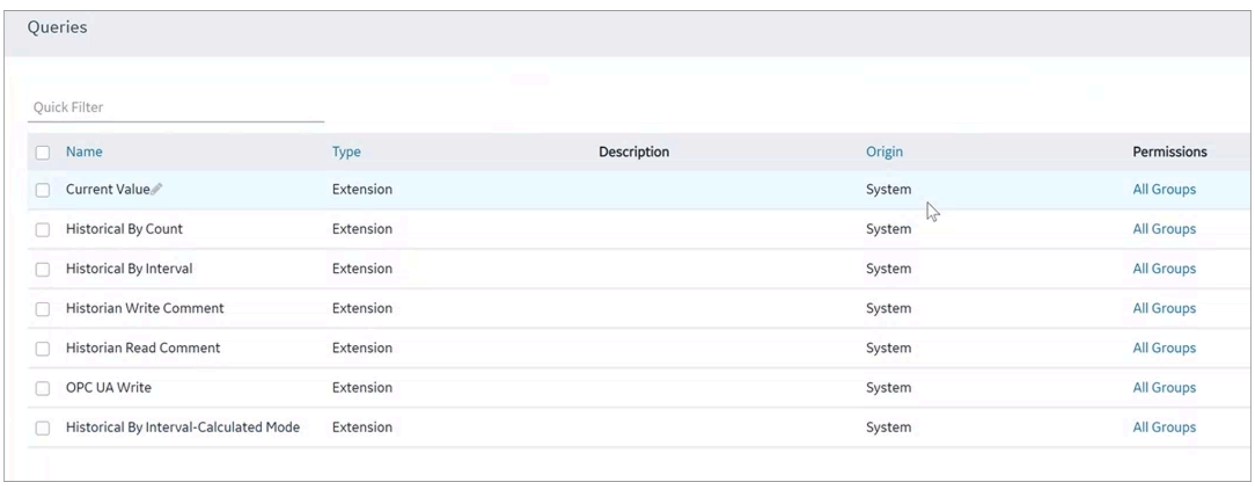
Using Operations Hub, you can create queries to access and manage data stored in Operations Hub, as well as data stored externally.

You can create the following types of queries:

- Entity Queries: Used to view and modify data stored in Operations Hub entities. Refer to Get *(on page 182)*, Update *(on page 190)*, Insert *(on page 195)*, and Delete *(on page 197)*.
- SQL *(on page 201)* Queries: Used to view and modify data stored in an external SQL database by executing existing stored procedures for that database.
- REST *(on page 204)* Queries: Used to view and modify data stored in external sources by accessing their exposed REST APIs, such as Historian.
- Extension *(on page 209)* Queries: Can be used with Historian, OPC UA, and data from asset models.

On installing Operations Hub, you also get a list of out-of-the-box (OOTB) queries for use. These are system queries and cannot be unlocked, modified, or deleted. You can duplicate such queries *(on page 214)* to modify and use them.

To access the list of OOTB queries, select **QUERIES** in the main navigation menu.



- **Current Value**: Use this query to retrieve the current values against Proficy Historian, Proficy iFIX, Proficy CIMPLICITY, and OPC UA data sources.
- **Historical By Count**: Use this query to retrieve historical values (by count) against a Proficy Historian data source.
- **Historical By Interval**: Use this query to retrieve historical values (by interval) against a Proficy Historian data source.
- **Historian Write Comment**: Use this query to write comments to a Proficy Historian data source.
- **Historian Read Comment**: Use this query to read comments from a Proficy Historian data source.
- **OPC UA Write**: Use this query to perform write operations to Proficy iFIX and Proficy CIMPLICITY data sources.
- **Historical By Interval-Calculated Mode**: Use this query to retrieve historical values (calculated mode) against a Proficy Historian data source.
- **OPC UA Write with Auth**: Use this query to perform OPC UA write operations with authentication.

To troubleshoot errors returned for OOTB queries, refer to Error Codes *(on page 616)*.

Grant Group Access to Execute a Query

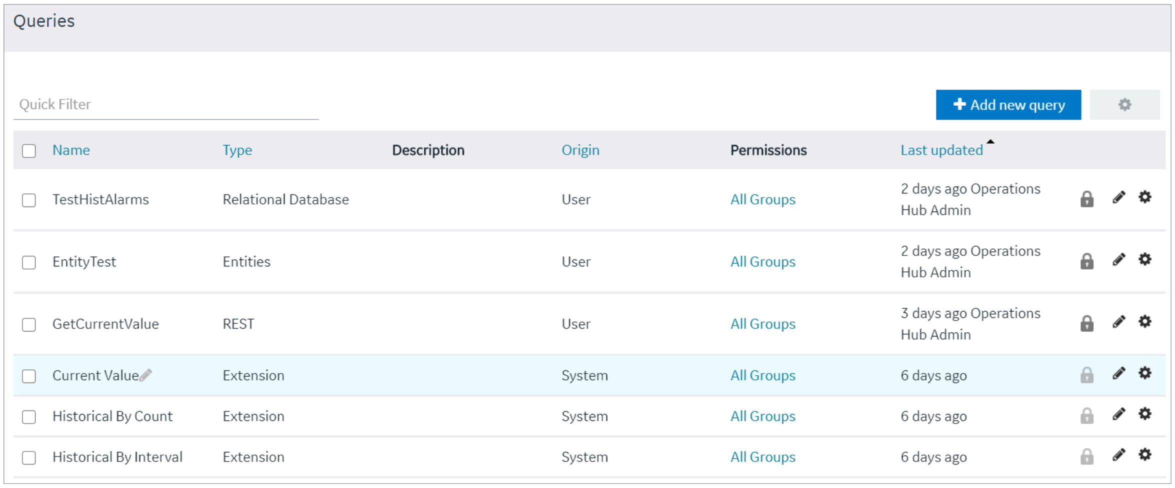
1. In the main navigation menu, select **QUERIES**.
   The **QUERIES** workspace appears, including a column summarizing the current query permissions. By default, newly created queries display “All users”, indicating all users have the ability to execute the query.
2. In the **Permissions** column, select the query to which you want to grant query execution permissions.
   The Query Permissions dialog box appears.
3. In the **Query Permissions** dialog box, if you want to grant query execution permissions to select groups only, select the “Selected Groups” option.
4. In the groups field, select the group or groups you would like to grant query execution permissions to and then select **Submit changes**.
   The selected groups can now execute the query.

> **Note:**
> It is possible to create a circular reference by nesting a parent group into its child. If there are circular references, the child groups will not display in the permissions dialog box.

Access a Query

1. In the main navigation menu, select **QUERIES**.

   The **QUERIES** workspace appears.

2. In the row containing the query that you want to access, in the **Name** column, select the link.

   The query appears, displaying a list of fields in the query.

   Tip:
   You can modify values in the available fields, and then select **Save** or **Save and Exit** to save your changes.

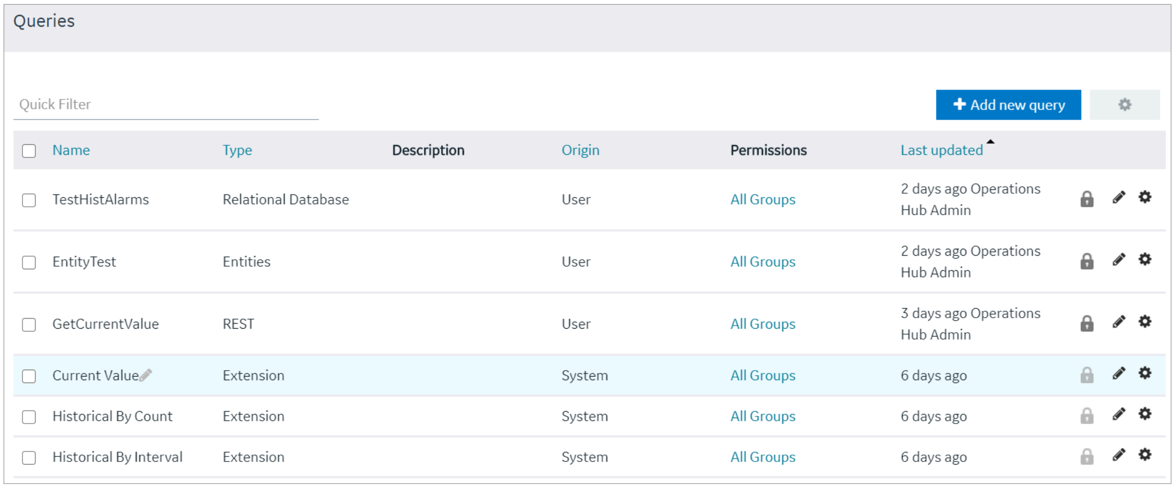
Create Get Query

This topic describes how to create a Get query.

Follow the steps to create a Get query. You can also copy a query *(on page 214)*.

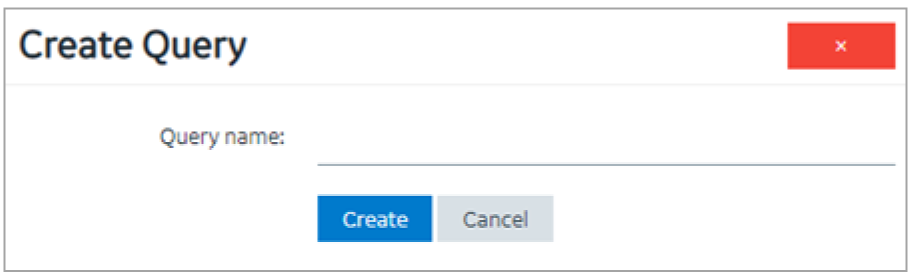
1. In the main navigation menu, select **QUERIES**.

   The **QUERIES** workspace appears.



2. Select **+Add new query**.

   The **Create Query** screen appears.

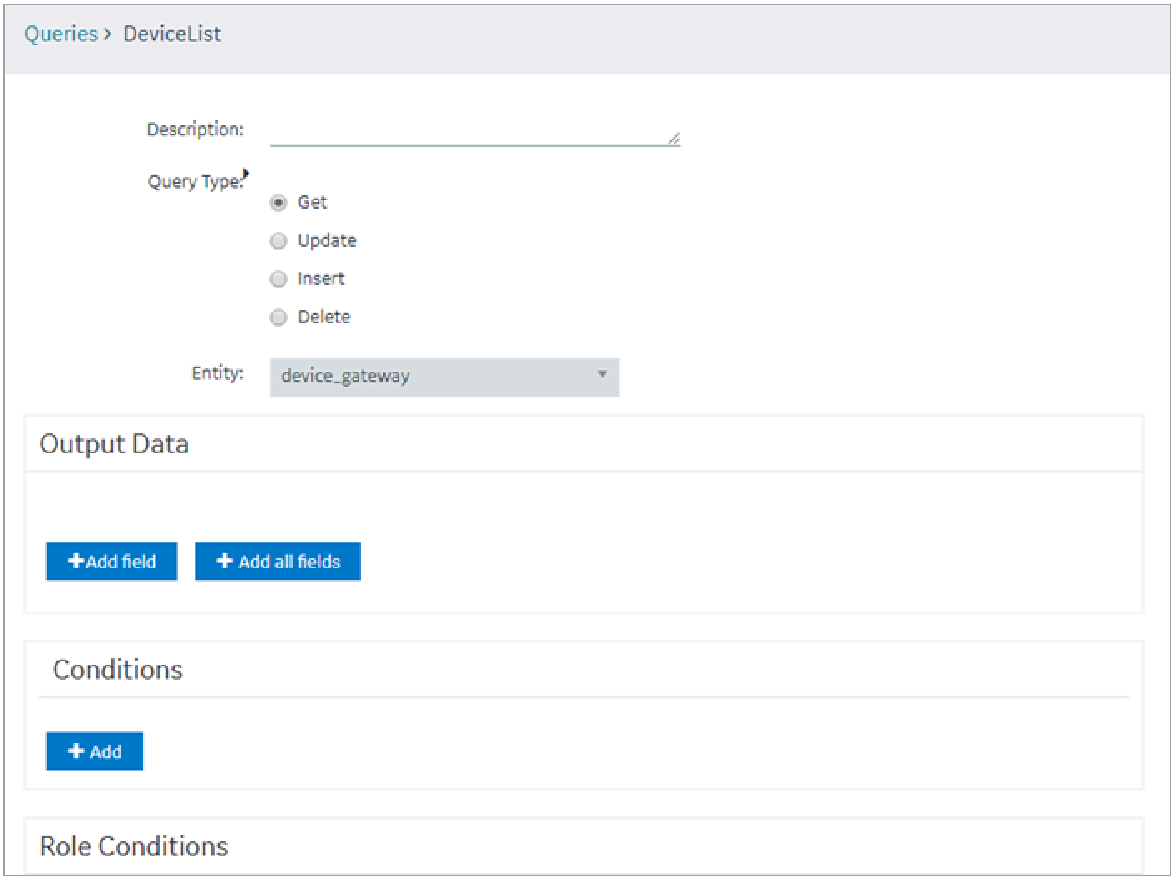


3. Enter a **Query name**, and select **Create**.

   The name must contain at least one uppercase or lowercase letter.

   The available options for creating the query appear.
4. Enter a **Description** for the query.
5. Select **Get** as **Query Type**.
6. From the **Entity** box, select an entity from which you want to get results.

   The **Output Data**, **Conditions**, **Role Conditions**, and **Advanced** sections appear.



7. Under **Output Data** section, select **+Add field**.

   The **FIELD**, **FUNCTION**, and **ACCESS** boxes appear.

> **Tip:**
> If you want to get values from all the fields in the query, select **+Add all fields**.

8. Enter or select values as specified in the following table.

Field	Description
FIELD	Select the field whose values you want to get using the query. **Tip:** If the entity that you have specified in the **Entity** box is a source entity in a re-

Field	Description
	lationship, you can select from fields in the source and target entities.
FUNCTION	Specify whether you want to get the maximum, minimum, average, sum, or count of the values in the field. By default, the value in this box is **None**, which indicates that the exact values will appear in the query results.
ACCESS	If you want to provide access to the data in the field only to users assigned to specific roles, select **Permitted roles**. By default, this box contains the value **All users**, which indicates that all users, regardless of the roles assigned to them, can access the query results. In the **PERMITTED ROLES** box that appears, navigate through the hierarchy of roles, and then select the roles assigned to users who can access the data in this field.

9. In the **Conditions** section, select **+Add**, and then enter or select values as specified in the following table.

Field	Description
Required or Optional	Select one of the following values: ◦ **Required**: Select this value if the field must always contain a value. For example, suppose you are creating a query to display account details based on the account number. If you select **Required**, when you run the query, if you have not specified an account number, no records appear. ◦ **Optional**: Select this value if the field need not contain a value. For example, suppose you are creating a query to display account details based on the ac-

Field	Description
	count number. If you select **Optional**, when you run the query, if you have not specified an account number, all the records appear.
Field	Select the entity field based on which you want to create a condition.
Operator	Select the conditional operator that you want to use to compare the value in the selected field.
Compare with	Select one of the following values: ◦ **Input field**: Select this value if you want to allow application users to specify a value that you want to compare with the entity field value. After you select this value, enter a name for the input field in the text box that appears. For example, suppose you want to create a query to display a list of devices in a specific site, and you want to allow the user to specify the site name. In this case: a. Select **Input field**, and then enter Site Name. b. Modify the page in the application that contains the query to include an input component that allows the user to enter or select the site name. c. Map the input component in the page with the input in the **Page Data** section. When the user enters a value in the **Site Name** field in the application, the query results are filtered accordingly.

Field	Description
	◦ **Fixed Value**: Select this value if you want to specify the value that you want to compare with the entity field value. After you select this value, enter a value in the text box that appears. For example, if you want to get data received from a device if the temperature exceeds 40 degrees Celsius: ▪ In the **Field** box, select the field that stores temperature. ▪ In the **Operator** box, select >. ▪ Select **Fixed Value**, and then enter 40 in the text box. ◦ **Query**: Select this value to specify a query whose output you want to compare with the field values in the specified entity. After you select this value, a drop-down list box appears in which you can select a query. For example, if there is a query that returns the maximum temperature recorded by a device, you can create a query to get a list of devices that record a temperature higher than the maximum temperature.

10. In the **Role Conditions** section, select **Add role condition**, and then enter or select values as specified in the following table.

Field	Description
Apply conditions to	Select one of the following values: ◦ **Specific Roles**: Select this value if you want to apply the condition only to users assigned to specific roles. After you select this value, navigate through the hierarchy of roles, and select the roles.

Field	Description
	◦ **All roles**: Select this value if you want to apply the condition to all or most users. After you select this value, the **Exclude** check box appears. Select this check box if you do not want to apply the condition to users assigned to specific roles. After you select this check box, navigate through the hierarchy of roles, and select the roles. For example, suppose the query returns sales data, and you want to apply the following conditions on who can access the query results: ▪ Users can access only the data that is related to their region. ▪ Regional officers can access data related to all regions. In this case, select the **Exclude** check box, and then select the Regional Officer role.
Row visibility	Select one of the following values: ◦ **Filter rows**: Select this value if you want to filter rows based on a condition, and then specify the condition in the **Entity field** and **In user's role tree** boxes. For example, if the query returns sales data, and you want users to access only the data that is related to their region, then:

Field	Description
	▪ In the **Entity field** box, select the entity field that stores the sales region data. ▪ In the **In user's role tree** box, select the category that stores the region roles. ◦ **Show all rows**: Select this value if you want users belonging to specific roles to access all the field values.
Entity field	This field appears only if the value in **Row visibility** is **Filter rows**. Select the entity field that contains the value that you want to compare with the value in **In user's role tree**.
In user's role tree	Select the group or category of users that will be used to filter data. This box appears only if the value in the **Row visibility** box is **Filter rows**.

11. In the **Advanced** section, enter or select values as specified in the following table:

Field	Description
Distinct	Select this check box if you do not want the query results to display duplicate field values. For example, suppose a query returns a list of countries that users belong to, and you want to view only the list of countries, you can select this check box so that each country appears only once.
Order By	Select **Add**, and then select the entity field and the order in which the field values should be arranged in the query results.
Group By	Select **Add**, and then select the entity field that you want to use to group the query results.

If the query results contain a list of users and the country that each user belongs to, and if you want to group the users based on their country and sort them alphabetically, perform the following steps:

a. From **Order By**, select the entity field that stores the user name, and then select **Asc**.
b. From **Group By**, select the entity field that stores the country.

12. Select **Save** or **Save And Exit**.

The query is created.

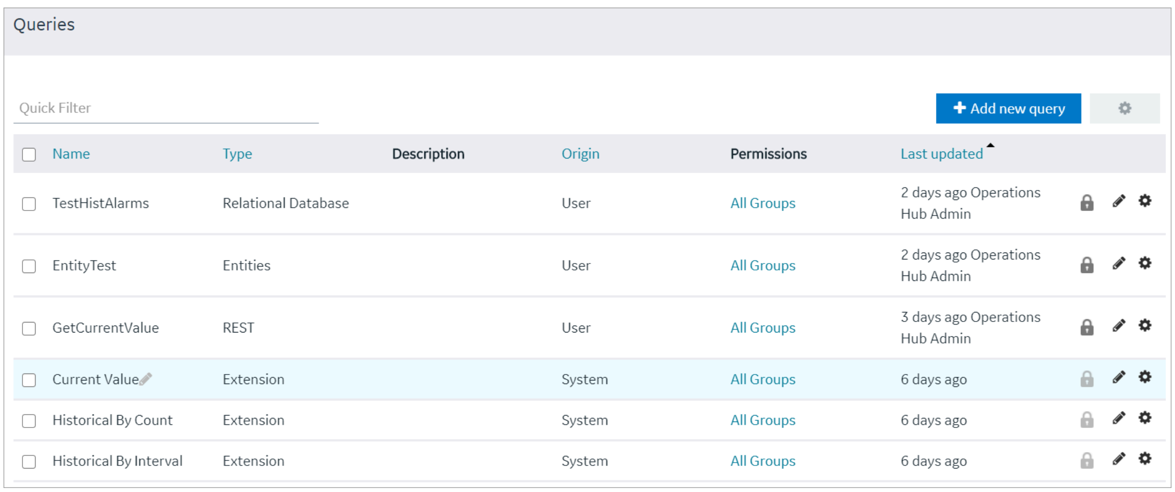
Create Update Query

This topic describes how to create an Update query.

Follow the steps to create an Update query. You can also copy a query *(on page 214)*.

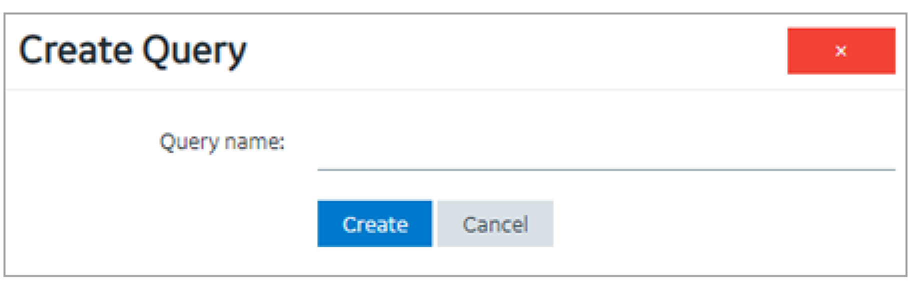
1. In the main navigation menu, select **QUERIES**.

The **QUERIES** workspace appears.

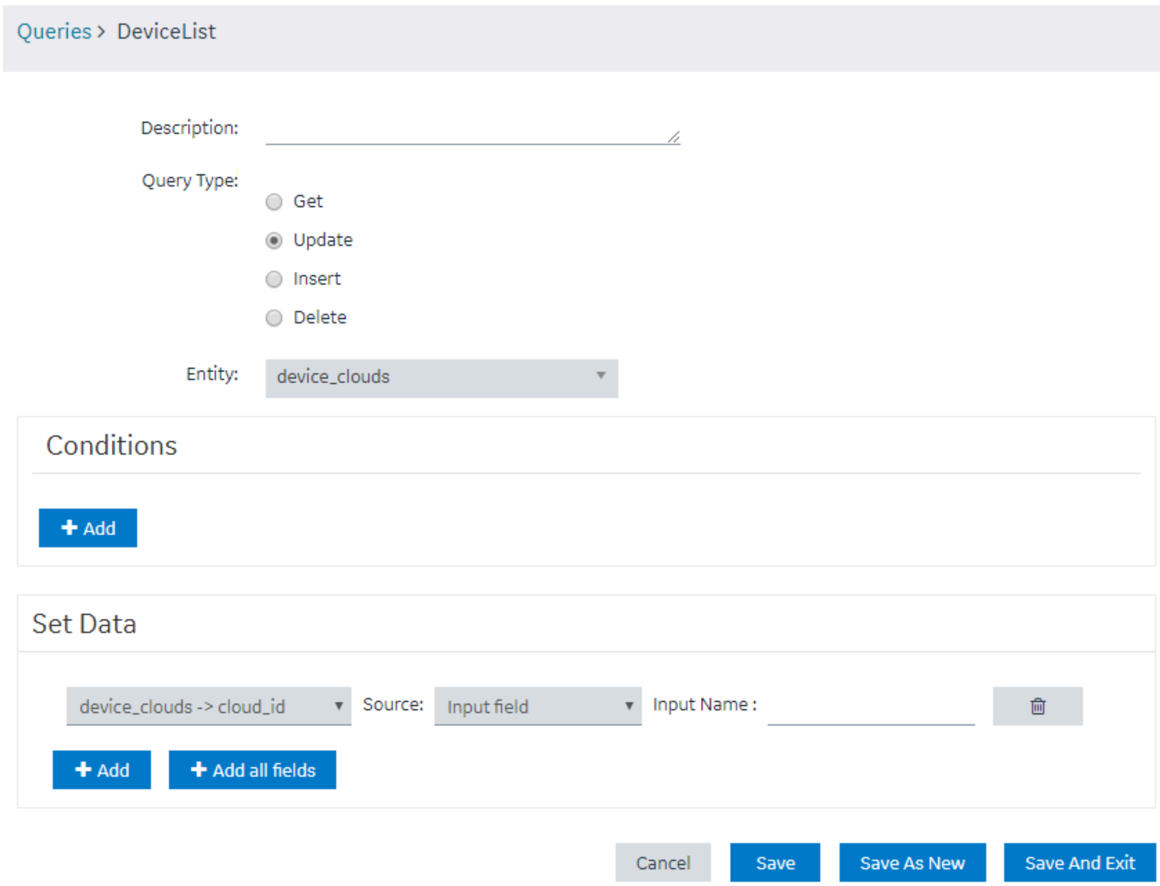


2. Select **Add new query**.

The **Create Query** window appears.



3. In the **Query name** box, enter a name, and then select **Create**. The name must contain at least one uppercase or lowercase letter.
   The available options for creating the query appear.
4. In the **Description** box, enter a value.
5. In the **Query Type** box, select **Update**.
6. In the **Entity** box, select an entity from which you want to update results.
   The **Conditions** and **Set Data** sections appear.



7. In the **Conditions** section, select **Add**, and then enter or select values as specified in the following table.

Field	Description
Entity Field	Select one of the following values: ◦ **Required**: Select this value if the field must always contain a value. For example, suppose you are creating a query to update account details based on the ac-

Field	Description
	count number. If you select **Required**, when the query is run from an application, if an account number is not specified, then a message appears, stating that the field is required. ◦ **Optional**: Select this value if the field need not contain a value. For example, suppose you are creating a query to update account details based on the account number. If you select **Optional**, when the query is run from an application, if an account number is not specified, then all the fields will be updated. Therefore, use caution when selecting this value. **Important:** Exercise extreme caution while selecting **Optional**. If used incorrectly, it can corrupt the data.
Field	Select the entity field based on which you want to create a condition.
Operator	Select the operator that you want to use to compare the value in the text box if **Input Field** is selected.
Compare with	Select one of the following values: ◦ **Input field**: Select this value if you want to allow application users to specify a value that you want to compare with the entity field value. After you select this value, enter a name for the input field in the text box that appears. For example, suppose you want to create a query to update all devices in a specific site, and

Field	Description
	you want to allow the user to specify the site name. In this case: a. Select **Input Type**, and then enter Site Name. b. Modify the page in the application that contains the query to include the query to add an input control that allows the user to specify or select the **Site Name** field. Using the drag-and-drop method, map the **Site Name** field in the query with the site name control. When the user enters or selects a value in the **Site Name** field in the application, and runs the query, all the devices with the selected site name are updated. ◦ **Fixed Value**: Select this value if you want to specify the value that you want to compare with the entity field value. After you select this value, enter a value in the text box that appears. For example, if you want to update the status of all devices if the temperature exceeds 40 degrees Celsius: ▪ In the **Field** box, select the field that stores temperature. ▪ In the **Operator** box, select >. ▪ Select **Fixed Value**, and then enter 40 in the text box. ◦ **Query**: Select this value to specify a query whose output you want to compare with the field values in the specified entity. After you select this value, a drop-down list box appears in which you can

Field	Description
	select a query. For example, if you want the query to update the status of devices when the temperature recorded by them exceeds a specified maximum temperature, you must create a query to get the maximum temperature, and select that query in this field.

8. In the **Set Data** section, select **Add**, and then enter or select values as described in the following table.

Field	Description
Entity field	Select the entity field whose values you want to update using the query.
Value	Select one of the following values: ◦ **Input field**: Select this value if you want to update values specified by application users, and then enter a name in the **Input Data Name** box. Add an input control for the field in the application, and map it to the input field in the query. ◦ **Fixed value**: Select this value if you want to insert a fixed value, and then enter the value in the **Name** box.
Input Data Name	This field appears only if you select **Input field** in the **Value** box. Enter the name of the field that you will add in the application. Application users can then provide the value by accessing the application.
Name	This field appears only if you select **Fixed value** in the **Value** box. Enter the value that you want to update using the query.

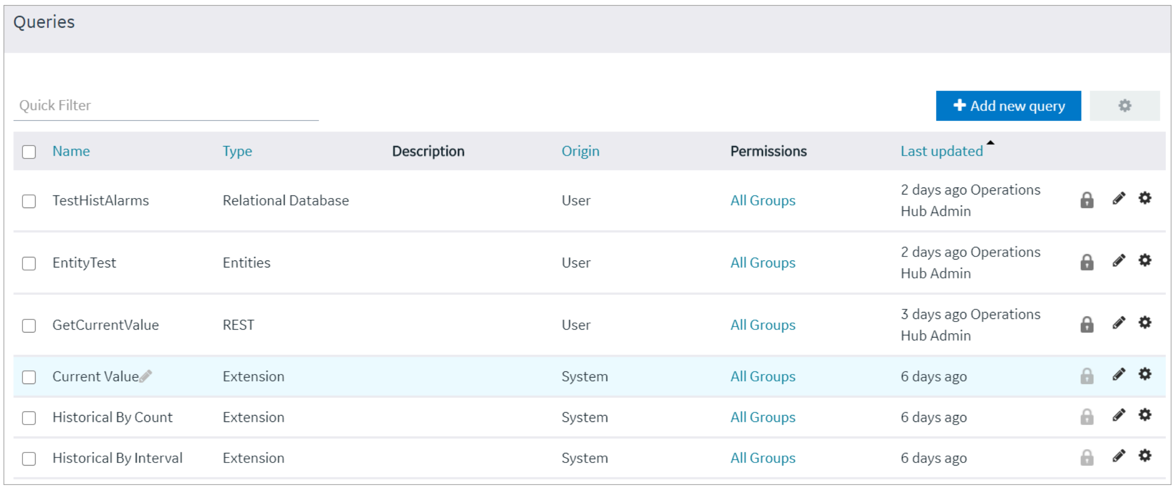
9. Select **Save** or **Save And Exit**.
   The query is created.

Create Insert Query

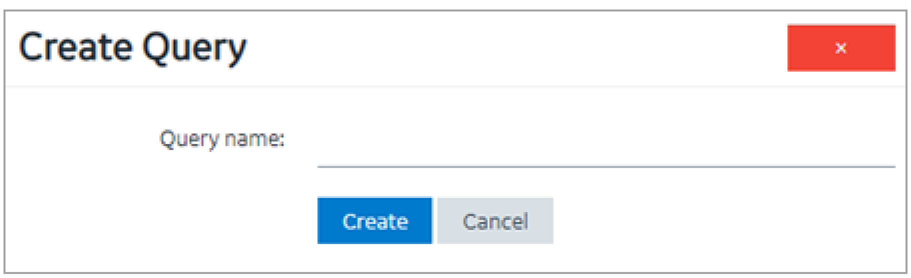
This topic describes how to create an Insert query.

Follow the steps to create an Insert query. You can also copy a query *(on page 214)*.

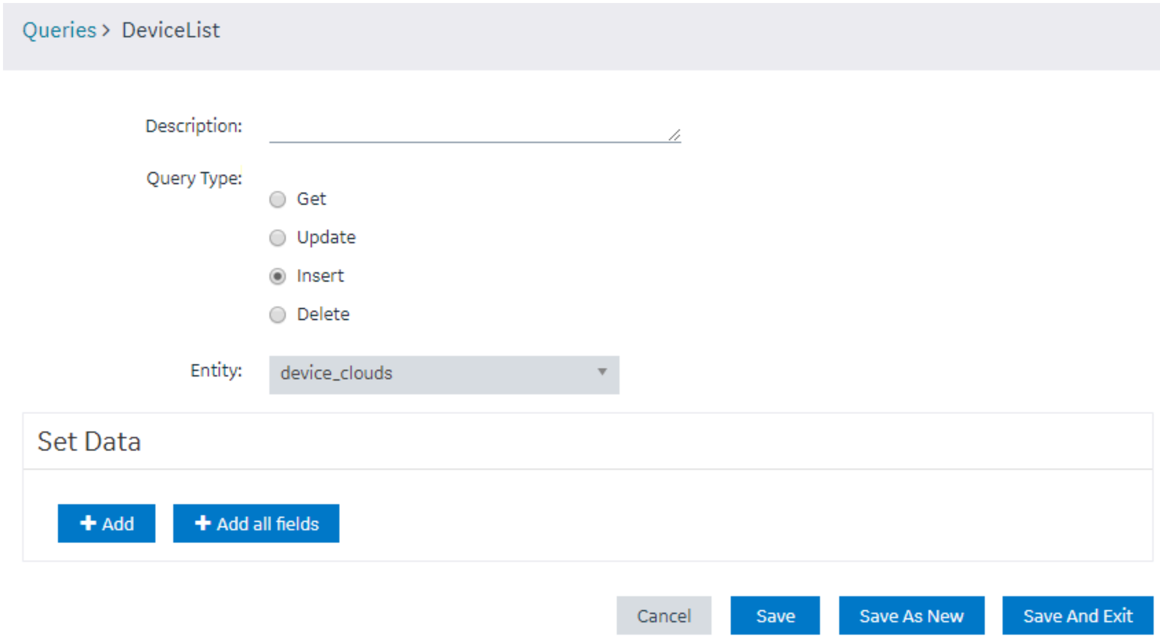
1. In the main navigation menu, select **QUERIES**.
   The **QUERIES** workspace appears.



2. Select **Add new query**.
   The **Create Query** window appears.



3. In the **Query name** box, enter a name, and then select **Create**. The name must contain at least one uppercase or lowercase letter.
   The available options for creating the query appear.
4. In the **Description** box, enter a value.
5. In the **Query Type** box, select **Insert**.
6. In the **Entity** box, select an entity in which you want to insert results.
   The **Set Data** section appears.



7. In the **Set Data** section, select **Add**, and then enter or select values as described in the following table.

Field	Description
Entity field	Select the entity field whose values you want to insert using the query.
Value	Select one of the following values: ◦ **Input field**: Select this value if you want to insert values specified by application users, and then enter a name in the **Input Data Name** box. Add an input control for the field in the application and map it to the input field in the query. ◦ **Fixed value**: Select this value if you want to insert a fixed value, and then enter the value in the **Name** box.
Input Data Name	This field appears only if you select **Input field** in the **Value** box. Enter the name of the field that you will add in the application. Application

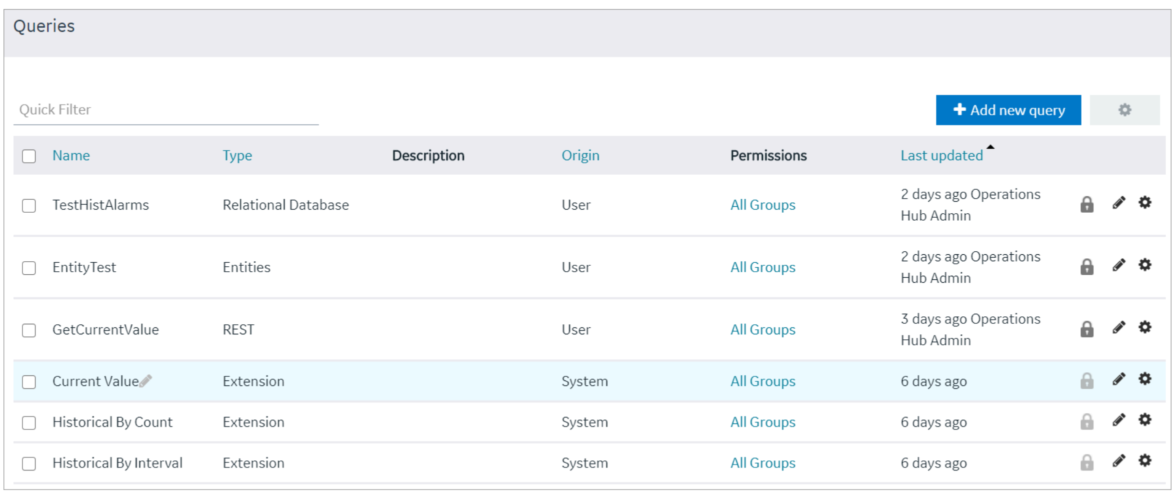
Field	Description
	users can then provide the value by accessing the application.
Name	This field appears only if you select **Fixed value** in the **Value** box. Enter the value that you want to insert using the query.

8. Select **Save** or **Save And Exit**.
   The query is created.

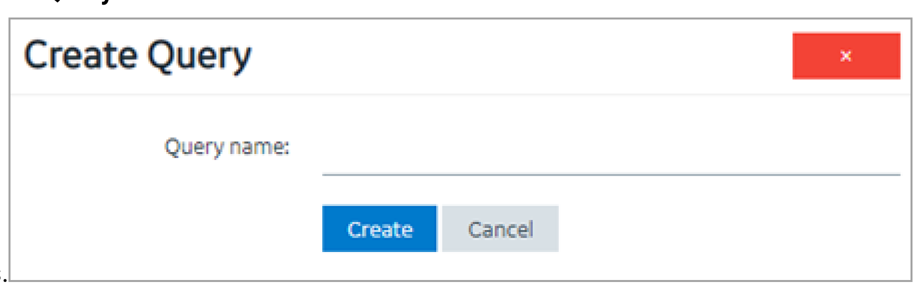
Create Delete Query

This topic describes how to create a Delete query.

1. In the main navigation menu, select **QUERIES**.
   The **QUERIES** workspace appears.



2. Select **Add new query**.
   The **Create Query** window

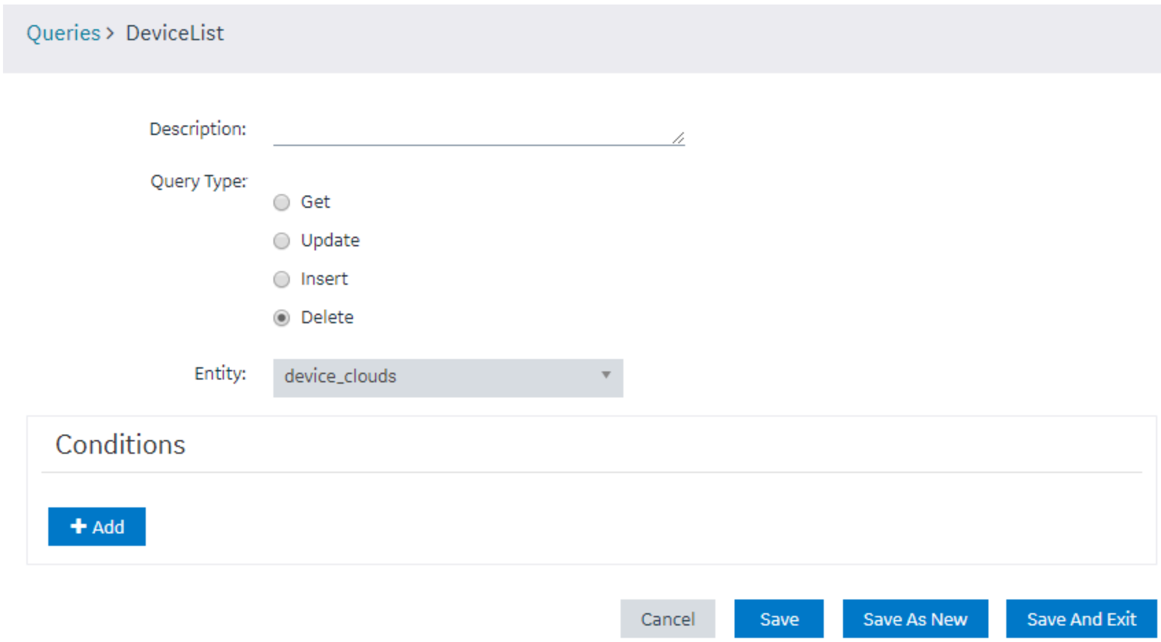


   appears.
3. In the **Query name** box, enter a name, and then select **Create**. The name must contain at least one uppercase or lowercase letter.

The available options for creating the query appear.

4. In the **Description** box, enter a value.
5. In the **Query Type** box, select **Delete**.
6. In the **Entity** box, select an entity from which you want to delete results.

   The **Conditions** section appears.



7. In the **Conditions** section, select **Add**, and then enter or select values as specified in the following table.

Field	Description
Required or Optional	Select one of the following values: ◦ **Required**: Select this value if the field must always contain a value. For example, suppose you are creating a query to delete account details based on the account number. If you select **Required**, when the query is run from an application, if an account number is not specified, a message appears, stating that the field is required. ◦ **Optional**: Select this value if the field need not contain a value. For example,

Field	Description
	suppose you are creating a query to delete account details based on the account number. If you select **Optional**, when the query is run from an application, if an account number is not specified, the all the records are deleted. **Important:** Exercise extreme caution while selecting **Optional** for a delete query. If the user does not specify a value, all the data in the entity will be deleted.
Field	Select the entity field based on which you want to create a condition.
Operator	Select the operator that you want to use to compare the value in the text box if Input field is selected.
Compare with	Select one of the following values: ◦ **Input field**: Select this value if you want to allow application users to specify a value that you want to compare with the entity field value. After you select this value, enter a name for the input field in the text box that appears. For example, suppose you want to create a query to delete devices in a specific site, and you want to allow the user to specify the site name. In this case: a. Select **Input Type**, and then enter Site Name. b. Modify the page in the application that contains the query to add an input control that allows users to

Field	Description
	specify the site name. Using the drag-and-drop method, map the input control in the query with the **Site Name** field. When the user enters a value in the **Site Name** field in the application, and runs the query, all the devices with the specified site name are deleted. ◦ **Fixed Value**: Select this value if you want to specify the value that you want to compare with the entity field value. After you select this value, enter a value in the text box that appears. For example, if you want to delete data received from a device if the temperature exceeds 40 degrees Celsius: ▪ In the **Field** box, select the field that stores temperature. ▪ In the **Operator** box, select >. ▪ Select **Fixed Value**, and then enter 40 in the text box. ◦ **Query**: Select this value to specify a query whose output you want to compare with the field values in the specified entity. After you select this value, a drop-down list box appears in which you can select a query. For example, if there is a query that returns the maximum temperature recorded by a device, you can create a query to delete all the devices that record a temperature higher than the maximum temperature.

8. Select **Save** or **Save And Exit**.

   The query is created.

Create SQL Query

This topic describes how to create a SQL query.

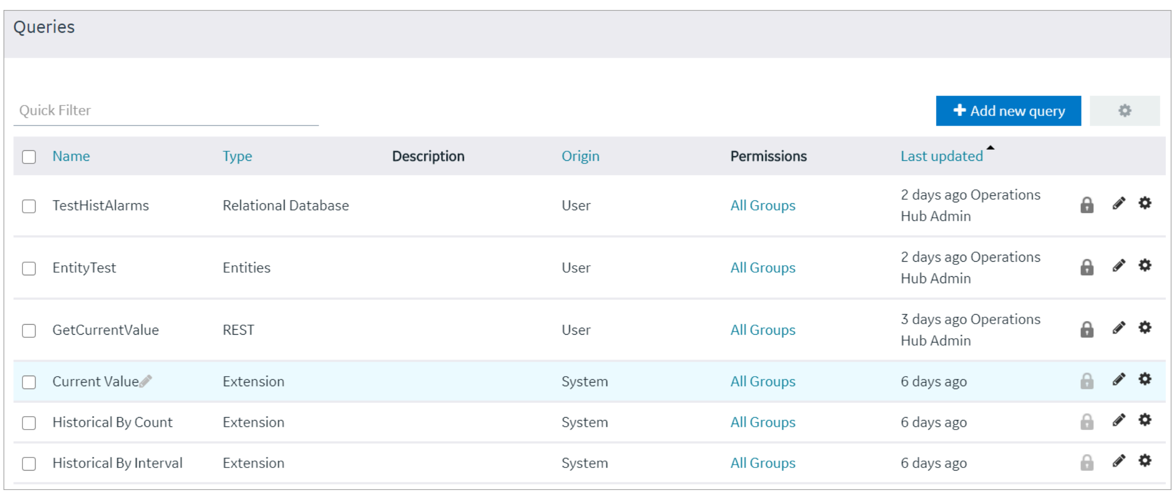
In order to proceed you must have a working SQL database, and the selected database must have stored procedures. You must also have created a data source for the relational database in Operations Hub.

To use a relational database in an Operations Hub application, you must:

- Create a Data Source *(on page 285)* with a Relational Database type and provide the details of the external database.
- Create a SQL Query, and specify the expected inputs and outputs of a Stored Procedure. (Described in this topic in the following steps.)
- Map the query in the page designer to use the query to fetch the data from the external database. See Use the Relational Database Query in the Designer *(on page 102)*.

1. In the main navigation menu, select **QUERIES**.

   The **QUERIES** workspace appears.



2. Select **Add new query**.

   The **Create Query** window appears.
3. In the **Name** field, enter a name, and then select **Create**. The name must contain at least one uppercase or lowercase letter.

   The available options for creating the query appear.
4. In the **Description** field, enter a description for the query.

5. In the **Type** field, select **Relational Database** .
6. In the **Data Source** field, select the name of the data source from the list.
7. In the **Query Type** field, observe that the field defaults to 'Stored Procedure' when you select 'Relational Database' as the Type.
8. In the **Schema** field, select the database schema that you want to use. All the database schemas will be loaded for the selected data source. The default selection is *dbo*.
9. In the **Stored Procedure** field, select the Stored Procedure that you want to use from the selected schema.

   After you selects all the required fields, the list of input parameters will be loaded if there are any, for the selected stored procedure.

   The value for the input parameters can be configured either while creating the query or while consuming the query in the page builder page.

   To assign the value for an input parameter while creating the query, select the type drop-down in the input parameter list. It has two options:

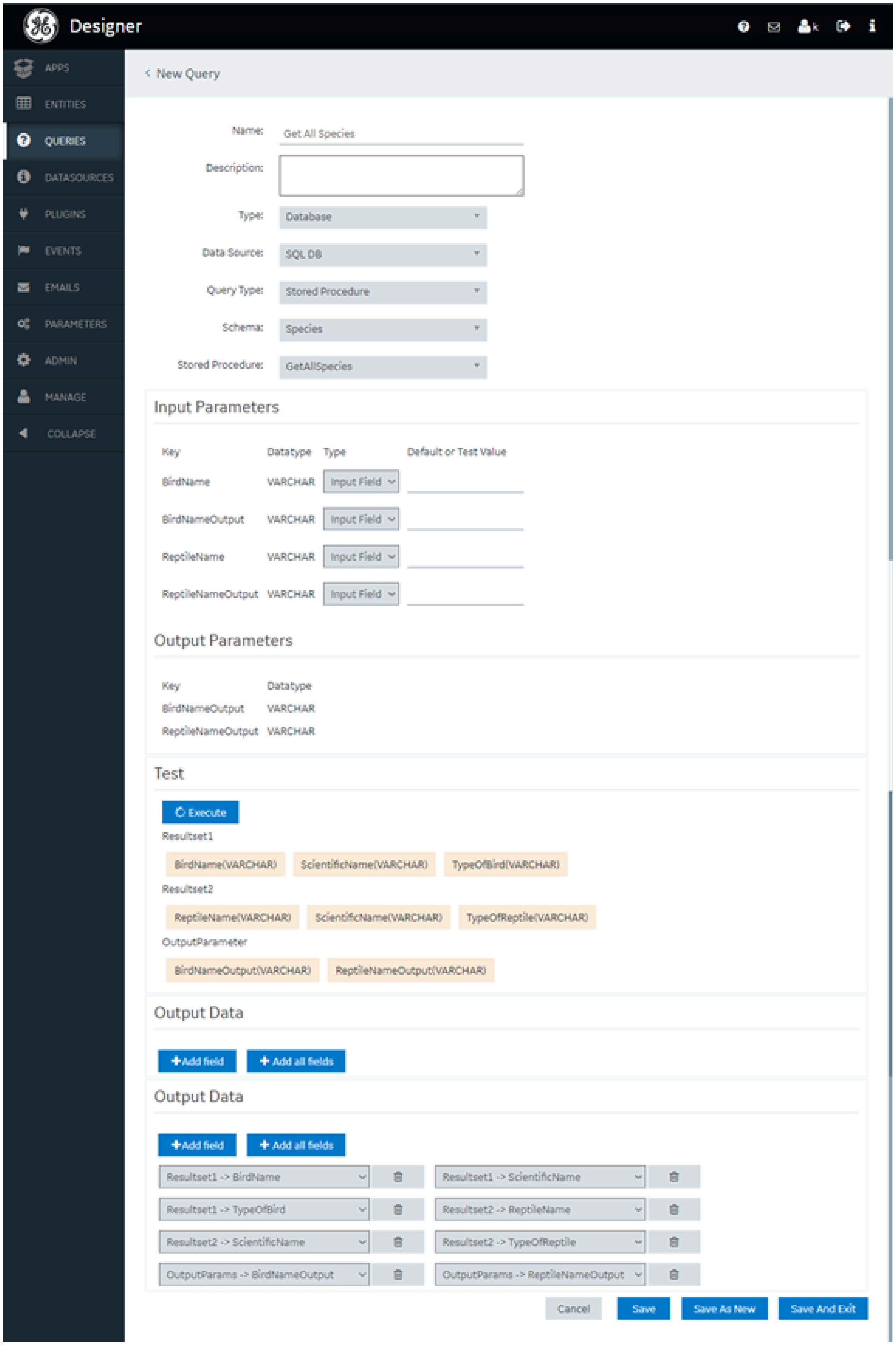
   - Fixed Value: If this option is selected, the value given will be taken as the input to the Stored Procedure. The input parameter will not be shown in the page builder page.
   - Input Field: If this option is selected, the value given will be taken as the default input to the Stored Procedure. The input parameter will be shown in the page builder page and if there is any input provided to while execution, the default value will be overridden.

   After the default values for input parameters are provided, select the **Execute** button under the Test category. You will then be presented with the various fields in Result Sets and Output Parameters sent out of the Stored Procedure.

   > **Note:**
   > Currently we do not support dynamic responses from the Stored Procedures. This means while building the query, the fields that appear after selecting **Execute**, should match the fields returned by the stored procedure while using the application.

10. Add the required fields.

    The following figure shows an example:


Designer
APPS
ENTITIES
QUERIES
DATASOURCES
PLUGINS
EVENTS
EMAILS
PARAMETERS
ADMIN
MANAGE
COLLAPSE
New Query
Name: Get All Species
Description:
Type: Database
Data Source: SQL DB
Query Type: Stored Procedure
Schema: Species
Stored Procedure: GetAllSpecies
Input Parameters
Key Datatype Type Default or Test Value
BirdName VARCHAR Input Field
BirdNameOutput VARCHAR Input Field
ReptileName VARCHAR Input Field
ReptileNameOutput VARCHAR Input Field
Output Parameters
Key Datatype
BirdNameOutput VARCHAR
ReptileNameOutput VARCHAR
Test
Execute
Resultset1
BirdName(VARCHAR) ScientificName(VARCHAR) TypeOfBird(VARCHAR)
Resultset2
ReptileName(VARCHAR) ScientificName(VARCHAR) TypeOfReptile(VARCHAR)
OutputParameter
BirdNameOutput(VARCHAR) ReptileNameOutput(VARCHAR)
Output Data
Add field
Add all fields
Output Data
Add field
Add all fields
Resultset1 -> BirdName
Resultset1 -> ScientificName
Resultset1 -> TypeOfBird
Resultset2 -> ReptileName
Resultset2 -> ScientificName
Resultset2 -> TypeOfReptile
OutputParams -> BirdNameOutput
OutputParams -> ReptileNameOutput
Cancel
Save
Save As New
Save And Exit

11. Select **Save** or **Save And Exit**.
    The query is created.

Create REST Query

You can create a REST query for the GET, PUT, POST, and DELETE methods.

- Create the data source *(on page 285)* that you want to use in the query.
- Create an entity *(on page 162)* to specify the query response. The entity fields that you want to map with the query output parameters must contain the same names as the parameters.
- It is recommended that you add the environment variable, no_proxy, to the System Variables. You should also add references to localhost as well as nodes which are targets of REST Queries to the System Variables. Be aware that the case of the environment variables for the a data source target in Operations Hub should match the case of the ones used by the Historian Server; environment variables are case-sensitive.

Note:
REST query will run even when system variable has no port number. A bad port leads to an error.

1. In the module navigation menu, select **QUERIES**.
   The **QUERIES** workspace appears.
2. Select **Add new query**.
   The **Create Query** window appears.
3. In the **Query name** box, enter a name, and then select **Create**. The name must contain at least one uppercase or lowercase letter.
   The available options for creating the query appear.
4. Provide values in the available boxes as specified in the following table.

Box	Description
Description	Enter a description for the query.
Type	Select **REST**.
Method	Select the method of the API you want to use in the query. Supported methods are GET, PUT, POST, and DELETE.
Entity	Select the entity that will specify the query response fields.

Box	Description
	Note: When using a Historian data source, the Entity field will auto-populate with the entity associated with the Available API selected.
Data Source	Select the data source that you want to use for the query.
Available API	Select the API that you want to use in the query. This box contains a list of APIs that are available in the data source that you have selected. The list of available APIs will be filtered based on the method selected. **Note:** Pre-existing APIs are available only for Historian data sources. For more information see: the Historian API help.

Note:
The **Base URL** and **Query URL** boxes are populated with the base portion (that is, the host name or IP address of the data source server) and the remaining portion of the URL. The values in these boxes together identify the complete URL endpoint. The **Base URL** box is always disabled. The **Query URL** box is disabled if you select an API for a Historian data source. If, however, you are using a custom data source, you can enter a value in the **Query URL** box.

5. In the **Parameters** section, please create parameters as needed for the API you are querying. Each parameter will require a default or test value if you wish to run the query with the Execute button.

Type of Parameter	Description	Example
Path parameters	Identify the parameters in the path of the endpoint. These ap-	For the endpoint `https://jsonplaceholder.typicode-`

Type of Parameter	Description	Example
	pear before the query string if query parameters are present.	`.com/users/1/posts`, the parameter between `users` and `posts`, which is the user ID, is the path parameter. The value for this parameter is 1.
Query parameters	Identify the parameters in the path of the endpoint that appear after the question mark (?).	For the endpoint `https://jsonplaceholder.typicode.com/posts?userId=1`, `userId` is the query parameter. The value for this parameter is 1.
Header parameters	Identify the parameters that you want to include in the request header. Typically, these parameters are related to authorization.	
Body parameters	Identify the parameters in the body of the request. Typically these will be required for PUT and POST methods, although they are sometimes required for DELETE as well. Body parameters can be supplied in Operations Hub as a URL encoded format, raw JSON, or raw XML. In case JSON or XML is selected, the first parameter should be used to supply the full JSON body. Subsequent parameters can be used for dynamic substitution into that JSON body. ◦ **JSON**: If selected, the subsequent parameters should be JSON keys	

Type of Parameter	Description	Example
	found in the body. The corresponding JSON values will be substituted. ◦ **XML**: If selected, the subsequent parameters should be strings found in the body. These strings will be substituted. You can also supply curly braces to delineate the parameters from text within the body. For example, `{{STRING_TO_SUBSTITUTE}}` Additionally, you have the option to preview the substitution for XML.	

Be aware that the following Historian REST queries require the multi-select input to be enabled on the EndApp page for output data to be displayed:

- Get > Raw Data
- Get > Calculated Data
- Get > Interpolated Data
- Post > Raw Data
- Post > Calculated Data
- Post > Interpolated Data

6. In the **Query Outputs** section, provide values as specified in the following table.

Box	Description
Raw Response	Select this check box if you want to get either the entire JSON response or XML response mapped to a single entity field. You can then access the response by referencing that entity field while designing an application. If you clear

Box	Description
	this check box, individual components of the response are mapped to individual entity fields.
Entity	Select the entity that will specify the query response fields.
Output fields	Select the entity fields that you want to map to the query response. If the **Raw JSON** check box is selected, only the first field that you select will be mapped to the query response, regardless of the field name. If the **Raw JSON** check box is cleared, the JSON response components are mapped to the entity fields with matching names. In the case of nested responses, dot notation is used to map to inner fields.

Note:
All REST queries must have a defined response. You can save the query only if you specify at least one output. This is true even for Delete REST API calls which do not normally return a response. In this case, please select any entity and entity field, regardless of name.

7. In the **Execute** section, select **Run Request**.
   The query output fields, as well as the query appear in the **Results** box.

Important:
Provide sample values leading to a successful response in order to properly test the REST endpoint. We strongly recommend using values you know will return a representative set of data; otherwise, an error occurs or the response may not return the field data that you need. For example: for Historian data queries, if the set of requested tags is different from the returned set of data (that is, if one or more tags does not have data), the call will fail. The user should modify the inputs to include only the tags for which they are confident there will be data in the response. For PUT/POST/DELETE, this action is not a test but an actual request which can change your data.

8. If required, select **Create Entity** from Results. This will create an entity with the appropriate output fields generated from the previous Run Request.
9. Select **Save** or **Save and Exit**.

The query is created.

Note:
While Operations Hub handles many response formats, there are some responses which it has difficulty mapping to output fields. In particular, embedded lists may be returned as strings rather than lists of objects.

Important:
When you have a large number of users (greater than 100) and each using an end app with multiple REST requests, coupled with a slow REST response, you can get into a situation where the server is waiting for a long time for the previous responses to return, and is therefore unable to process new requests. To avoid this situation, reduce the number of REST calls in your App. Alternatively, you may adjust the Operations Hub timeout setting in the settings.conf file in the following folder: `C:\ProgramData\GE\Operations Hub\iqp-config\IQP\app`. Use the following command so that the slower REST requests do not hold up the Operations Hub server. You can change the seconds value to increase the timeout setting further:

```
#REST client timeout (seconds)
rest_timeout=30
```

Create Extension Query

This topic describes how to an Extension query.

Extension type queries work with multiple data sources.

1. In the main navigation menu, select **QUERIES**.
   The **QUERIES** workspace appears.
2. Select **Add new query**.
   The **New Query** window appears.
3. Provide these details:

Field	Description
Name	Enter a name that contains at least one uppercase or lowercase letter.
Description	Enter a brief description for the query.

Field	Description
Type	Select **Extension**.
Method	Select the type of query you want to create from these options: ◦ Read ◦ Write ◦ Add Comment The **Query Parameters** and **Output Data** are loaded based on the method selected for the query.

4. Provide the query parameter *(on page 210)* values for the required fields.
    - Fixed Value: If this option is selected, the provided value is considered as a fixed value for the field. Fixed value fields are not shown in the application page builder.
    - Input Field: If this option is selected, the provided value appears as a default value for the field in the page builder. Any value provided before executing the query overrides the default value.
5. Select next to the parameters you do not want to include in your query.
   To retrieve deleted query parameters and output data, select **+Add All Query Params** and **+Add All Outputs** respectively.
6. Save the query.
   The extension query is created.

The saved query appears in the application page builder under **PAGE DATA > Query > Entities**.

Go to the application page builder to apply and execute the query.

Extension Query Parameters

Use these parameters in your extension query.

Parameter	Description
Tag Source	Specify a tag source.
Tag	Allows to browse and select a tag.
Authentication	Select how to authenticate when you submit a query:

Parameter	Description
	• `Logon User Token`: Uses the user login token for authentication. • `Provide in Query Parameters`: Uses **User Name** and **Password** input fields for authentication. • `Use Data Source Credentials`: Uses the write credentials configured in the data source for authentication. • `Anonymous`: No authentication.
Tag Display Format	Select a display format for the tag name.
Sampling Mode	Select a sampling mode for retrieving data.
Calculated Mode	If the sampling mode is `Calculated`, specify the calculation mode.
Start Time	Select the calendar icon to set a start time.
Duration	Enter the duration.
End Time	Select the calendar icon to set an end time.
Sampling Time	Enter the sampling time.
Sampling Count	Enter the sampling count.
Sampling Direction	Direction of sampling, whether forward or backward. **Note:** This parameter is used only when the sampling mode is `RawByNumber`. You must also specify the sampling count for this parameter.
Show Comments	Select/Clear the check box to show/hide comments.
Sort By	Defines how a Data Distributor extension query result-set should be sorted. You must enter the syntax, which is a comma-separated list of Data Distributor extension query fields. The result set is sorted by the fields specified in the list, in the given order. Examples:

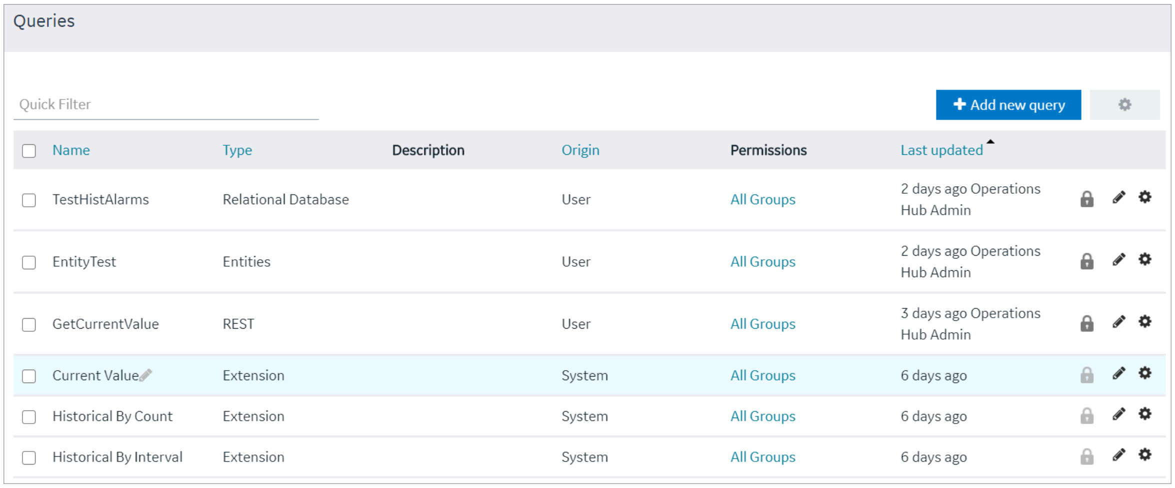
Parameter	Description
	• `timestamp,name` means to sort by timestamp first, then by name. • `name,timestamp` means to sort by name first, and then by timestamp. Each field in the syntax can optionally have a suffix of a plus (+) or minus (-) sign to indicate the sorting order for that field. For example, "timestamp-,name+" means sorting by timestamp in descending order, and then by name in ascending order. By default, timestamp's sorting order is descending, and rest of the fields are ascending. Example: • `timestamp-,name+` means to sort by timestamp first in a descending order, then by name in an ascending order. Each field in the syntax can be denoted either by its full output field name, or a built-in one letter identifier. For example, • `t` for timestamp • `n` for tag name • `v` for value • `q` for quality If you do not enter a syntax, or left this field blank, then the behavior is to sort by timestamp descending. Currently, for auto sync queries, the sorting order only applies to the initial result set and not any subsequent new rows to the result set.

Update Preloaded REST Queries after Import

REST queries from the previous version of Operations Hub are supported. The upgrade process imports these queries to the latest version of the proloaded API. The queries will work with no need for interaction. The display fields need to be manually updated, however. The following steps describe how to update your display fields for a REST query using the Historian GET request.

1. In the main navigation menu, select **QUERIES**.

   The **QUERIES** workspace appears.



2. In the row containing the query you want to access, in the **Name** column, select the link.

   The query appears, displaying a list of fields in the query.
3. In the API Name field, select the appropriate API from the drop-down list (the list will already be populated). Use the following tables as a guide on the renamed APIs.

v1.5 API Name	v1.6 API Name
1.5	1.6
Get Tag Properties	Tag Properties
Get Tags	Tags
Get Tags List	Tag List
Get Raw Data	Raw Data
Get Interpolated Data	Interpolated Data
Get Current Value	Current Value
Get Calculated Value	Calculated Value
Get Sampled Data	Sampled Data
Get Trend Data	Trend Data

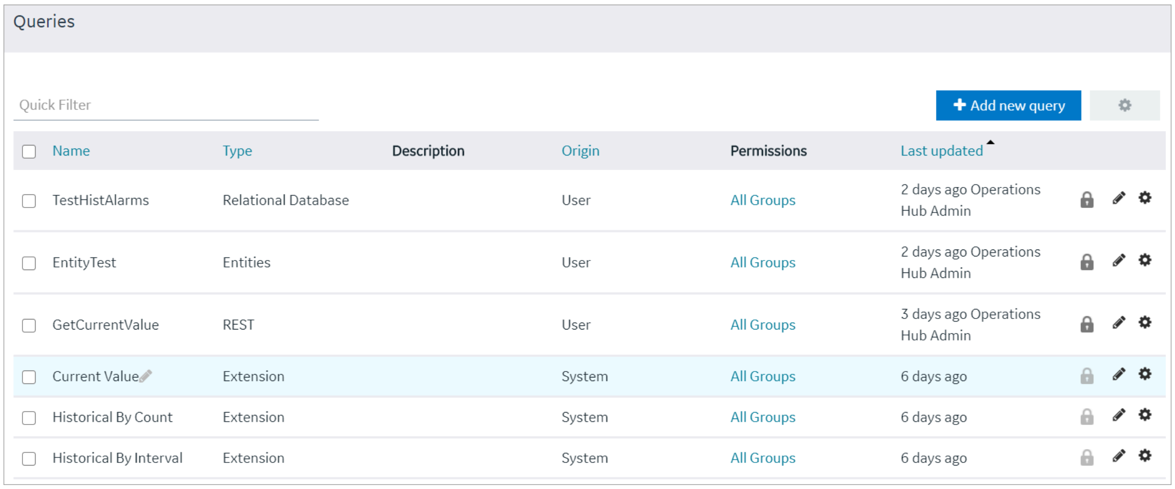
4. Select **Save** or **Save and Exit** to resave the query.

   The query display field is updated.

Update Entity Display Fields After an Import

Entities defined in the previous version of Operations Hub are supported, and imported to the latest version. They will work with no need for interaction. The display fields need to be manually updated, however. The following steps describe how to update your display fields for entities.

1. In the main navigation menu, select **QUERIES**.
   The **QUERIES** workspace appears.

2. In the row containing the query you want to access, in the **Name** column, select the link.
   The query appears, displaying a list of fields in the query.
3. In the Entity Name field, select the appropriate Entity from the drop-down list (the list will already be populated). Use the following tables as a guide on the renamed Entities.

v1.5 Entity Name	v1.6 Entity Name
1.5	1.6
historian_gettagproperties	historian_tagproperties

4. Select **Save** or **Save and Exit** to save your changes.
   The entity display field is updated.

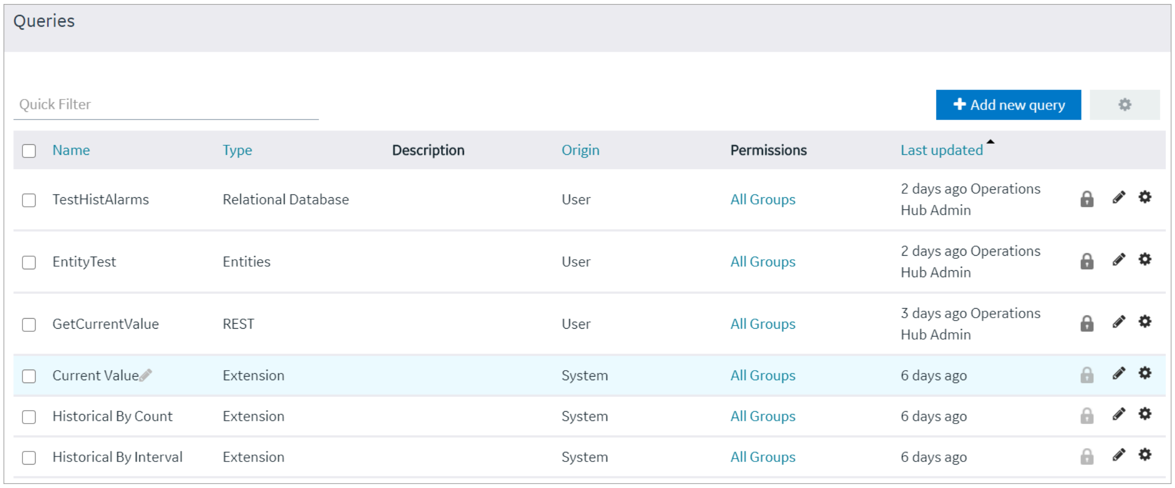
Copy a Query

Creates a duplicate copy of a query.

This topic describes how to copy a query. You can also create a query *(on page 182)*.

1. In the main navigation menu, select **QUERIES**.

   The **QUERIES** workspace appears.

2. In the row containing the query that you want to copy, select , then select **Duplicate query**.

   The **Please enter new name** screen appears, displaying the name of the query that you have selected, appended with a system-generated value.
3. As needed, modify the name of the query, and select **OK**.

   The name must contain at least one uppercase or lowercase letter.

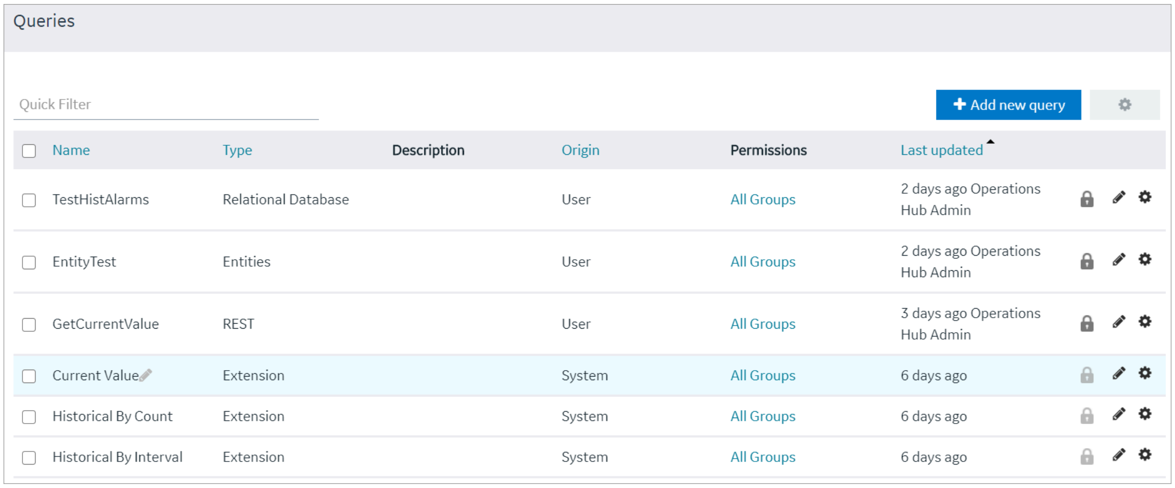
   The selected query is copied.

Delete a Query

- You cannot delete a query if it is locked or used in an application.
- You cannot delete a preconfigured query that came with the system installation.

1. In the main navigation menu, select **QUERIES**.

   The **QUERIES** workspace appears.



2. In the rows containing the queries that you want to delete, select the check boxes.
3. In the workspace heading, select , and then select **Delete queries**.

   A message appears, asking you to confirm that you want to delete the selected queries.

   > **Tip:**
   >
   > Alternatively, in the row containing the query that you want to delete, select , and then select **Delete query**.

4. Select **Delete**.

   The queries are deleted.

Plug-Ins

About Plug-Ins

A plug-in is a widget that you can configure to work with the components of an application (such as entities and queries), and then use it in an application. You can thus add additional functionality to Operations Hub.

Using Operations Hub, you can embed plug-ins in an application. You can use plug-ins stored on your local machine or imported from a different site.

> **Note:**
> When configuring input targets for plugins, ensure that no other binding exists for the target query input. To remove a binding from the query input, select the unlink icon next to the binding.

To create a custom plug-in, refer to Custom Plug-In structure *(on page 222)*

Pump Temperature Plug-In

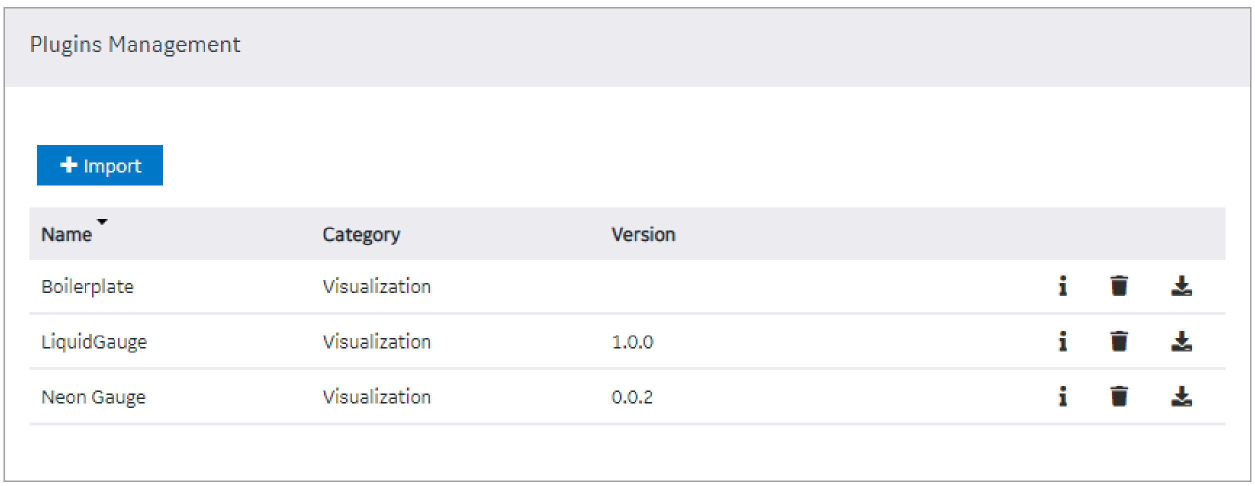
Suppose there is a plug-in that shows the trend graph of the highest temperature recorded in a pump.

Suppose you want to create an application that monitors the energy efficiency of the pump. In addition to the other parameters that you want to display in the application, you can use the plug-in to show the highest temperature recorded in the pump (instead of creating a trend graph from scratch).

Access a Plug-in

This topic describes how to access custom plug-ins.

In the main navigation menu, select **PLUGINS**.
The **PLUGINS** workspace appears, displaying a list of plug-ins that are imported.



> **Tip:**
>
> You can access the information related to a plug-in by selecting i in the corresponding row.

Import a Plug-in

This topic describes how to import custom plug-ins.

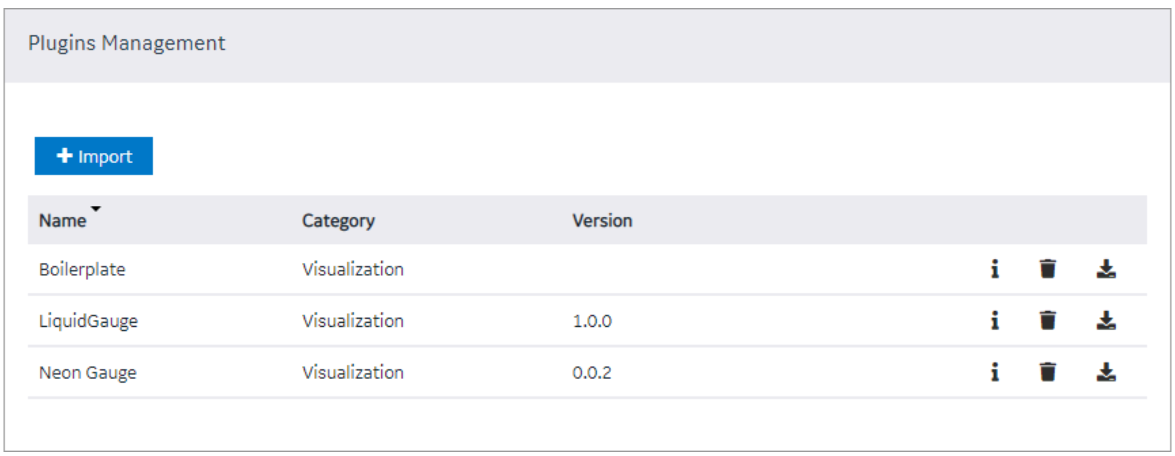
Follow these steps to import each custom plug-in to Operations Hub. Plug-ins also get imported when they are used in an application that you import to Operations Hub.

Note:
In case you imported a newer version of an existing plugin, you need to revisit the application pages (designer) wherever the old version was in use.

1. Delete the old plugin version from the container. All plugin configuration settings are lost when you delete the old version.
2. Add the new plugin version to replace the deleted one. Reconfigure the settings for the new version.

You can also use a third party client (for example, Postman) to import plug-ins. Send a post request to `https://enter your machine name/site/ajax/plugin`

1. In the main navigation menu, select **PLUGINS**.
   The **PLUGINS** workspace appears.



2. Select **Import**.
3. Navigate to and select the plug-in that you want to import, and then select **Open**.
   The plug-in is imported.

Note:
If the plug-in name contains special characters, then the plug-in is not imported. You must fix the plug-in name to import it to Operations Hub. However, existing plug-ins containing special characters in their name are allowed in Operations Hub as long as they are not deleted.

In the page designer of an application, the imported plug-in appears in the **CUSTOM** section.

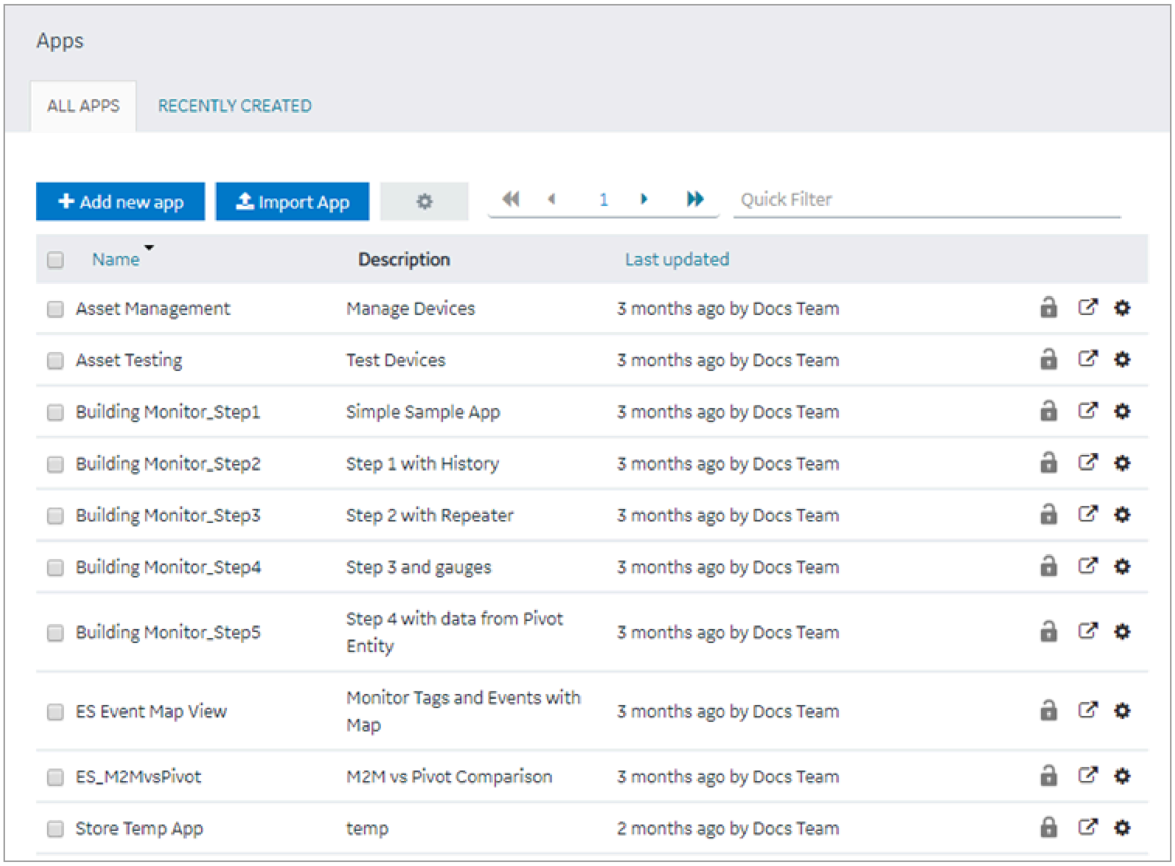
Use the plug-in in an application *(on page 219)*.

Use a Plug-in in an Application

Import the plug-in *(on page 217)* that you want to use in an application.

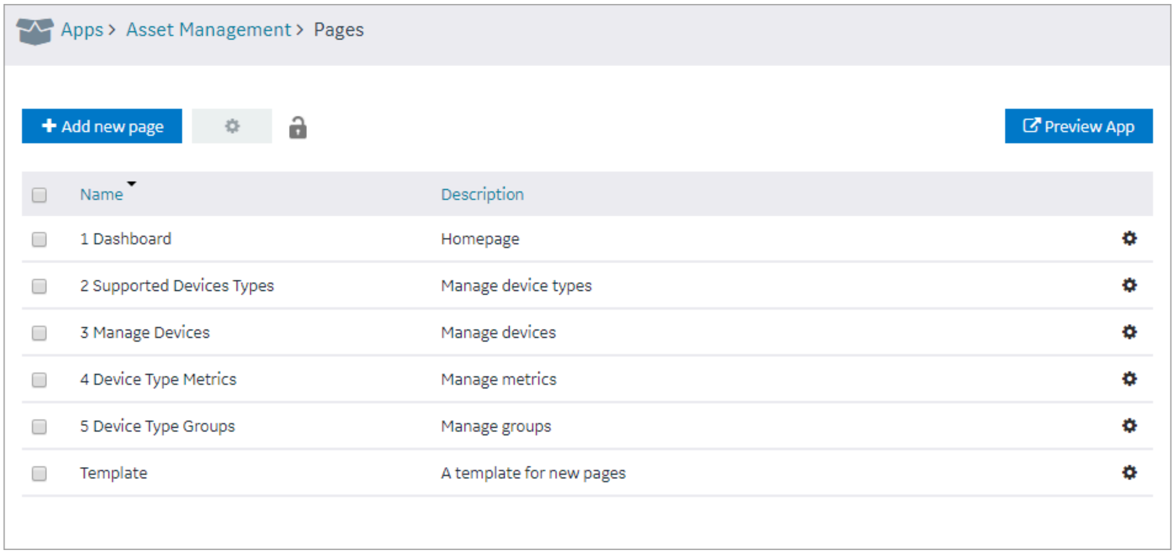
1. In the main navigation menu, select **APPS**.

   The **APPS** workspace appears.

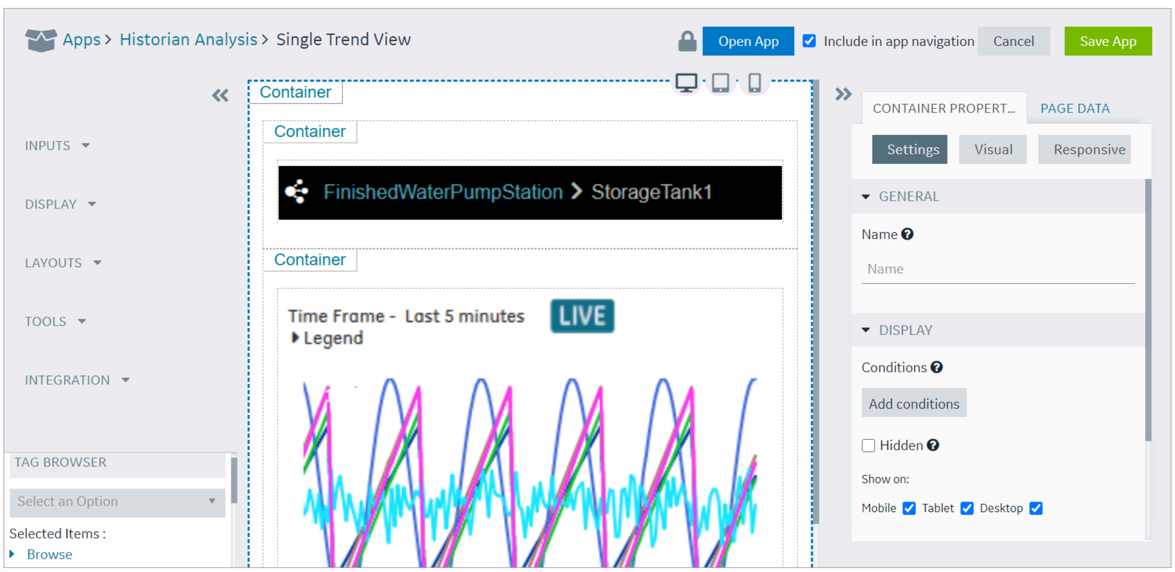
2. In the **Name** column, select the application in which you want to use the plug-in.

   The **PAGES** workspace appears, displaying a list of pages created in the application.



3. In the **Name** column, select the page in which you want to include the plug-in.

   The page designer appears, displaying the elements in each container in the page. The plug-ins that are available in the site appear in the **CUSTOM** section.



4. From the list of plug-ins in the **CUSTOM** section, drag the plug-in to the container in which you want to include the plug-in.
5. Select **Save App**.

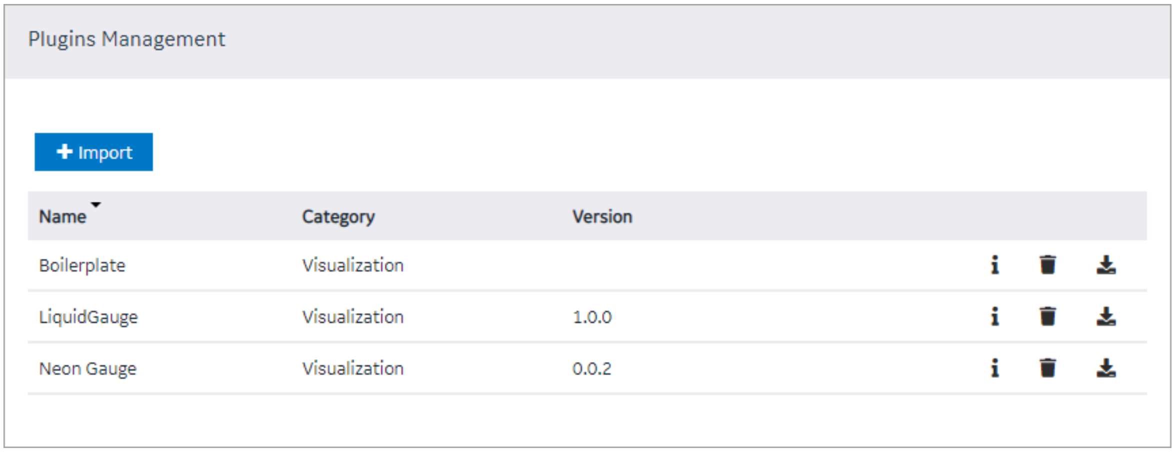
   The plug-in is used in the application.

Download a Plug-In

This topic describes how to download a plug-in.

1. In the main navigation menu, select **PLUGINS**.

   The **PLUGINS** workspace appears.



2. In the row containing the plug-in that you want to download, select .

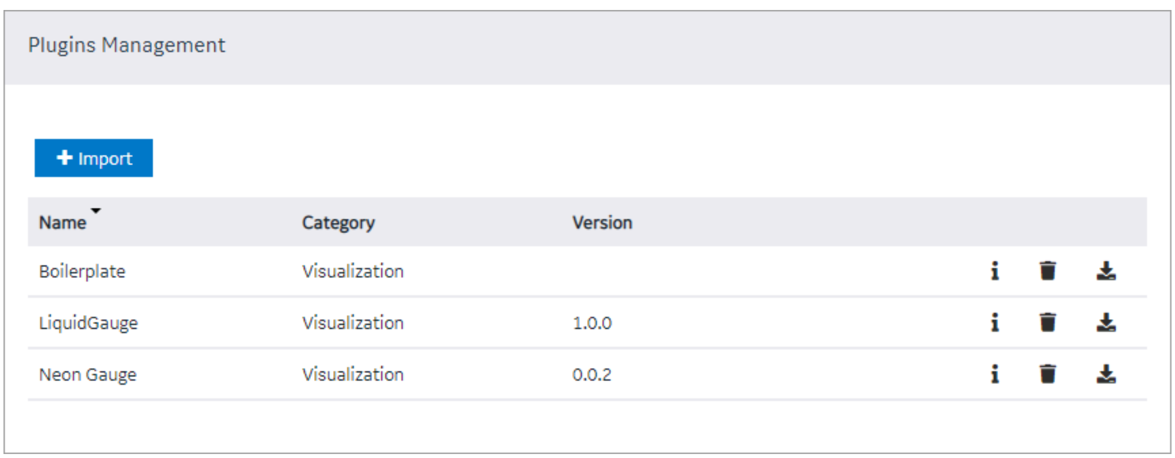
   The plug-in is downloaded as a .zip file.

Delete a Plug-in

This topic describes how to delete a plug-in.

1. In the main navigation menu, select **PLUGINS**.

   The **PLUGINS** workspace appears, displaying a list of plug-ins that are imported.



2. In each row containing the plug-in that you want to delete, select .

   A message appears, asking you to confirm that you want to delete the plug-in.
3. Select **OK**.

   The plug-in is deleted.

Custom Plug-In structure

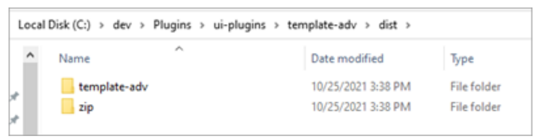
This topic describes how to use plug-in components.

A plug-in must contain the following components:

- index.html *(on page 223)*: Contains the plug-in html code.
- main.js *(on page 227)*: Contains the plug-in javascript code.
- manifest.json *(on page 224)*: Contains the plug-in configuration details.
- style.css: Contains the plug-in stylesheet details.
- The scripts folder: Contains external scripts.

Get started with the sample templates to build your own plug-in.

Template Type	How to Use
Download the sample template for simple plug-in Includes examples using data source.	Use this template to build a simple plug-in. 1. Unzip the downloaded file. The unzipped file contains a folder called `template` with components to build a simple plug-in. 2. Modify the plug-in components. 3. Rename the `template` folder to match with the `typeName` (plug-in name) in `manifest.json`. 4. Create a zip file of your modified folder (do not zip only plug-in components). The zip filename should also be the plug-in name. For example, if your plug-in name is `table`, then the zip file and the folder within should also be named as `table`. 5. Import *(on page 217)* the modified zip file to Operations Hub to load as a plug-in.
Download the sample template for advanced plug-in	Use this template to build an advanced plug-in.

Template Type	How to Use
• Includes examples using data source and data target. • Loads external scripts (tools.zip) imported using webpack. • Loads DevExtreme using manifest (scripts element). • `tools.js` contains color conversion script and connecting to datasources for manual, global, query, or formula. **Important:** Do not import the sample template file as a plug-in. Follow the instructions on how to use the downloaded template to build a plug-in, which can be imported to Operations Hub.	1. Unzip the downloaded file. 2. Perform `npm install` in the root folder to download dependencies. 3. Modify the plug-in components. 4. To generate a zip file of the modified template: ◦ Perform `npm run build` to generate a development package. ◦ Perform `npm run prodBuild` to generate a production package (minified). 5. The generated zip file is saved to the `dist` folder in the project folder.  6. Import (on page 217) the zip file to Operations Hub to load as a plug-in.

The index.html file

Each plug-in must contain an index.html file in the root folder of the plug-in.

> **Note:**
> If html code is not required, create a blank file.

The markup defined in the index.html file is included in the body of a page in an application. Therefore, tags such as html, head, meta will be omitted.

> **Important:**
> Do not use the script tag because of the asynchronous behavior of the tag outside of the html head.

JavaScript Dependencies

The easiest way to add external javascript dependencies is to place them in the scripts folder (in the root folder) and reference this dependency in the manifest.json file.

Important:
When using this method, all javascript dependencies are included in the global scope of the application, which can create conflicts between different plug-ins. Therefore, we recommend that you use a build tool like Webpack to manage dependencies of plug-ins.

The manifest.json file

Every plug-in must contain a manifest.json file in the root folder of the plug-in. This file provides the essential information about the plug-in to Operations Hub.

The following table provides the parameters that you must include in the `manifest.json` file.

Parameter	Description
typeName [String]	The unique name of the plug-in. Does not support special characters. For example, comma, period, ampersand, dollar sign, percent sign, parenthesis, asterisk, etc.
pluginId [String]	The unique ID of the plug-in. The value for this parameter must be a long, random one.
Type [String]	The type of the plug-in.
category [String]	The category of the plug-in.
description [String]	The description of the plug-in. This value appears in Operations Hub when you design an application to include the plug-in.
info	The following information about the plug-in: • version • update • size • developer

Parameter	Description
scripts [Array]	The array for the scripts that you want to use in the plug-in.
customIcon [String]	The icon that will appear next to the name of the plug-in in Operations Hub when designing an application to include the plug-in.
origin [String]	The origin of the plug-in. Provide the value custom for this parameter.
placeholder [String]	A placeholder for the plug-in, which will appear in Operations Hub when designing an application to include the plug-in.
preview [String]	The picture preview of the plug-in that will appear in Operations Hub when designing an application to include the plug-in.
fieldsDescription [Object]	The plug-in description for informational messages.
isNotAllowToAddFields [Boolean]	Indicates whether to allow the user to add more data fields when designing an application to include the plug-in. If you do not want the user to add data fields, enter true.
schema{}	An array of the following types of schema: • JSONSchema{} • UISchema{}

Schema

The schema is based on JSON. It is used in the manifest.json file to specify the plug-in input and output.

- Input: The input for a plug-in can be static or dynamic. Static data is available in any of the following JSON schema types:
  - string
  - number
  - integer
  - boolean

    - null
    - object
    - array

  The dynamic data is available in an Operations Hub component such as a query, global variable, or manual entry of data.
- Output: The output of a plug-in is defined in the Operations Hub target, such as a query with inputs or a global variable.

The schema defined in the manifest.json is presented in Operations Hub in the html format. This format is implemented using the react-jsonschema-form library, which introduces the concept of UI schema to provide the information about the form behavior and to give an extensive API for the form customization. Customization is typically done using custom fields and widgets that become part of the default form registry. The library renders all form fields leveraging the Bootstrap semantics, so that it can be styled with bootstrap themes or custom CSS.

Tip:
The following websites provide information on creating plug-ins:

- React-JSON-Schema Documentation
- React-JSON-Scheme Playground

Supported Widgets

The following table provides the supported widgets for each field type.

Field Type	Supported Widgets
Boolean	• Check box • Radio button • Select
String	• Text • Password • Email • URI • Radio button • Select • Text area

Field Type	Supported Widgets
	• Datetime • Color
Number	• Text • Select • Range • Radio button

The main.js file

The plug-in API is exposed through the global object EMBED. You can access this object when the plug-in source code is included in Operations Hub. The following table provides the methods used in EMBED.

Method	Description
EMBED.getRootElement()	Returns the jqLite element, which must be used as the mounting point of the root element of the plug-in.
EMBED.onChangeData(callback)	This method is a general data change listener. call-back - function, which is invoked with one argument every time when data change event is triggered.
EMBED.getData()	Returns existing page data.

The following table provides the four main methods to work with the Data Source and Data Target fields.

Method	Description
EMBED.subscribeFieldToQueryChange(field, callback)	Field object: Data Source Callback: Function that is invoked when query change event received. Callback is invoked with one argument, which is a data selection as per field configuration.
EMBED.subscribeFieldToGlobalChange(field, callback)	Field object: Data Source Callback: Function that is invoked when global change event received. Callback is invoked with

Method	Description
	one argument, which is a global data as per field configuration.
EMBED.subscribeFieldToDataChange(field, callback)	Field object: Data Source Callback: Function that is invoked when global or query change event received.
EMBED.submitTarget(field, value)	Field object: Data Target Value: javascript primitives or Object/Array This method targets the input of a query or a global variable, as per field configuration.

Upgrade Plug-in Schema

This topic describes how to update old plug-ins and use them in Operations Hub.

You must perform these steps if you are prompted to upgrade your custom plug-ins using old schema.

1. Migrate your old plug-in/s to the new React JSON schema *(on page 225)*.
2. Write a transformation specification for plug-in upgrade *(on page 155)*.
3. Place the plug-in transformation files in this location folder `..\ProgramData\GE\Operations Hub\iqp-config\plugin-transform-spec`.
4. Import the plug-in *(on page 217)* updated with the new schema to Operations Hub.
   Plug-ins also get upgraded when you upgrade applications *(on page 157)* in Operations Hub.

Events

About Events

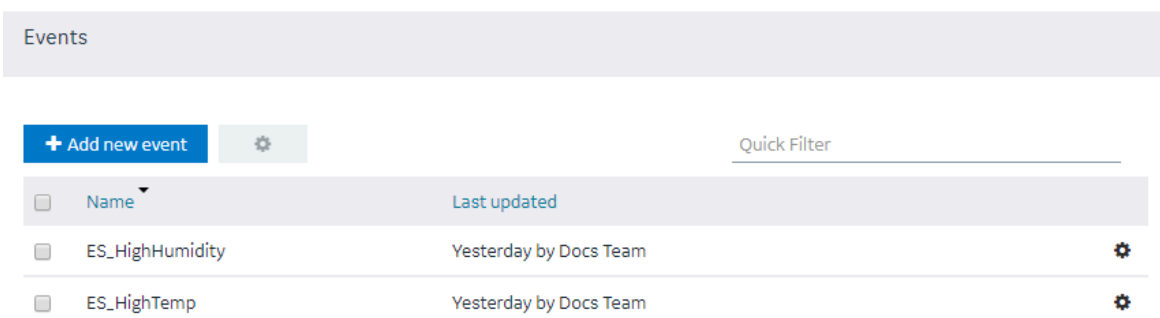
In Operations Hub, you can create events that will trigger actions when specific conditions are satisfied. To create an event, you must create a trigger and then create an action.

- Trigger: When you create a trigger, you define the set of conditions that must be satisfied for the event to happen. You can create a trigger based on conditions on values added or updated in an entity or values received from a device.
- Action: When you create an action, you define what should happen if the conditions specified in the trigger are satisfied (that is, when the event is triggered). You can create one or more of the following actions:
    - Send an email: You can create an action to send an email when the event is triggered. You can enter the email addresses manually, fetch them from a query, or allow application users to specify the email addresses.
    - Run a query: You can create an action to run a query when the event is triggered.
    - Send a command to a device: You can create an action to send a command to a device when the event is triggered. Before you do so, you must configure IQP MQTT to communicate with the device to which you want to send a command.

Creating an event in the event editor only creates a template for the event. It does not activate the event. The event is activated when a notifier is added and turned on in an event settings widget in an application.

Access an Event

1. In the main navigation menu, select **EVENTS**.
   The **EVENTS** workspace appears.



2. In the row containing the event that you want to access, in the **Name** column, select the link.
   The event appears, displaying a list of fields in the event.

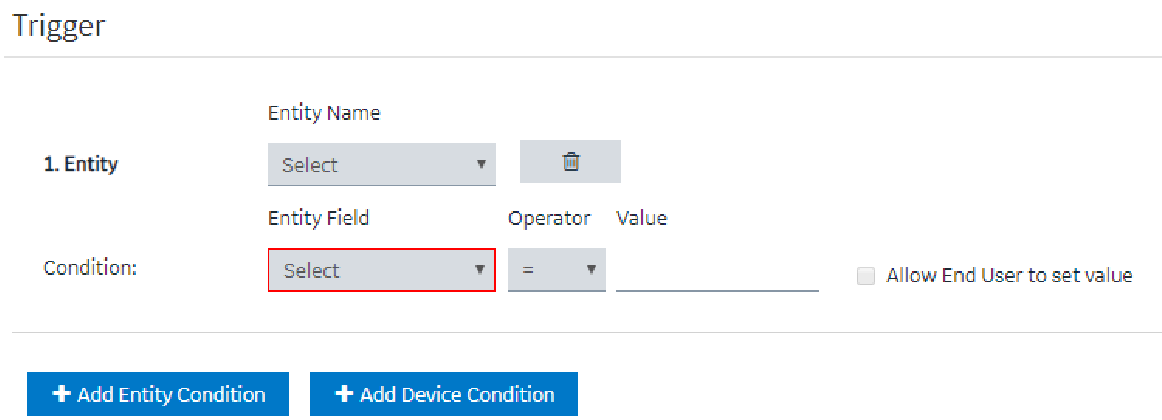
> **Tip:**
> You can modify values in the available fields, and then select **Save** or **Save And Exit**.

Create a Trigger Based on an Entity

This topic describes how to create a trigger based on conditions on values stored in an entity. You can also create a trigger based on conditions on values received from a device *(on page 230)*.

1. Access the event *(on page 229)* for which you want to create a trigger.
2. Select **Add Entity Condition**.

   The **Entity** and **Condition** sections

   appear.
3. In the **Entity Name** box, select the entity based on which you want to create a trigger.

   In the **Entity Field** box, a list of fields in the selected entity appears.
4. In the **Entity Field**, **Operator**, and **Value** boxes, select values that you want to use in the trigger.

   If you want to create a trigger if the temperature recorded in the entity exceeds 40 degrees Celsius, then in the **Entity Field**, **Operator**, and **Value** boxes, select or enter Temperature, >, and 40, respectively.
5. If you want to allow the end user to set the value manually, then select the **Allow End User to set value** check box, and then enter a value in the **Input Name** box.

   If you want to create a trigger when the temperature stored in the entity field reaches a certain limit, and you want application users to specify that limit, then:

   a. In the **Input Name** box, enter Maximum Temperature.
   b. In the application, add an event settings widget, and then select the event that you have created.

      In the application, the widget contains an input field labeled Maximum Temperature, which allows the user to change the value that you have specified in the event.
6. If there is more than one condition, and if you want to create a trigger only if all the conditions are satisfied, select **Meet ALL of the conditions**. By default, this option is selected. If, however, you want to create a trigger if at least one of the conditions is satisfied, select **Meet ANY of the conditions**.

Create an action *(on page 230)*.

Create a Trigger Based on a Device

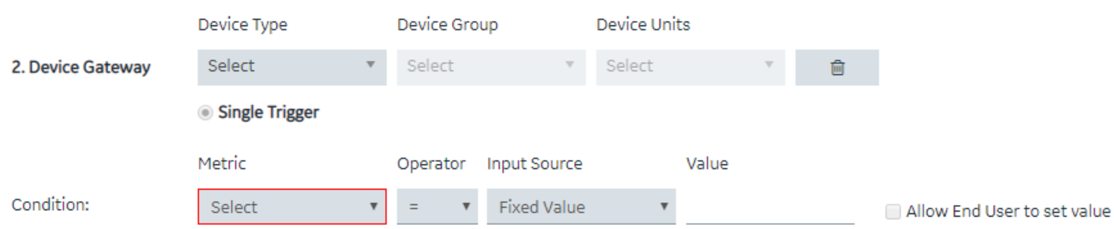
Register the device details and metrics that you want to use in the trigger, using baseline entities.

1. Register at least one device type and metric using the supported_device_gateway and the metrics_device_type entities, respectively.
2. Register at least one device group and device for the device type using the M2M_groups and device_gateway entities, respectively.

This topic describes how to create a trigger based on conditions on values received from a device. You can, however, create a trigger that will cover only a single device, a group of devices, or all the devices of a given type.

You can also create a trigger based on conditions on values stored in an entity *(on page 230)*.

1. Access the event *(on page 229)* for which you want to create a trigger.
2. Select **Add Device Condition**.
   The **Device Gateway** and **Condition** sections

   appear.
3. In the **Device Type**, **Device Group**, and **Device Units** boxes, select the type, group, and unit of the device, respectively.
   The following table provides values that you can select in these boxes, and which devices will be filtered accordingly.

Device Type	Device Group	Device Units	Result
MyDevice-Type	Any	Any	All devices of the type MyDevice-Type.
MyDevice-Type	MyGroup	Any	All devices in the group MyGroup.

Device Type	Device Group	Device Units	Result
MyDevice-Type	MyGroup	MyDevice	The device named MyDevice.

In the **Metric** box, a list of metrics registered for the device type appears.

4. In the **Metric**, **Operator**, **Input Source**, and **Value** boxes, select or enter the metric, operator, input source, and value, respectively.
   If you want to create a trigger when the temperature recorded by the device exceeds 40 degrees Celsius, in the **Metric**, **Operator**, **Input Source**, and **Value** boxes, select or enter Temperature, >, Fixed Value, and 40, respectively.
5. If you want to allow the end user to set the value manually, select the **Allow End User to set value** check box, and then enter a value in the **Input Name** box.
   If you want to create a trigger when the temperature stored in the entity field reaches a certain limit, and you want application users to specify that limit:
   a. In the **Input Name** box, enter Maximum Temperature.
   b. In the application, add an event settings widget, and then select the event that you have created.

      In the application, the widget contains an input field labeled Maximum Temperature, which allows the user to change the value that you have specified in the event.
6. If there is more than one condition, and if you want to create a trigger only if all the conditions are satisfied, select **Meet ALL of the conditions**. By default, this option is selected. If, however, you want to create a trigger if at least one of the conditions is satisfied, select **Meet ANY of the conditions**.

Create an action *(on page 231)*.

Create an Action to Send an Email

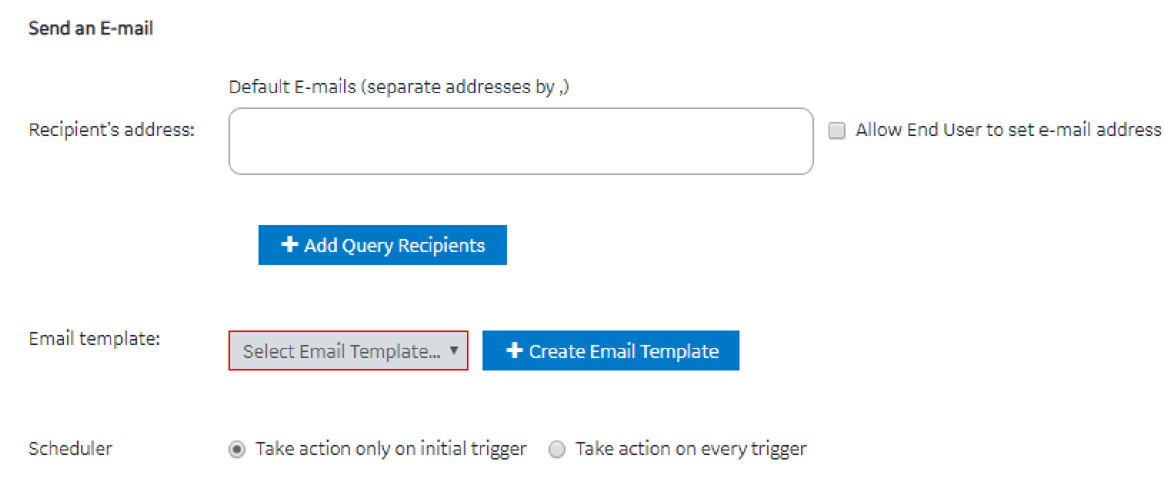
This topic describes how to create an action to send an email. You can also create an action to perform the following steps:

- Run a query *(on page 235)*
- Send a command to a device *(on page 236)*

Create a trigger based on an entity condition *(on page 230)* or a device condition *(on page 231)*.

1. Access the event (on page 229) for which you want to create an action.
2. Select **Send e-mail**.

   The **Send an E-mail** section

   appears.
3. Enter or select values as specified in the following table.

Field	Description
Recipient's address	Enter the email address of the user who will receive an email when the event is triggered. You can enter multiple email addresses separated by commas.
Allow End User to set e-mail address	Select this check box if you want to allow application users to provide the email addresses of the users who will receive an email, and then enter the name of the input field that you will add in the application.
Add Query Recipients	Select this button if you want to add email addresses of the recipients using a query. When you select this button, the **Query Name** box appears, displaying a list of Get queries created in the site.
Query Name	Select the query that returns a list of email addresses to which you want to send the email. If the query that you have selected requires input

Field	Description
	values, then the corresponding fields appear. If that happens, enter values in the fields.
Email template	Select the email template that you want to use. If, however, you want to create an email template *(on page 241)*, select **Create Email Template**, enter values as needed, and then select **Save and Return**.
Scheduler	Select one of the following options: ◦ **Take action only on initial trigger**: Select this option if you want to run the query after switching from the state of not meeting the condition to meeting the condition. By default, this option is selected. For example, suppose you have created an action to send an email when the temperature recorded by a device exceeds 40 degrees Celsius. Suppose the temperature recorded by the device is as follows: 35, 38, 41, 45, 39, 42. In this scenario, the email is sent when the temperature is 41 and 42. ◦ **Take action on every trigger**: Select this option if you want to send an email every time the event is triggered. For example, suppose you have created an action to send an email when the temperature recorded by a device exceeds 40 degrees Celsius. Suppose the temperature recorded by the device is as follows: 35, 38, 41, 45, 39, 42. In this scenario, the email is sent when the temperature is 41, 45, and 42.

4. Select **Save** or **Save and Exit**.

   The event template is created.

When the event is triggered, an email is sent to the email addresses that you have specified.

> **Note:**
> Gmail integration is possible on allowing access to less secure apps for the account. Alternatively, you can enable a 2-Step verification for the account and use the Google account "App passwords" feature. This will generate a password to use in conjunction with the email address to configure email server in Operations Hub Admin Console.

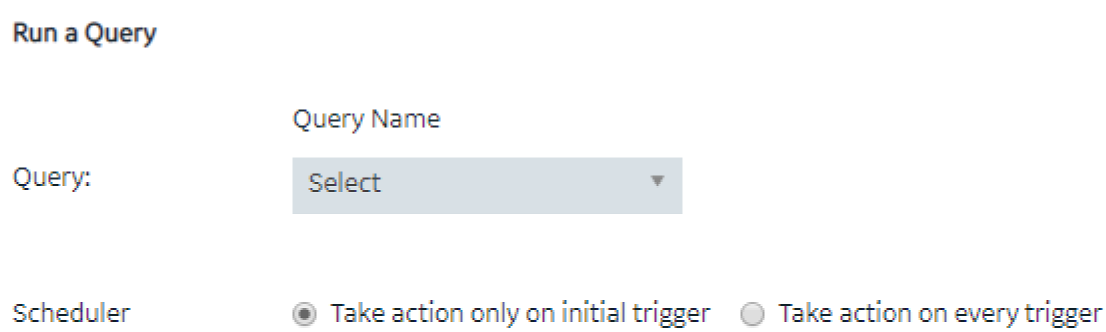
Create an Action to Run a Query

This topic describes how to create an action to run a query. You can also create an action to:

- Send an email *(on page 232)*
- Send a command to a device *(on page 236)*

Create a trigger based on an entity condition *(on page 230)* or a device condition *(on page 231)*.

1. Access the event *(on page 229)* for which you want to create an action.
2. Select **Run a Query**.
   The **Run a Query** section appears.



3. Enter or select values as described in the following table.

Field	Description
Query	Select the query that you want to run when the event is triggered. If the query that you have selected requires input values, the corresponding

Field	Description
	fields appear. If that happens, enter values in the available fields.
Scheduler	Select one of the following options: ◦ **Take action only on initial trigger**: Select this option if you want to run the query after switching from the state of not meeting the condition to meeting the condition. By default, this option is selected. For example, suppose you have created an action to run a query when the temperature recorded by a device exceeds 40 degrees Celsius. Suppose the temperature recorded by the device is as follows: 35, 38, 41, 45, 39, 42. In this scenario, the query is run when the temperature is 41 and 42. ◦ **Take action on every trigger**: Select this option if you want to run the query every time the event is triggered. For example, suppose you have created an action to run a query when the temperature recorded by a device exceeds 40 degrees Celsius. Suppose the temperature recorded by the device is as follows: 35, 38, 41, 45, 39, 42. In this scenario, the query is run when the temperature is 41, 45, and 42.

4. Select **Save** or **Save and Exit**.
   The event template is created.

When the event is triggered, the query that you have specified is run.

Create an Action to Send a Command to a Device

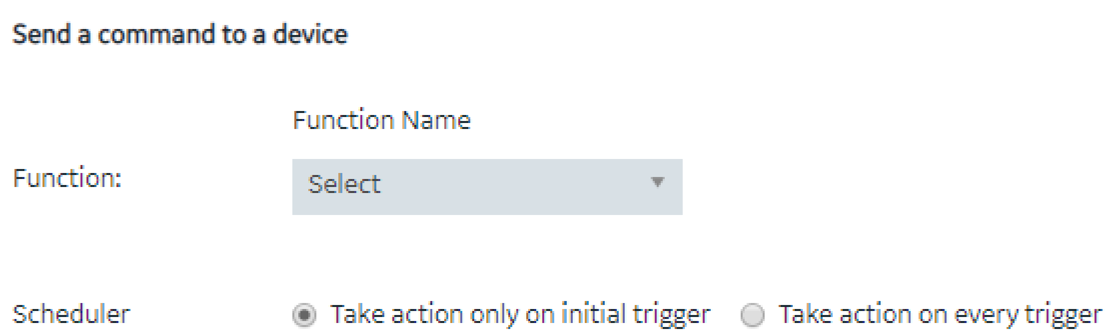
This topic describes how to create an action to send a command to a device. You can also create an action to:

- Run a query *(on page 235)*
- Send an email *(on page 232)*

1. Configure IQP MQTT to communicate with the device to which you want to send a command.
2. Create a trigger based on an entity condition *(on page 230)* or a device condition *(on page 231)*.

1. Access the event *(on page 229)* for which you want to create an action.
2. Select **Send Command to Device**.

   The **Send a command to a device** section

   appears.
3. Enter or select values as described in the following table.

Option	Description
Function	Select **Send_MQTT_Command** to send a command to a device that is configured with IQP MQTT. The **Input Source** and **Value** boxes appear for topic and payload.
Input Source	Select **Fixed value** if you want to send a fixed value to the device when the event is triggered.
Value	Enter the fixed value that you want to send to the device when the event is triggered.
Allow End User to set value	Select this check box if you want application users to set the value, and then enter a name in the **Input Name** box that appears.
Scheduler	Select one of the following options:

Option	Description
	◦ **Take action only on initial trigger**: Select this option if you want to send the command after switching from the state of not meeting the condition to meeting the condition. By default, this option is selected. For example, suppose you have created an action to send the command when the temperature recorded by a device exceeds 40 degrees Celsius. Suppose the temperature recorded by the device is as follows: 35, 38, 41, 45, 39, 42. In this scenario, the command is sent when the temperature is 41 and 42. ◦ **Take action on every trigger**: Select this option if you want to send the command every time the event is triggered. For example, suppose you have created an action to send a command when the temperature recorded by a device exceeds 40 degrees Celsius. Suppose the temperature recorded by the device is as follows: 35, 38, 41, 45, 39, 42. In this scenario, the command is sent when the temperature is 41, 45, and 42.

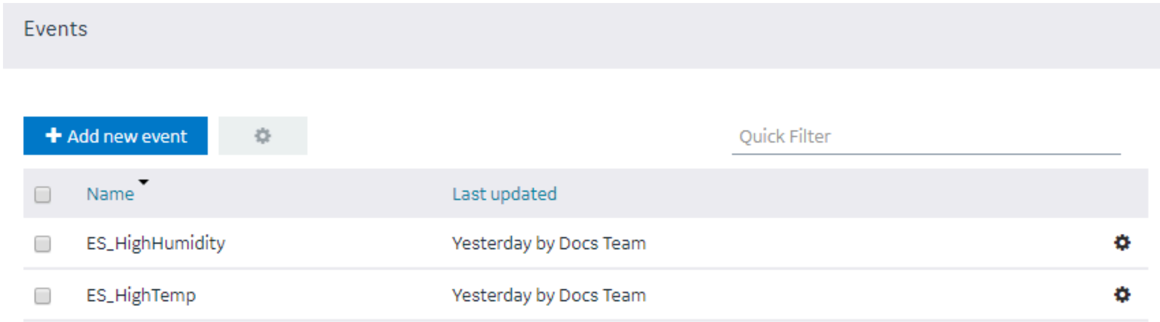
4. Select **Save** or **Save and Exit**.
   The event template is created.

When the event is triggered, the command is sent to the MQTT broker.

Delete an Event

You cannot delete an event if it is locked or used in an application or a parameter.

1. In the main navigation menu, select **EVENTS**.
   The **EVENTS** workspace appears.



2. In the rows containing the events that you want to delete, select the check boxes.
3. In the workspace heading, select , and then select **Delete Events**.
   A message appears, asking you to confirm that you want to delete the event.

> **Tip:**
>
> Alternatively, in the row containing each event that you want to delete, select , and then select **Delete event**.

4. Select **Delete**.
   The events are deleted.

Email Templates

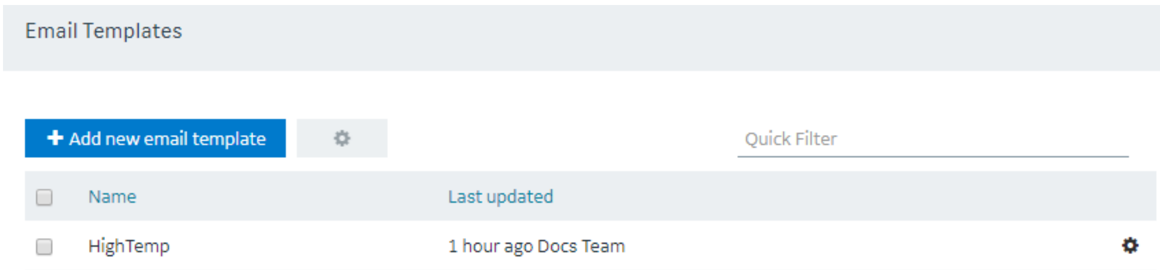
About Email Templates

Email templates store information about the default content and structure of an automated email, which can be sent when an event is triggered. The template allows you to include fixed or dynamic content so that the email is customized to the event that triggered it. You can define the default structure for the following sections in an email template:

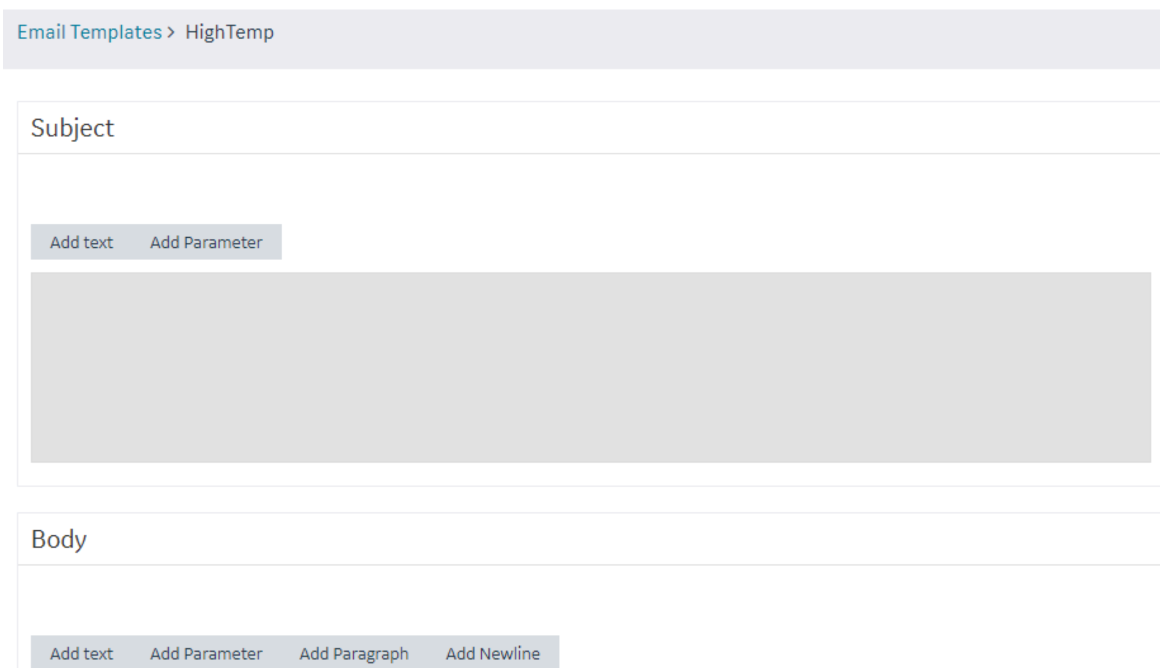
- Subject
- Body
- URL

Access an Email Template

1. In the main navigation menu, select **EMAILS**.
   The **EMAIL TEMPLATES** workspace appears.



2. In the row containing the email template that you want to access, in the **Name** column, select the link.
   The email template appears, displaying the **Subject**, **Body**, and **URL** sections.

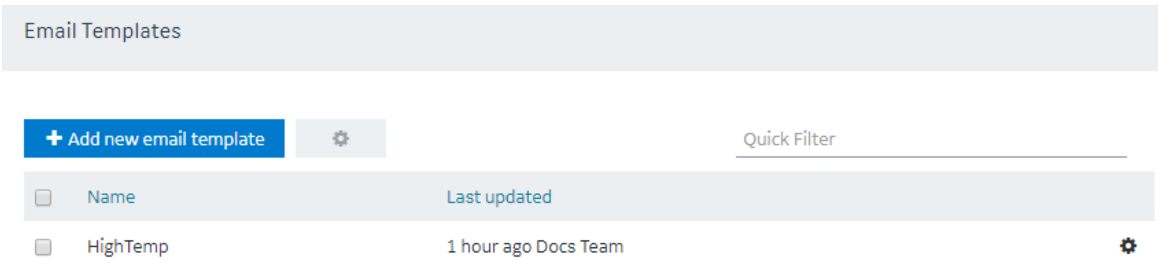


> **Tip:**
> If needed, modify the email template, and then select **Save** or **Save and Exit**.

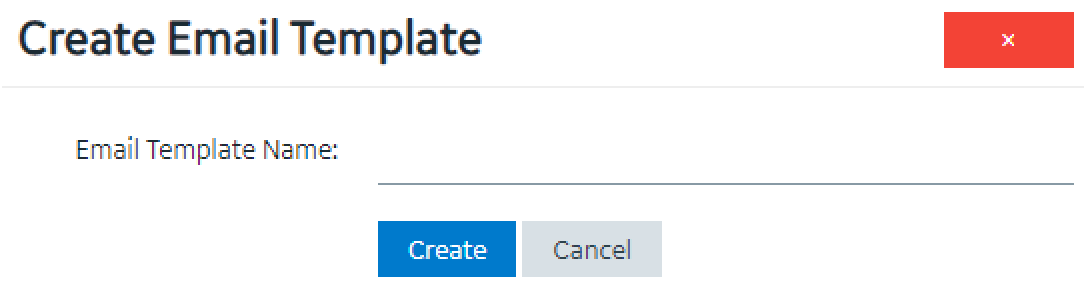
Create an Email Template

This topic describes how to create an email template. You can also copy an email template *(on page 242)*.

1. In the main navigation menu, select **EMAILS**.
   The **EMAILS** workspace appears.



2. Select **Add new email template**.
   The **Create Email Template** window appears.



3. Enter a value in the **Email Template Name** box, and then select **Create**. The name must contain at least one uppercase or lowercase letter.
   The **Subject**, **Body**, and **URL** sections of the email template appear.
4. In the **Subject**, **Body**, and **URL** sections, select the options for which you want to add details.

Option	Description
Add Text	When you select **Add Text**, a text box appears in the corresponding section. You can enter the text that you want to include in the email template.
Add Parameter	Parameters *(on page 244)* allow you to add dynamic content to the email based on values

Option	Description
	from the event. When you select **Add Parameter**, a drop-down list box appears in the corresponding section. You can select the parameter that you want to include in the email template.
Add Paragraph	When you select **Add Paragraph**, a resizeable text box appears in the corresponding section. You can enter the text that you want to include in the email template. You can add a paragraph only in the **Body** section.
Add Newline	When you select **Add Newline**, a line appears after the current element.

5. As needed, in the **URL** section, enter a URL that you want to include in the email template.
6. Select **Save** or **Save And Exit**.

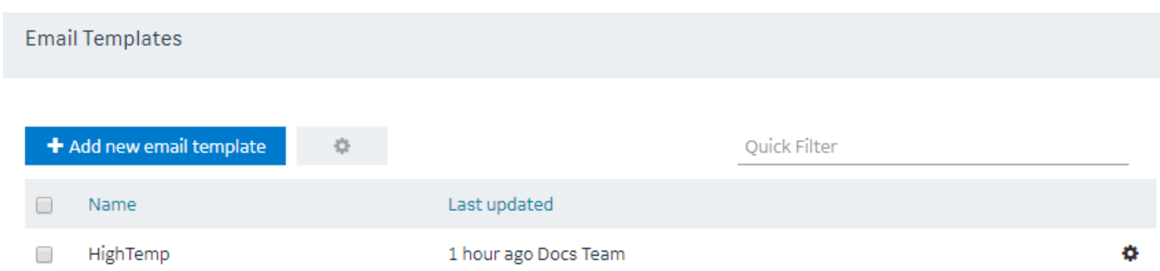
   The email template is created.

Copy an Email Template

This topic describes how to copy an email template. You can also create an email template *(on page 241)*.

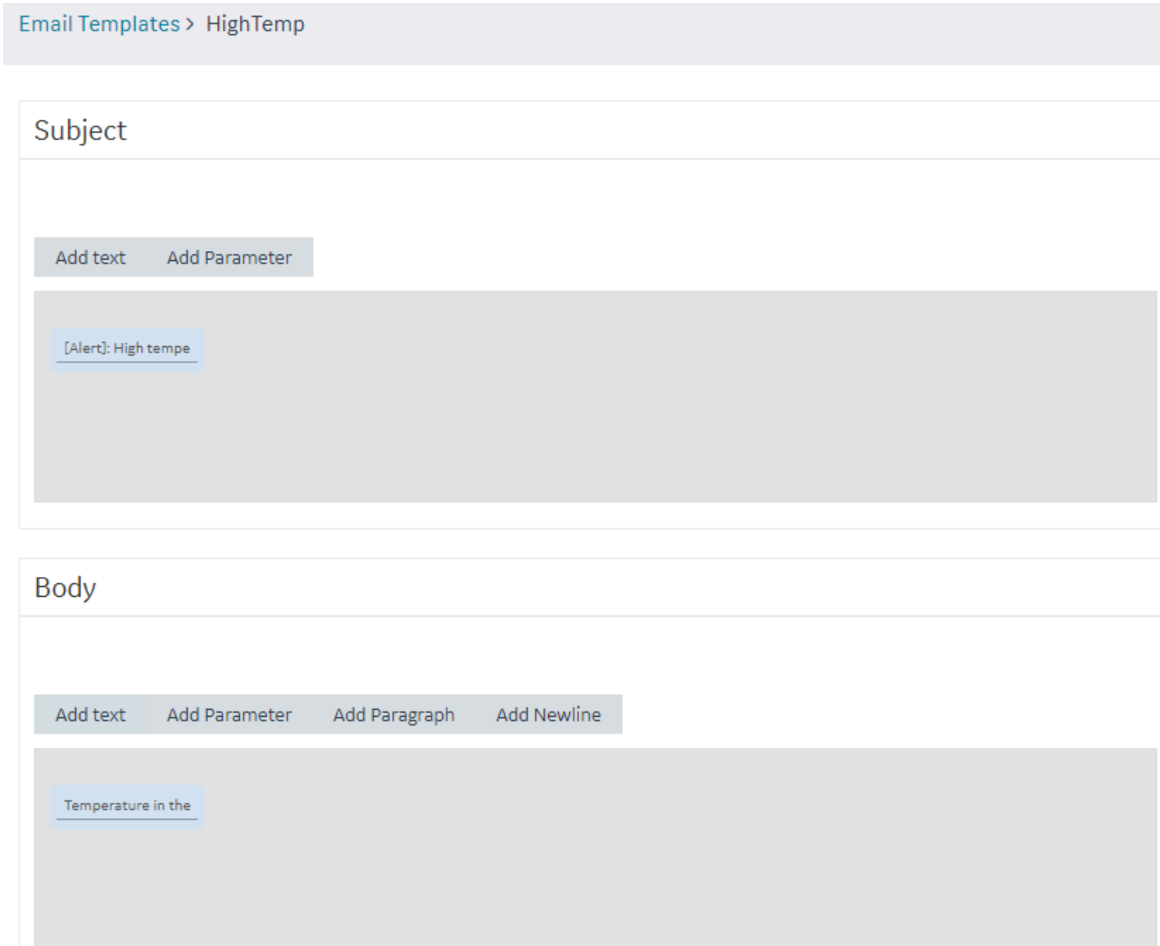
1. In the main navigation menu, select **EMAILS**.

   The **EMAILS** workspace appears.

2. In the row containing the email template that you want to copy, select the link.

   The email template appears.

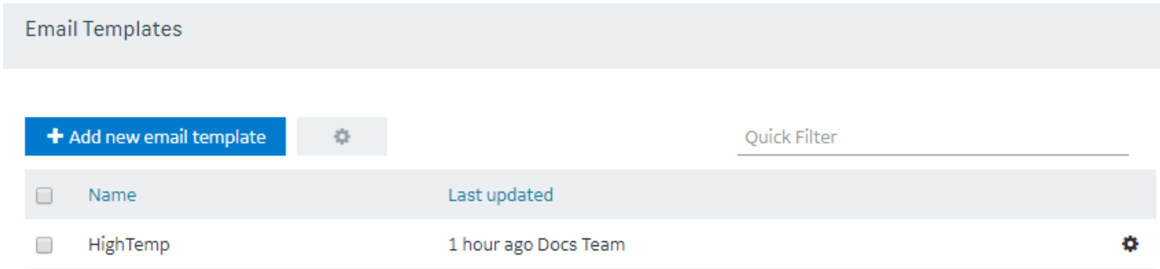


3. Modify the email template as needed, and then select **Save As New**.
   A window appears, asking you to enter a name for the email template. By default, the name contains the name of the original email template, appended with a system-generated value.
4. Modify the default name, and then select **OK**.
   The email template is copied.

Delete an Email Template

You cannot delete an email template if it is used in an event.

1. In the main navigation menu, select **EMAILS**.
   The **EMAILS** workspace appears.



2. In the workspace heading, select , and then select **Delete email templates**.
   A message appears, asking you to confirm that you want to delete the email templates.

   > **Tip:**
   >
   > Alternatively, in the row containing each email template that you want to delete, select , and then select **Delete email template**.

3. Select **Delete**.
   The email template is deleted.

Parameters

About Parameters

Parameters store values that you can use in an email template. These values can be fixed or generated at runtime. You can create one of the following types of parameters:

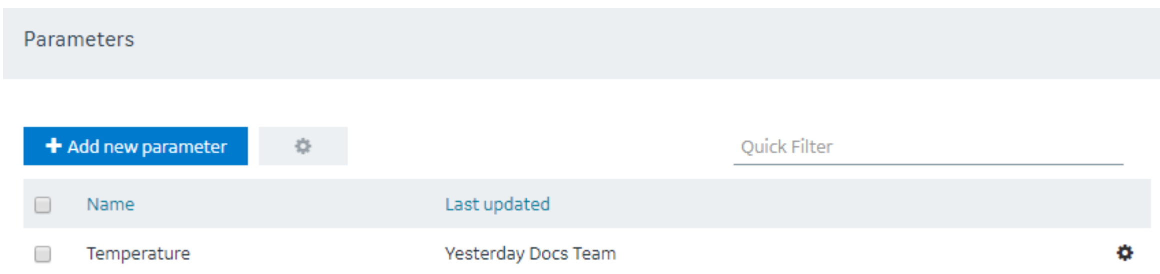
- Fixed: Stores a fixed value that you specify when you create the parameter.
- Event Variable: Stores event time values from an entity field or a device field that is used in an event condition.
- From Query: Stores the results of a Get query with inputs from event time values. This allows you to retrieve additional data about the device or entity that triggered the event from another entity on the system.

Suppose you want to send an automated email when the temperature recorded by a device exceeds 40 degrees Celsius. In the email, you want to include the temperature, date, and time recorded by the device. In this case:

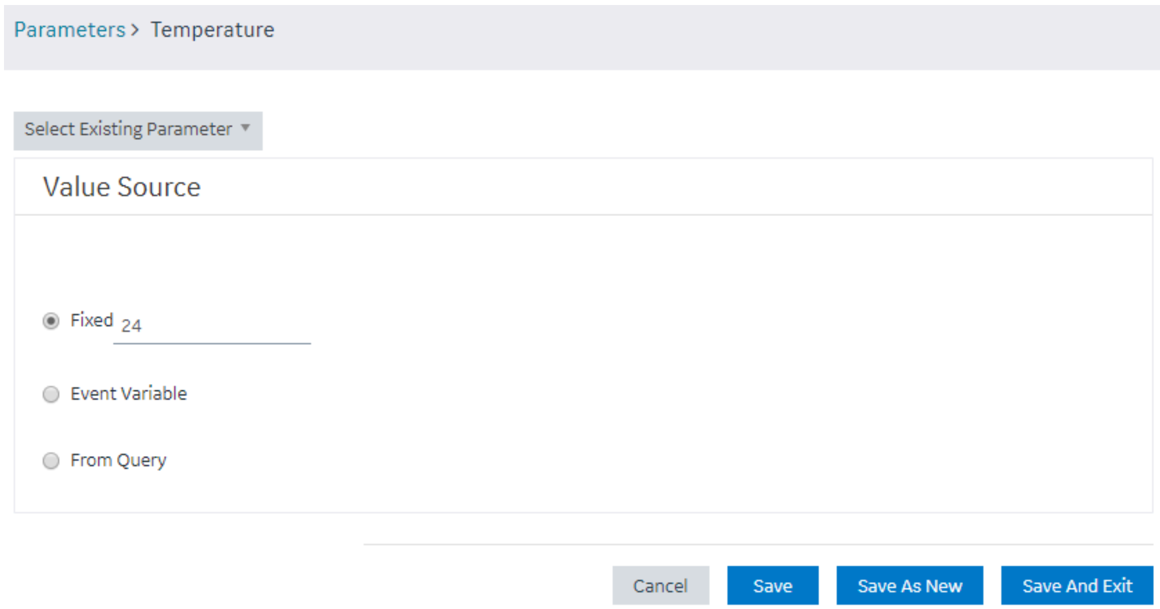
1. Create an event as follows:
   - Create a condition such that the event is triggered when the temperature recorded by the device exceeds 40 degrees Celsius.
   - Create an action such that an email is sent when the event is triggered.
2. Create a parameter to store the temperature recorded by the device.
3. Create another parameter to store the date and time recorded by the device.
4. Create an email template, and include both the parameters in the template.
5. Use the email template in the event that you have created in step 1.

Access a Parameter

1. In the main navigation menu, select **PARAMETERS**.
   The **PARAMETERS** workspace appears.



2. In the row containing the parameter that you want to access, in the **Name** column, select the link.
   The parameter appears.

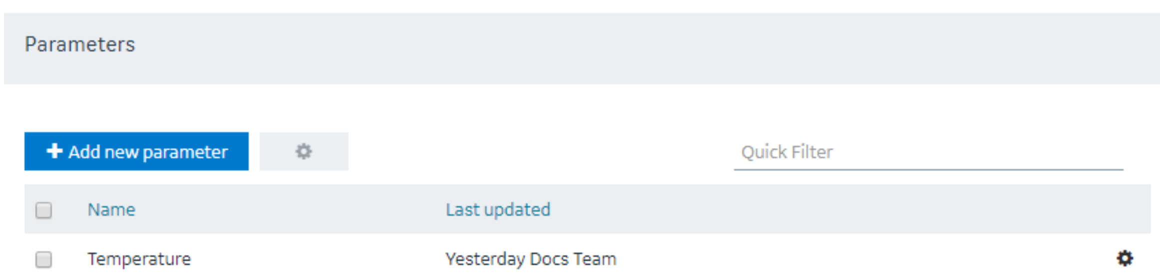


Tip:
If needed, you can modify values in the available fields, and then select **Save** or **Save and Exit**.

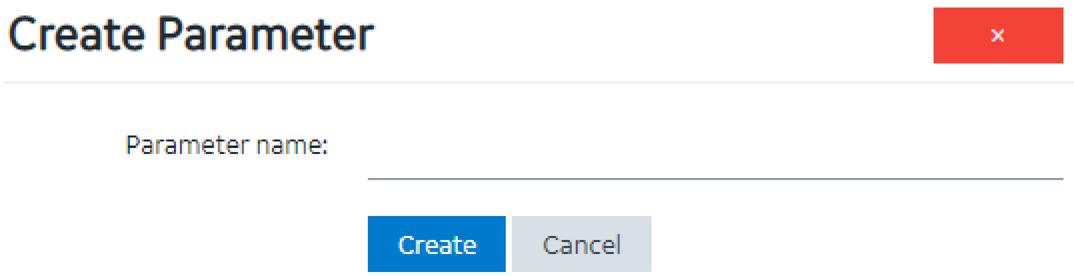
Create a Parameter

This topic describes how to create a parameter. You can also copy a parameter *(on page 249)*.

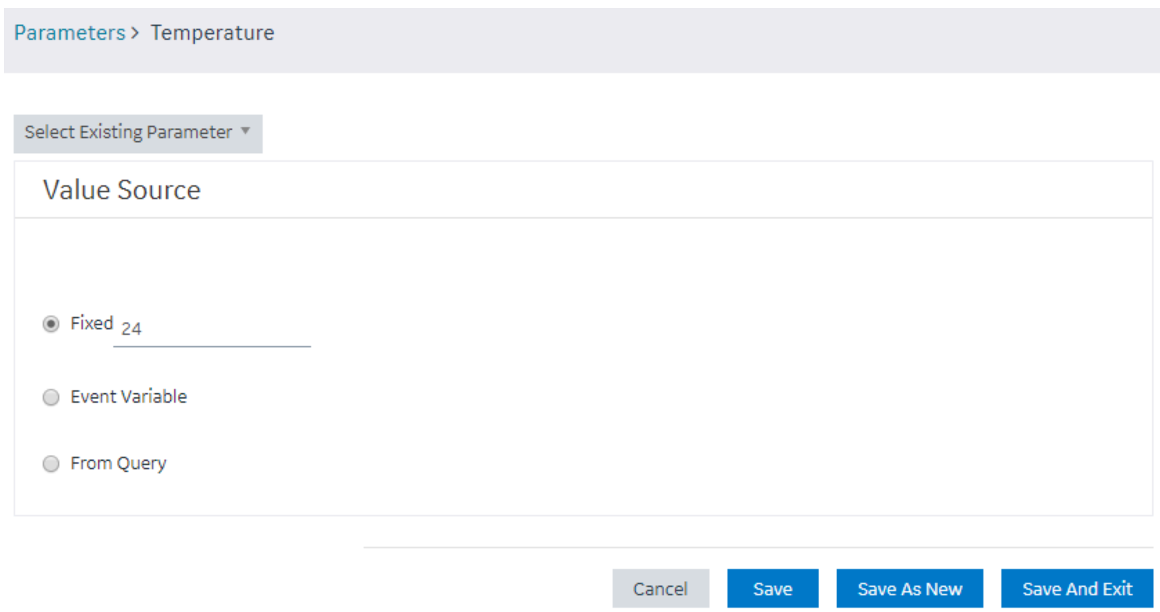
1. In the main navigation menu, select **PARAMETERS**.
   The **PARAMETERS** workspace appears.



2. Select **Add new parameter**.
   The **Create Parameter** window appears.



3. Enter a name in the **Parameter name** box, and then select **Create**. The name must contain at least one uppercase or lowercase letter.
   The parameter appears.



4. Enter or select values as described in the following table.

Option	Description
Fixed	Select this option if you want to create a parameter with a fixed value, and then enter the value. By default, this option is selected.
Event Variable	Select this option if you want to create a parameter using an event variable, and then select values in the **Select Event**, **Event Condition**, and **Condition Value** boxes that appear.

Option	Description
	◦ **Select Event**: Select the event whose variable you want to use while creating the parameter. After you select the event, the **Event Condition** box contains sequential numbers of conditions in the event. For example, if there are three conditions in the event, the **Event Condition** box contains the values 1, 2, and 3. ◦ **Event Condition**: Select the sequential number of the condition that you want to use. If you select a number, the **Condition Value** box contains a list of entity fields or device fields depending on whether you have selected an event condition or a device condition. ◦ **Condition Value**: Select the entity field or device field whose values you want to store in the parameter.
From Query	Select this option if you want to create a parameter using a query, and then select the query in the **Select Query** box that appears. It contains a list of Get queries in the site. If the query that you have selected requires input values, the corresponding fields appear. If that happens, enter values as needed. **Note:** The query that you want to use in a parameter should return only a single value.

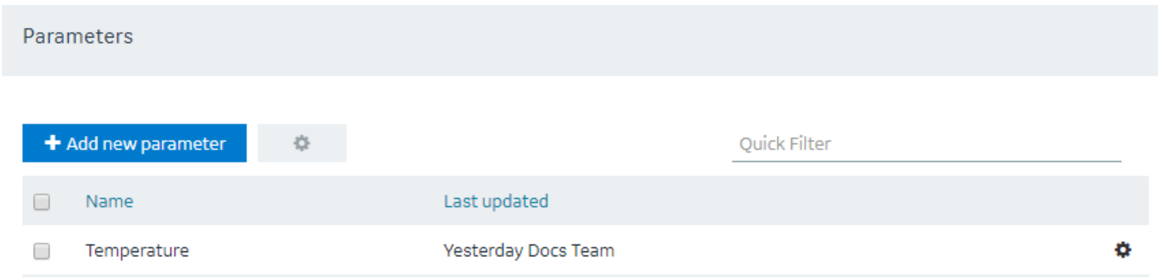
5. Select **Save** or **Save And Exit**.

   The parameter is created.

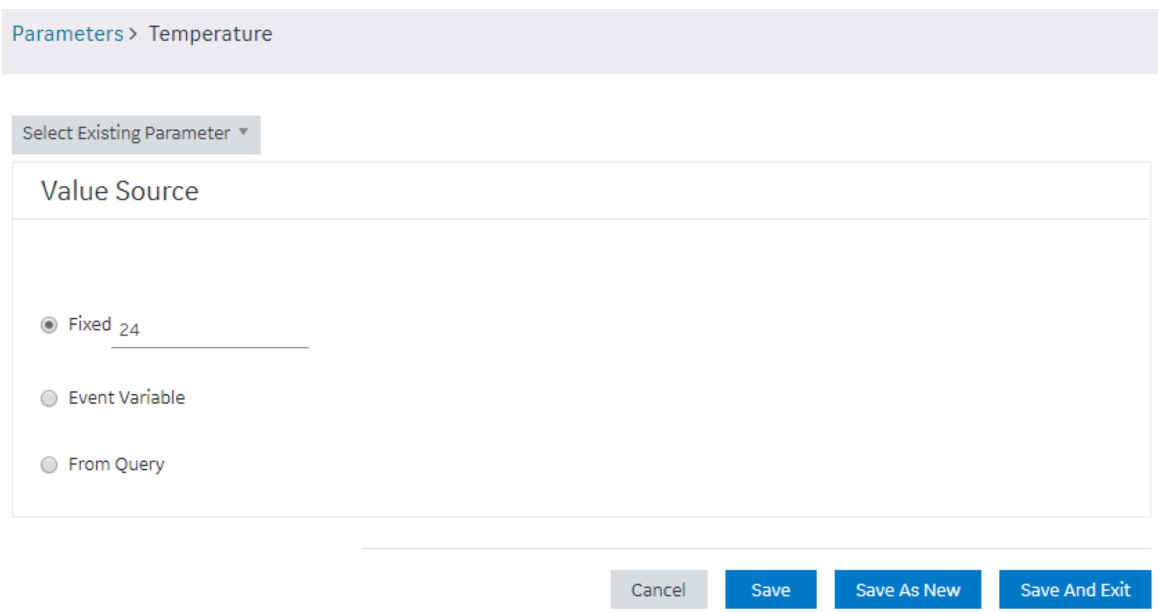
Copy a Parameter

This topic describes how to copy a parameter. You can also create a parameter *(on page 249)*.

1. In the main navigation menu, select **PARAMETERS**.
   The **PARAMETERS** workspace appears.



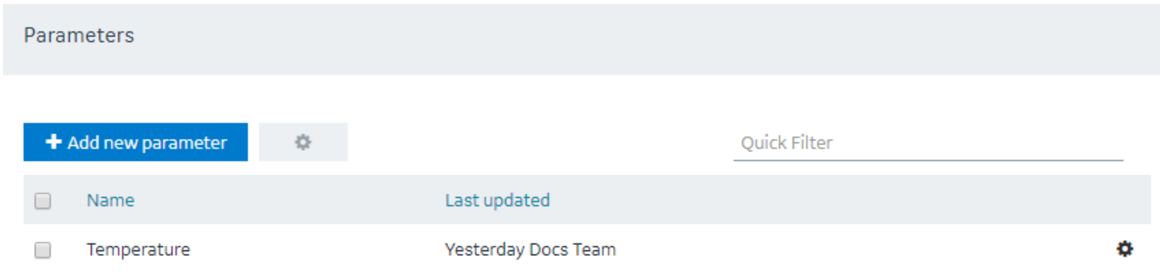
2. In the row containing the parameter that you want to copy, select the link.
   The workspace for the parameter appears.



3. As needed, modify values in the available fields, and then select **Save As New**.
   A window appears, asking you to enter a name for the parameter. By default, the name contains the name of the original parameter, appended with a system-generated value.
4. Modify the name of the parameter, and then select **OK**.
   The parameter is copied.

Delete a Parameter

1. In the main navigation menu, select **PARAMETERS**.
   The **PARAMETERS** workspace appears.

2. In the rows containing the parameters that you want to delete, select the check boxes.
3. In the workspace heading, select , and then select **Delete parameters**.
   A message appears, asking you to confirm that you want to delete the selected parameters.

   > **Tip:**
   >
   > Alternatively, in the row containing each parameter that you want to delete, select , and then select **Delete parameter**.

4. Select **Delete** or **Delete All**.
   The parameters are deleted.

Users

About Users

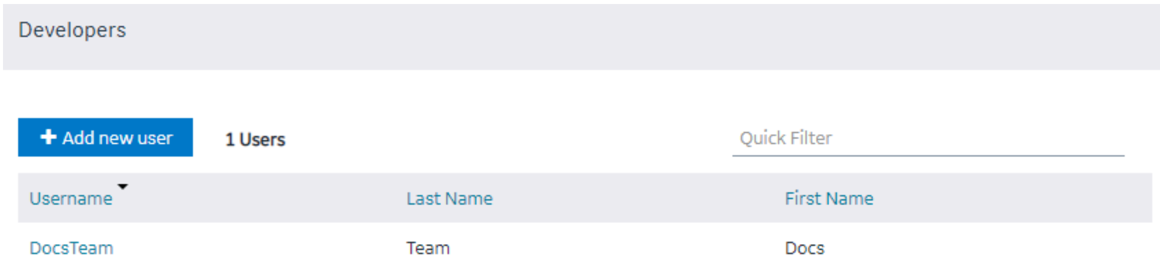
Using Operations Hub, you can create the following types of users:

- Developers: Users who will develop an application. These users can access the pages for creating an application. When you create a developer, an application user is also created for the developer with the same credentials.
- Application users: Users who will use an application. These users can only access applications to which they have been granted access. They cannot access the pages for creating an application.

Access a User

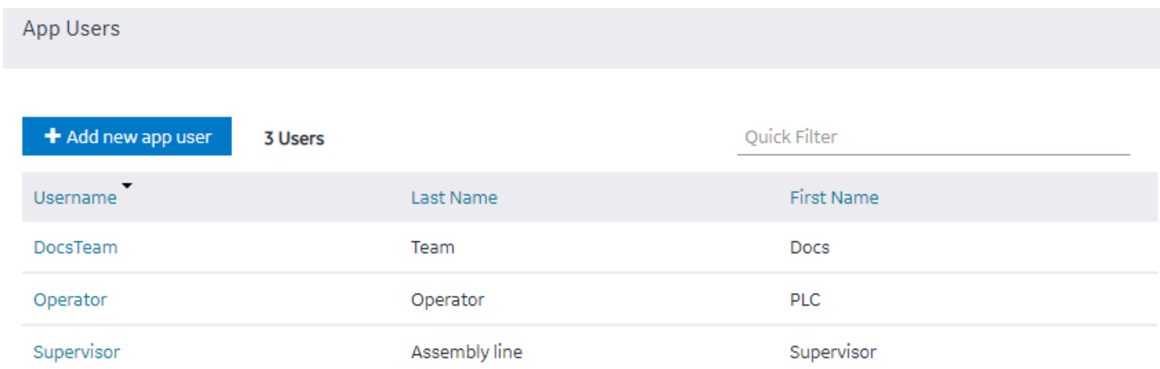
1. In the main navigation menu, select **MANAGE**.

   The **Developers** workspace appears, displaying a list of users who are developers.



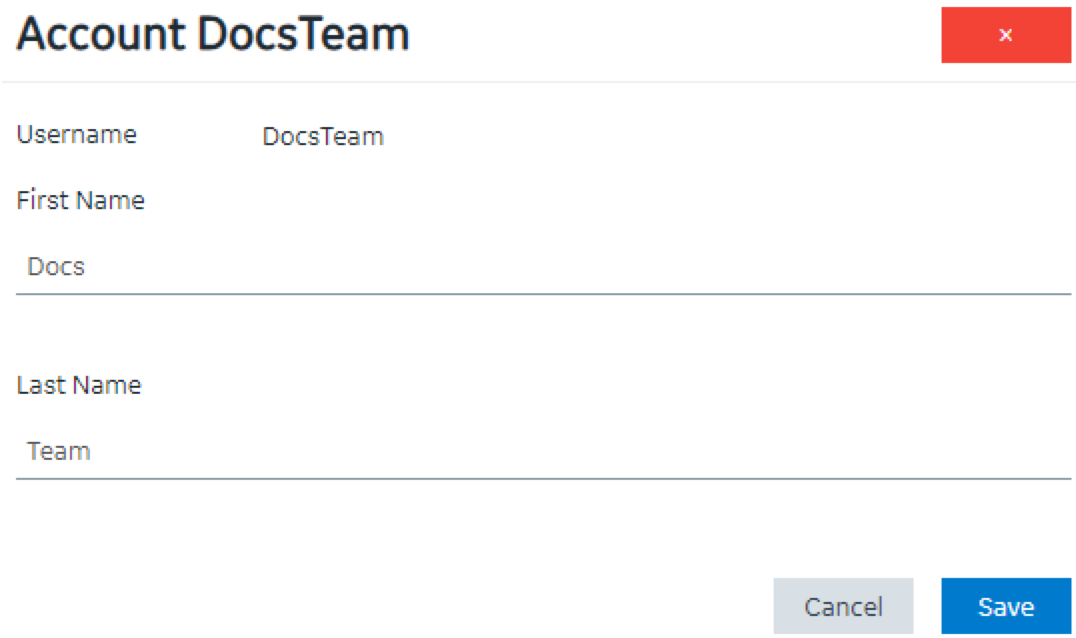
2. If you want to access an application user, in the module navigation menu, select **App Users**.

   The **App Users** workspace appears, displaying a list of application users.



3. In the row containing the user that you want to access, in the **Username** column, select the link.

   The **Account <user name>** window appears, displaying the details of the user.

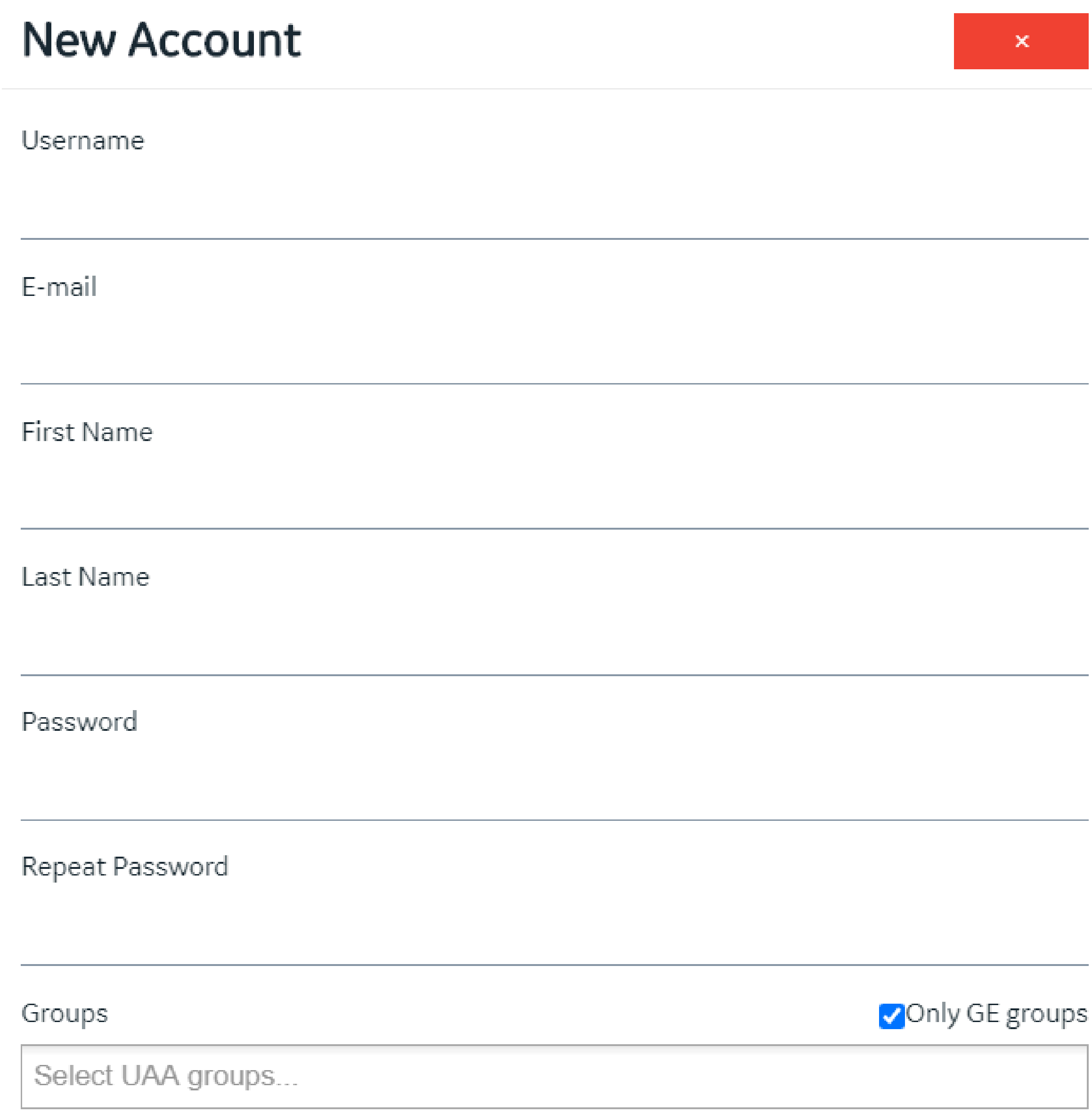


Tip:
If needed, you can modify the first and last names of your user account, and then select **Save** to save your changes. You cannot, however, modify the first and last names of any other user account.

Create a User

Only a tenant administrator can create and manage developers.

1. In the main navigation menu, select **MANAGE**, and then select **Developers** or **App Users**.
2. Select **Add new user**.
   The **New Account** window appears.



3. Enter values in the available fields as described in the following table.

Field	Description
Username	Enter the user name that the user will use to log in to Operations Hub. The value must be unique.
E-mail	Enter the email ID of the user. The value must be unique.
First Name	Enter the first name of the user.

Field	Description
Last Name	Enter the last name of the user.
Password	Enter a password that the user will use to log in to Operations Hub. The password must meet the following criteria: ◦ Must contain between 8 and 15 characters ◦ Must include at least one number ◦ Must include at least one uppercase or lowercase letter
Repeat Password	Enter the password that you have entered in the Password field.
Only GE Groups	Select this check box if you only want to view groups associated with GE products in the Groups list box.
Groups	Select the UAA group that you want to assign to this user.

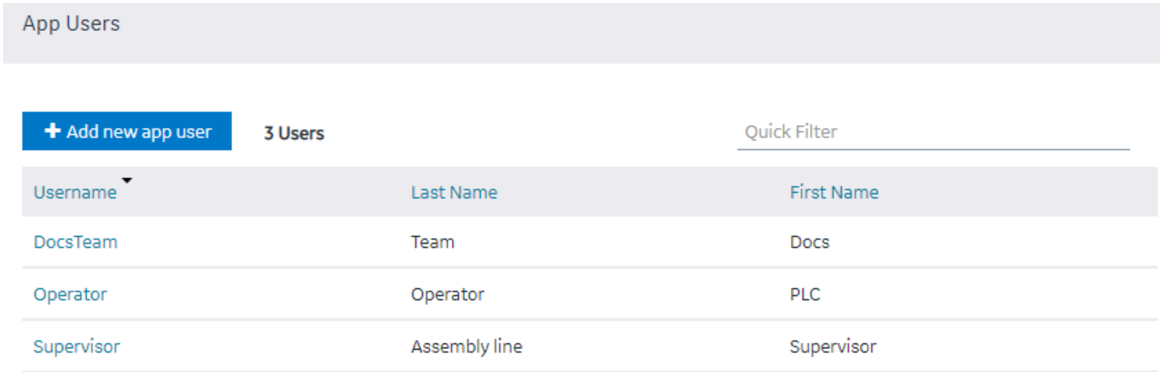
4. Select **Create**.
   The user is created. If you have created a developer, an application user is also created.

If you have created an application user, provide access to one or more applications to the user.

Grant Access to a Role

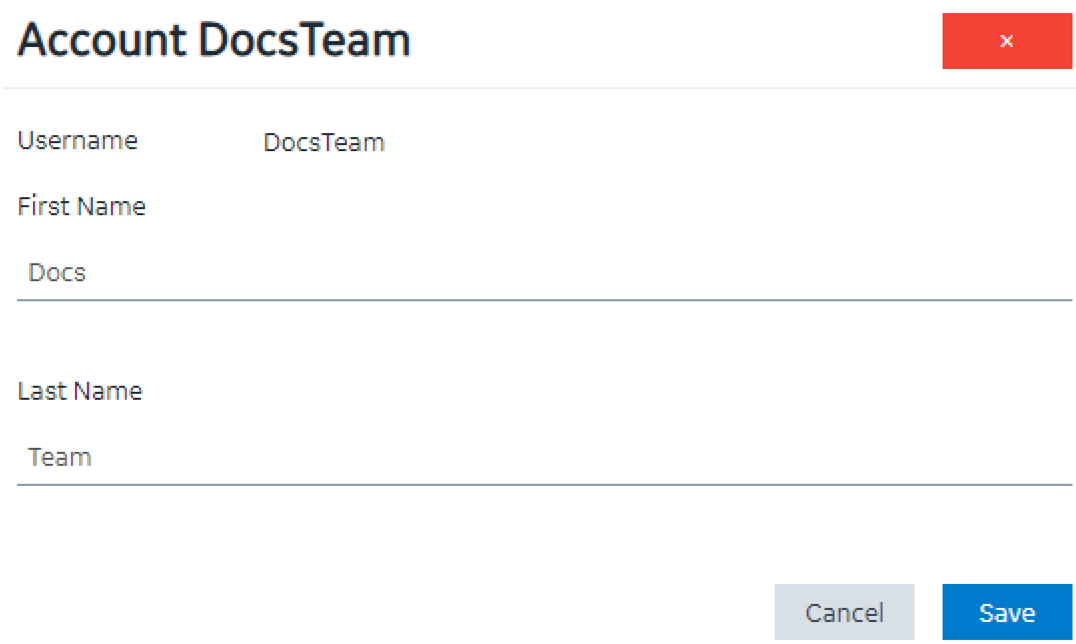
This topic describes how to grant access to a role. You can also grant access to an application *(on page 139)*.

1. In the main navigation menu, select **MANAGE**, and then select **App Users**.
   The **App Users** workspace appears, displaying a list of application users.



2. In the row containing the user to whom you want to grant access, in the **Username** column, select the link.

   The **Account <user name>** window appears, displaying the details of the user.



3. In the **Apps** box, select the applications to which you want to grant access to the user.
4. In the **Role Groups** box, select the check boxes corresponding to the categories and groups to which you want to grant access to the user.

> **Tip:**
> When you select a category or a group, all the underlying groups in the hierarchy are selected. You can clear the check box corresponding to a category or a group if you do not want to grant access to it.

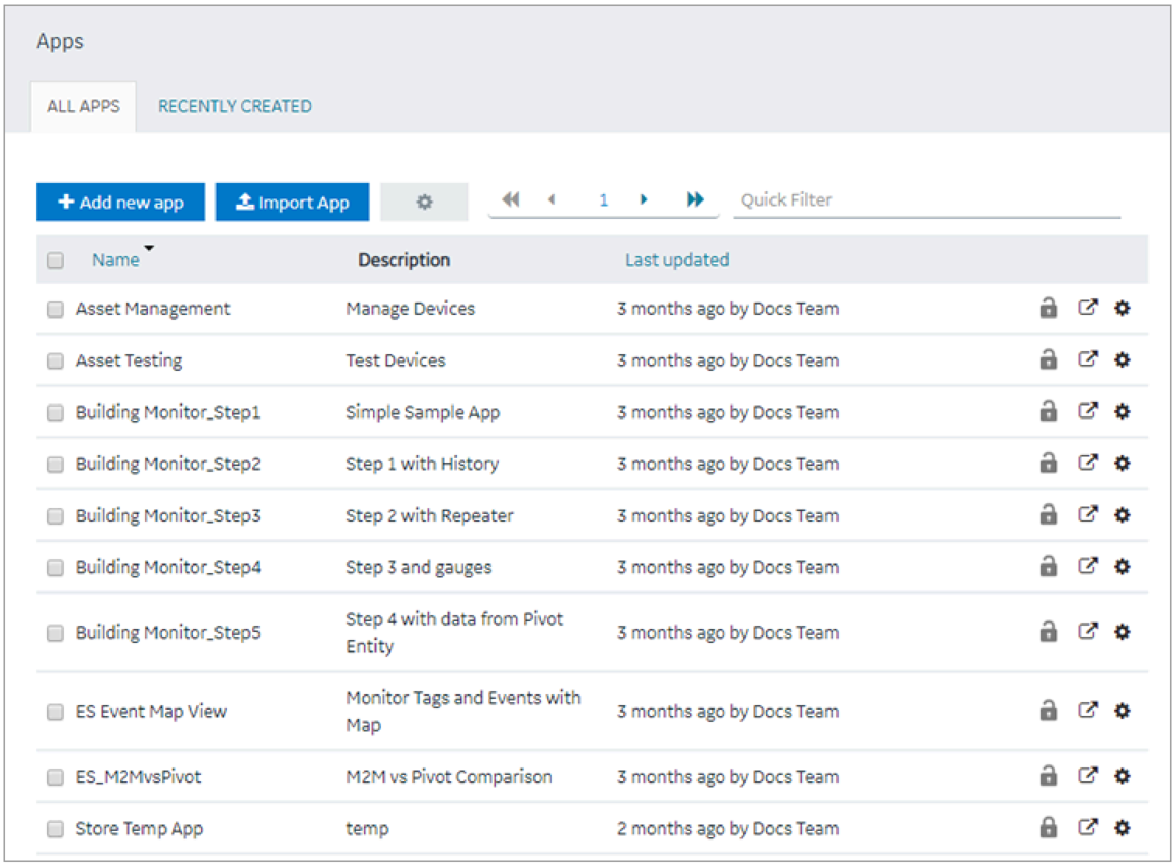
5. Select **Save**.

   The user can now access the selected applications, categories, and groups.

Revoke Access to an Application

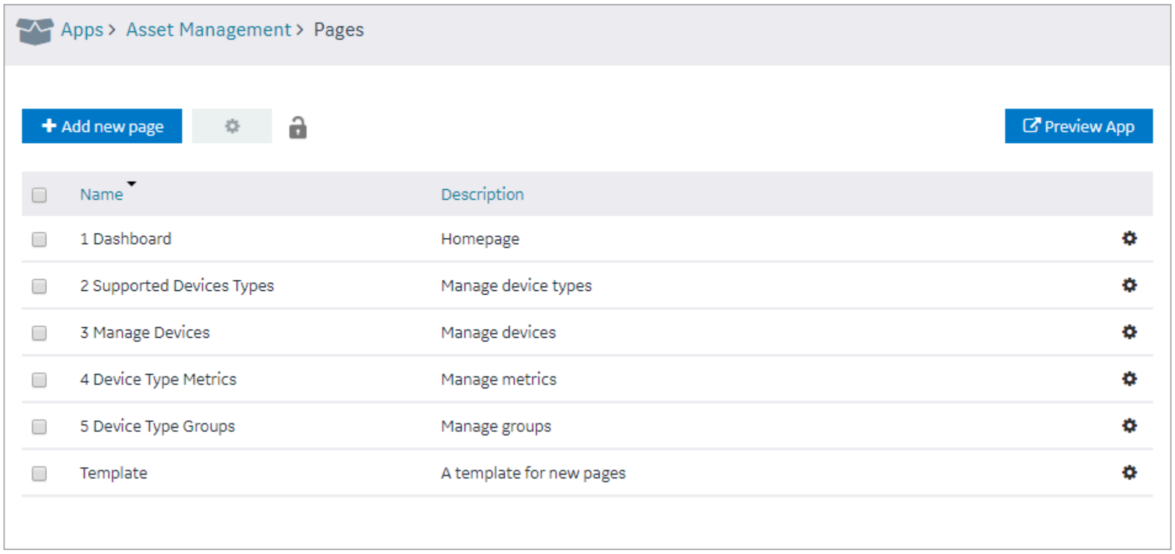
1. In the main navigation menu, select **APPS**.

   The **APPS** workspace appears.

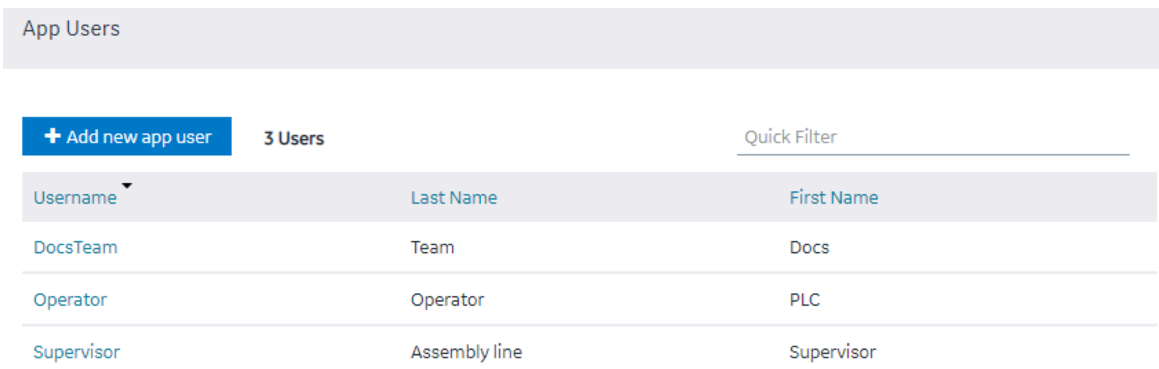
   

2. In the **Name** column, select the application for which you want to revoke access.

   The **PAGES** workspace appears.



3. In the main navigation menu, select **APP USERS**.
   The **APP USERS** workspace appears, displaying a list of application users created in the site.

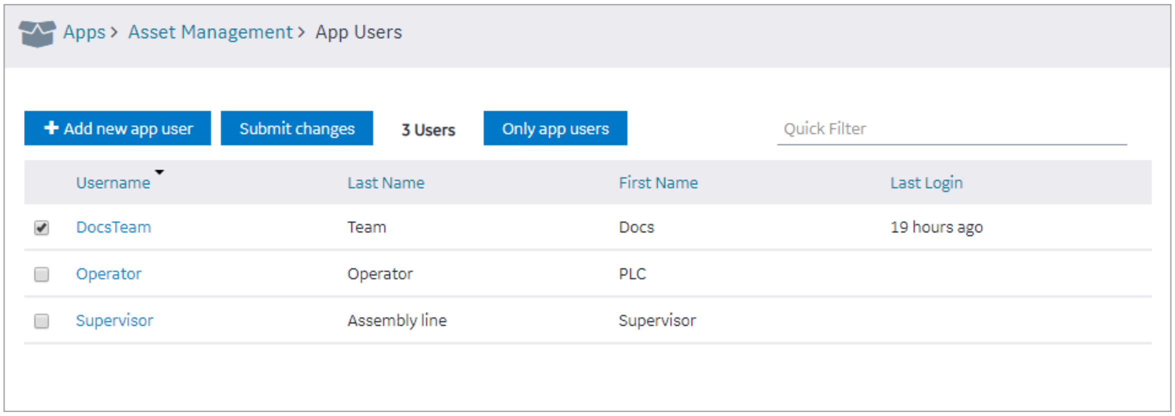


4. In each row containing a user whose access you want to revoke, clear the check box, and then select **Submit changes**.
   Access to the application is revoked for the selected users.

Delete a User

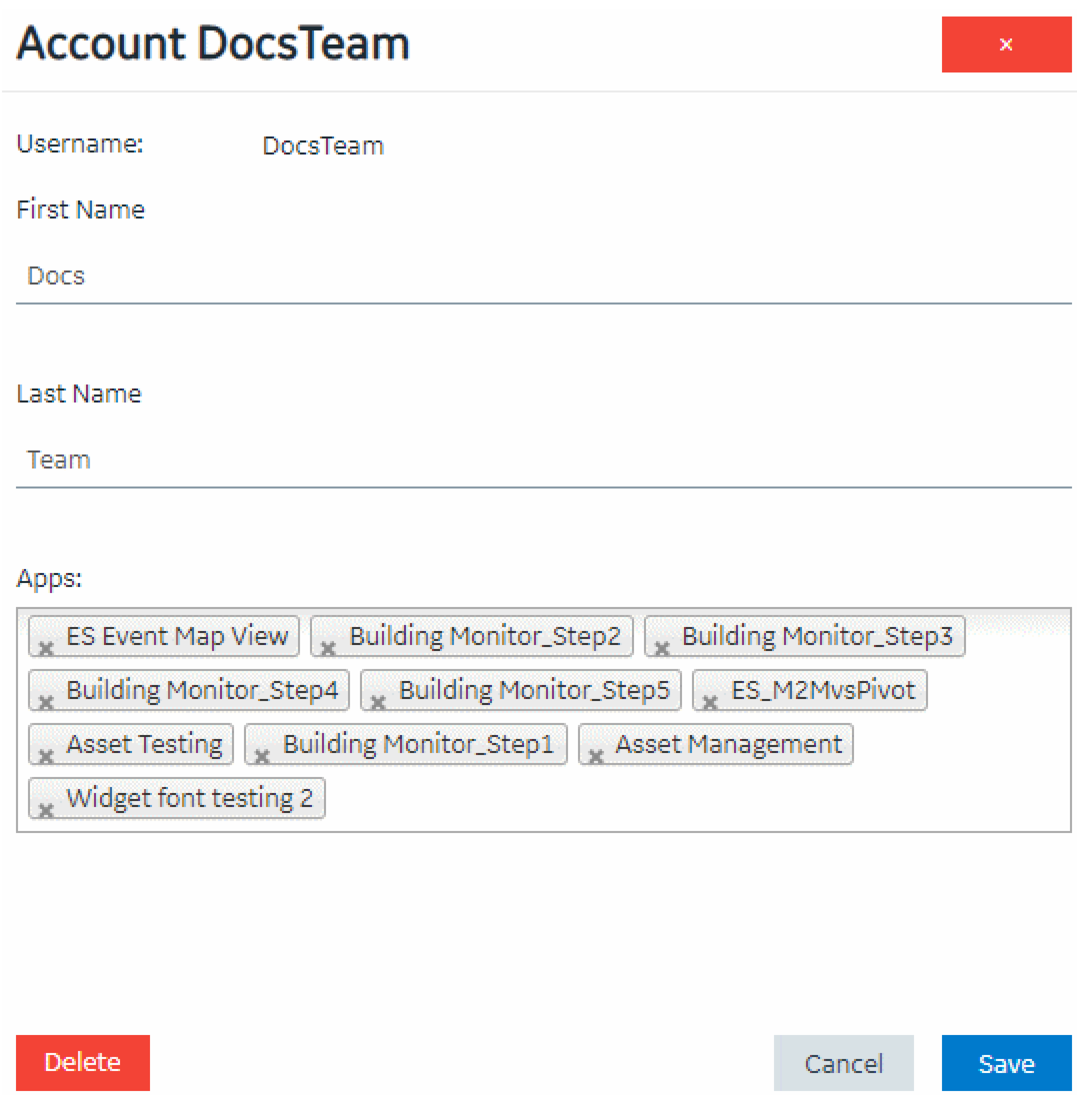
You cannot delete your user account.

1. In the main navigation menu, select **MANAGE**, and then select **App Users**.
   The **App Users** workspace appears.



2. In the row containing the user that you want to delete, select the link in the **USERNAME** column.

   The **Account <user name>** window appears, displaying the details of the user.



3. Select **Delete**.

   A message appears, asking you to confirm that you want to delete the user.
4. Select **OK**.

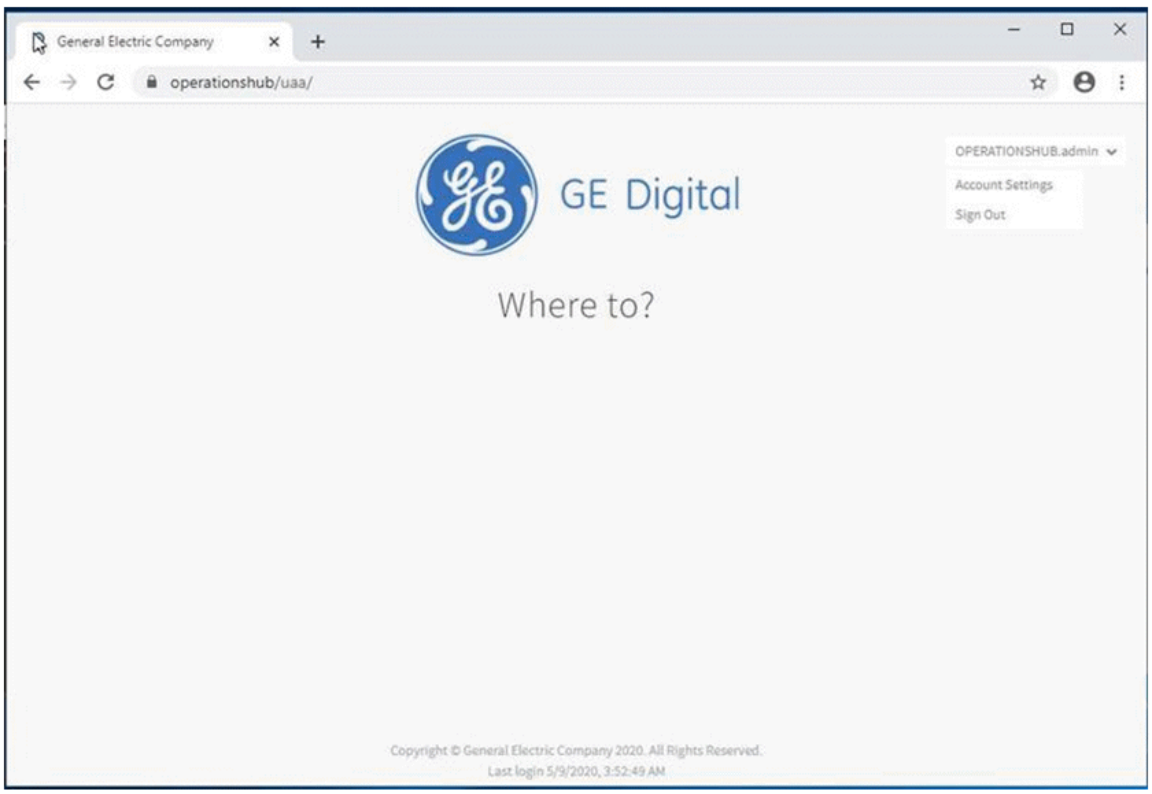
   The user is deleted.

Change Your Password

If a user wants to change his or her password in Operations Hub, use the following steps to do so.

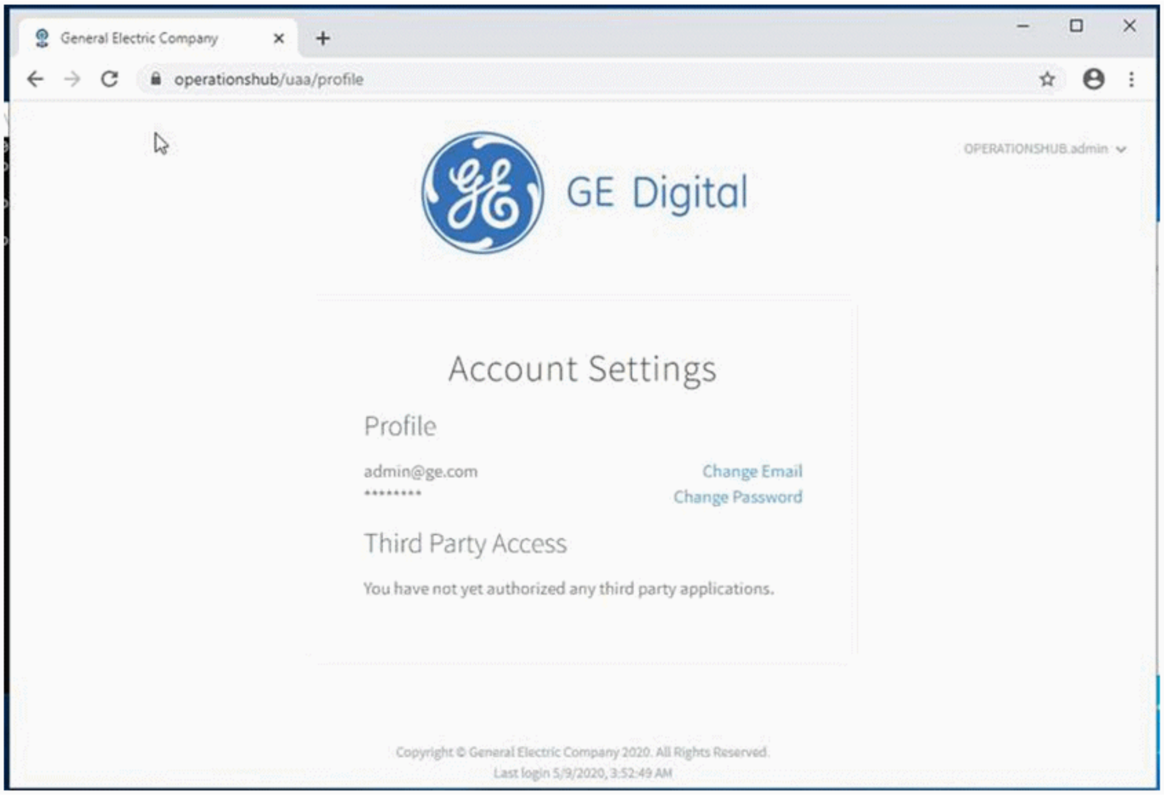
1. Log out of all instances of Operations Hub, and close your browser.
2. Reopen your browser, and go to this page: https://*machineName*/uaa/login.

   The following screen appears.



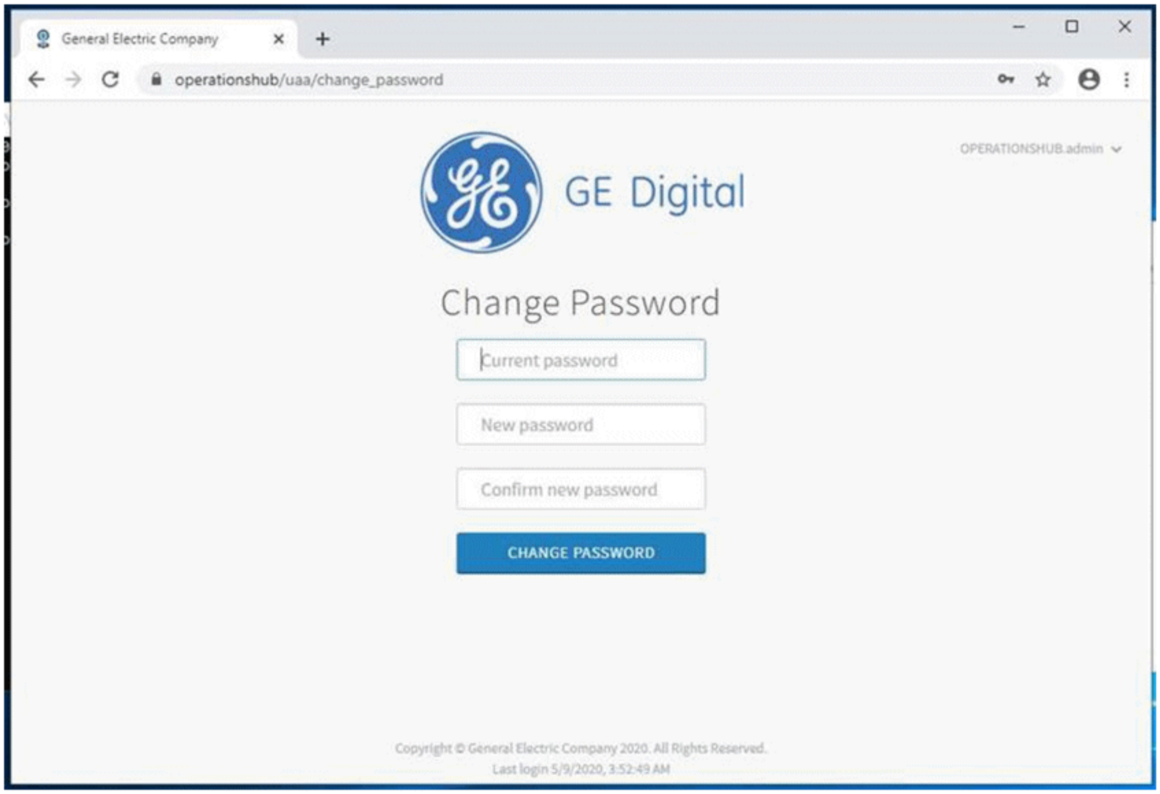
3. In the upper right-hand corner of the screen, click **Account Settings.**

The following screen appears.



4. Select the **Change Password** link.

The next screen appears.



5. In the **Current Password** field, enter the existing password.
6. In the **New Password** field, enter the new password that you want to use to log in to Operations Hub.

   The password must meet the following criteria:

   - Must contain between 8 and 15 characters

     Note:
     For the 2.0 release, the password cannot be 15 characters long.

     This rule applies only when setting up the password for the first time for the first user account (OphubAdmin). After the completion of iqp-provisioner, the initial password for OphubAdmin can also be updated to a password of 15 characters length. Subsequent user accounts (including LDAP, external IDP accounts) can have a password length of 15 characters.

   - Must include at least one number
   - Must include at least one uppercase or lowercase letter

7. In the **Confirm New Password** field, enter the new password again.
8. Click **Change Password** to proceed.

Roles

About Roles

You can create roles to define which users can access specific information. When you create a role, you create a category and a group within that category. You can create multiple categories containing multiple levels of groups.

Managing Access to Data Fields

Suppose you have created an application that provides the following details of users, and you want only the Finance personnel to view the salary details:

- User name
- User ID
- Joining date
- Salary

In this case, you will perform the following tasks:

1. Create a category named Department.
2. In the Department category, create a group named Finance.
3. Modify the **Roles Conditions** section of the query that fetches the user account details as follows:
    a. In the **Entity field** box, select the field that stores the salary details.
    b. In the **Access** box, select **Permitted Roles**.
    c. In the **Roles** box, expand the Department category, and select the check box corresponding to the Finance group.
    d. Save the query.

    When the query is run, the user name, user ID, and joining date details are returned to all users. However, users who belong to the Finance department will also see the salary details.

Managing Access to Data Rows

Suppose you have created an application that provides the following details of users, and you want all users to only see rows from their location:

- User name
- User ID

- Joining date
- Salary
- Location

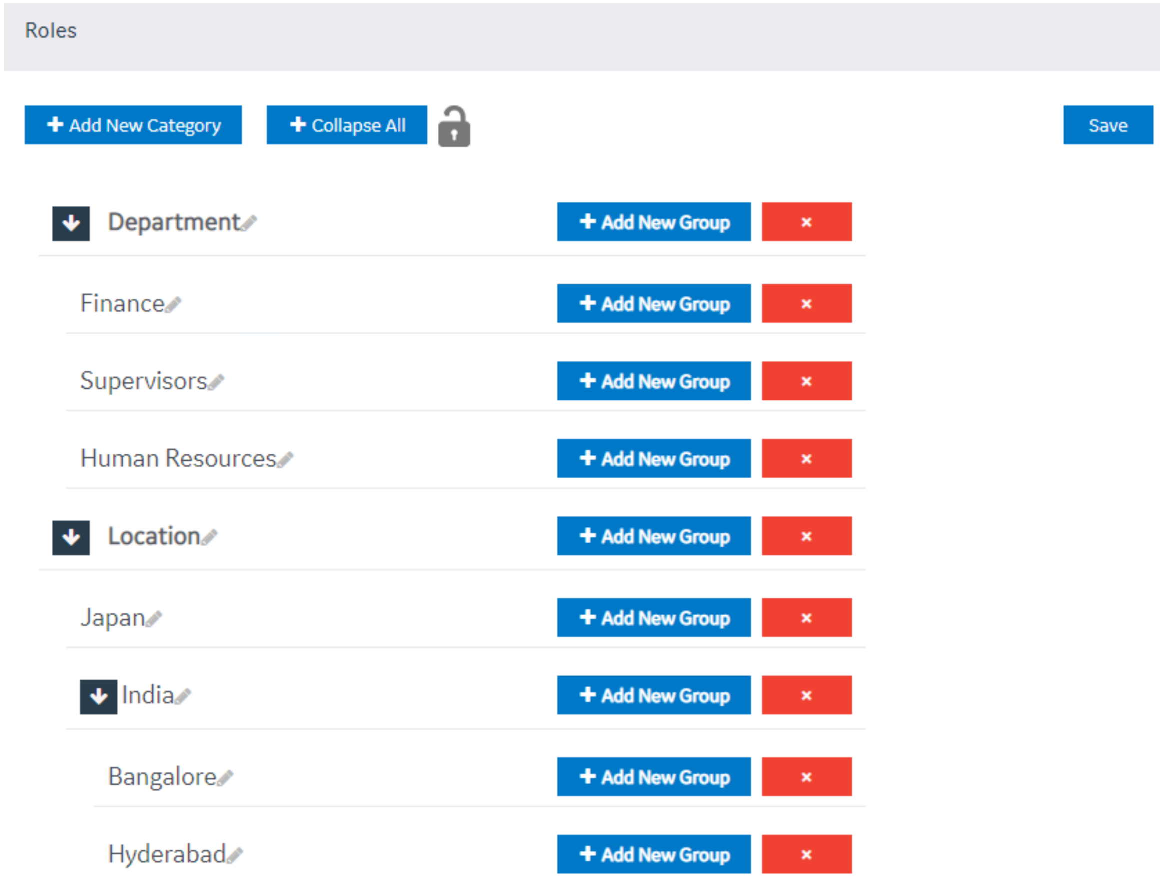
In this case, you will perform the following tasks:

1. Create a category named Locations.
2. In the Location category, create groups for each location.
3. Modify the **Roles Conditions** section of the query that fetches the user account details as follows:
    a. In the **Apply conditions to** section, select **All roles**.
    b. In the **Row visibility** box, select **Filter rows**.
    c. In the **Entity field** box, select the field that stores the location of the user.
    d. In the **In user's role tree** box, select the Locations category.
    e. Save the query.

    When the query is run, users will only see records where the Location field matches the Location role that has been allocated to them.

Access a Category or a Group

1. In the main navigation menu, select **MANAGE**, and then select **Roles**.
   The **Roles** workspace appears, displaying a list of categories and groups.



2. In the row containing the category that you want to access, select .
   The category expands, displaying a hierarchical view of groups.

> **Tip:**
> You can select **Expand All** to expand all categories and groups.

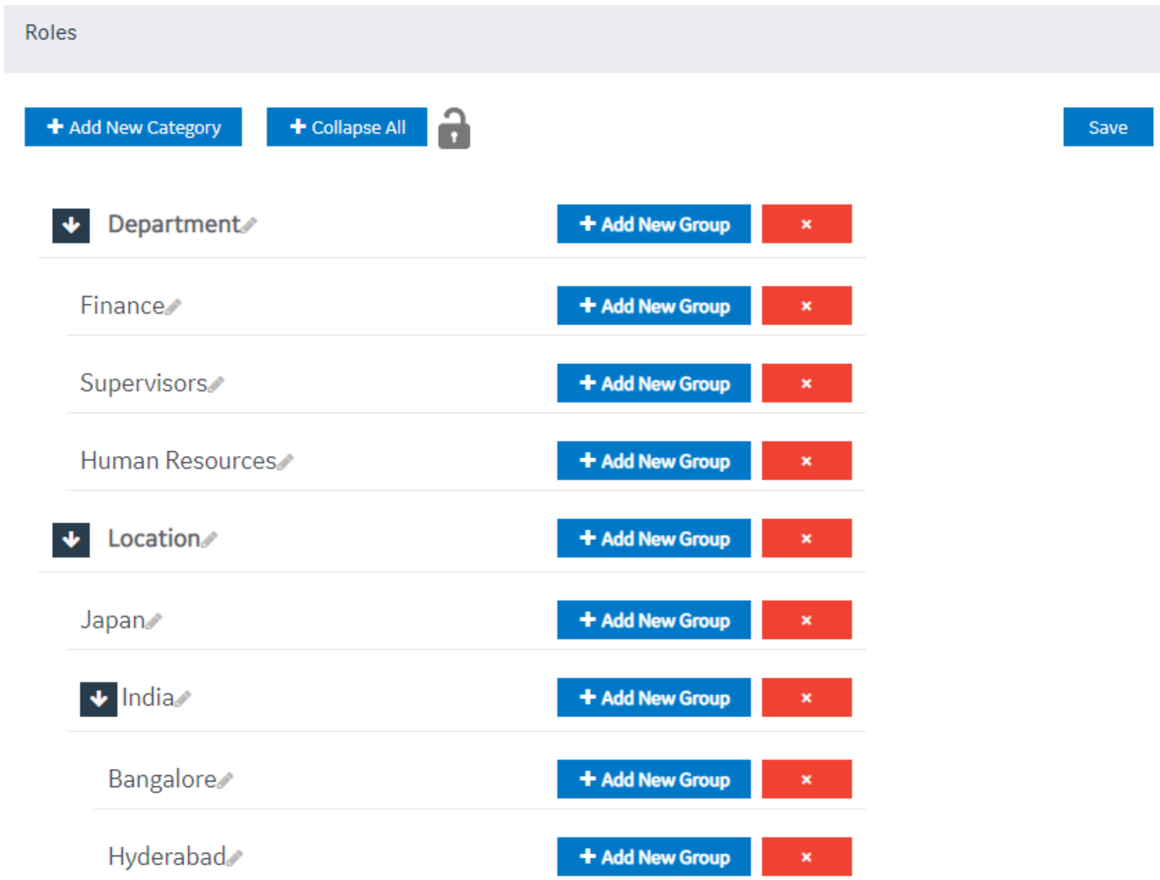
3. If you want to access a group, navigate to the group in the hierarchy.

> **Tip:**
> If needed, you can modify the name of a category or a group by selecting next to the name.

Create a Category

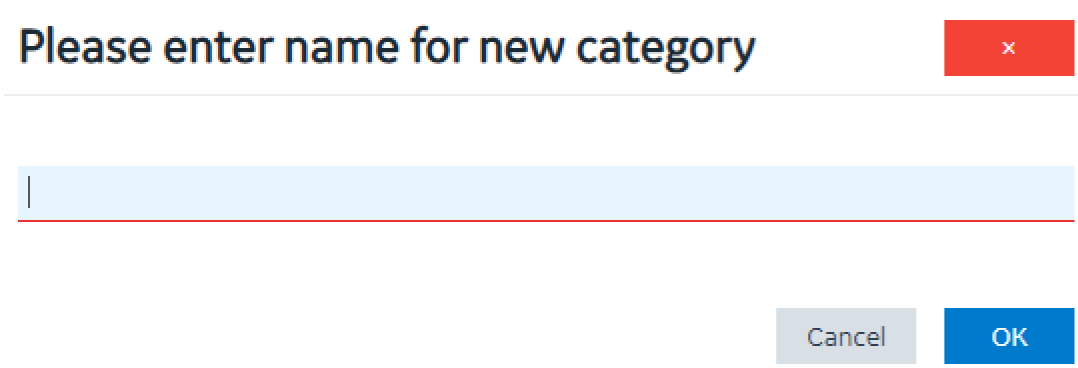
1. In the main navigation menu, select **MANAGE**, and then select **Roles**.

   The **Roles** workspace appears, displaying a list of categories.



2. Select **Add New Category**.

   A window appears, asking you to enter a name for the category.



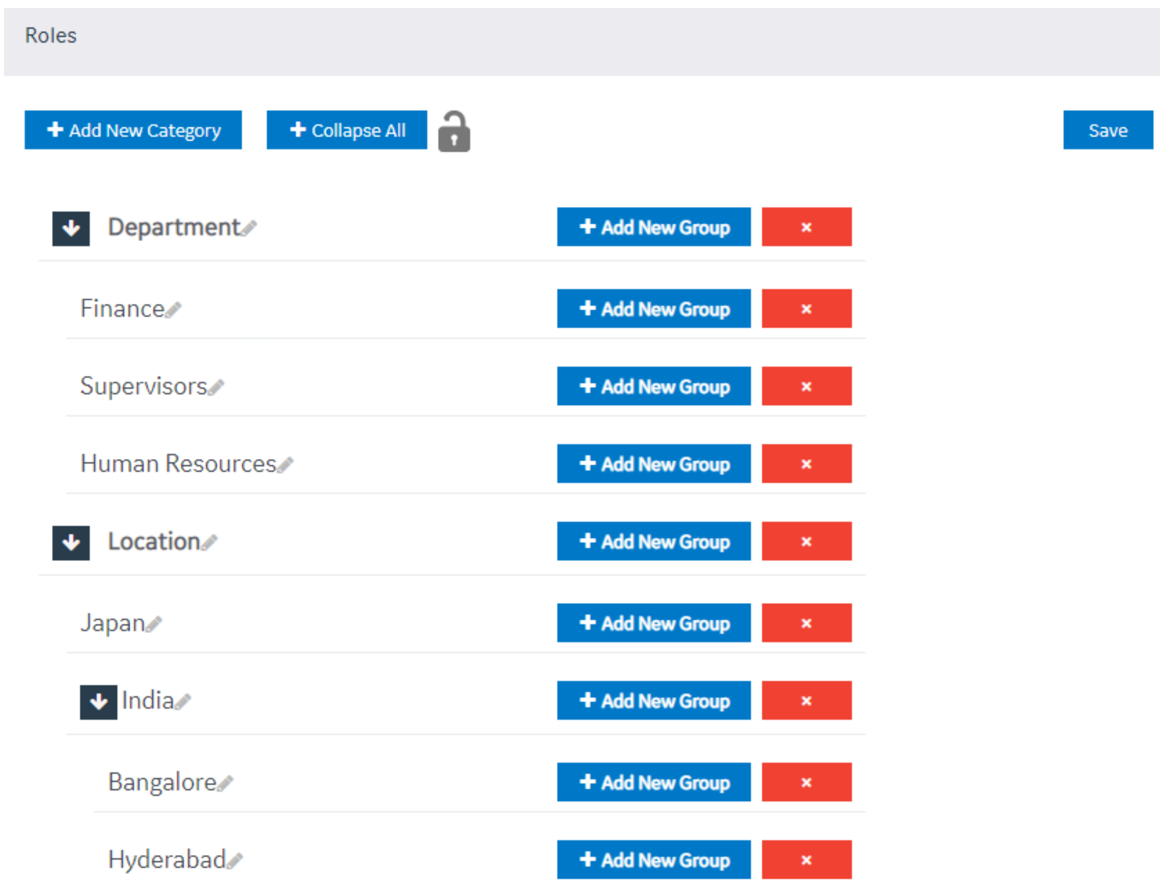
3. Enter a name, and then select **OK**. The name must contain at least one uppercase or lowercase letter.
   The category is created.

Create a group *(on page 265)*.

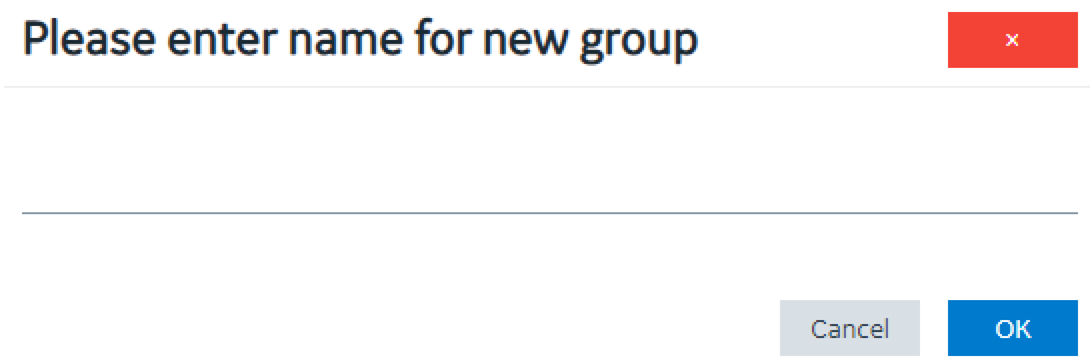
Create a Group

Create a category *(on page 265)*.

1. In the main navigation menu, select **Roles**.
   The **Roles** workspace appears, displaying a list of categories.



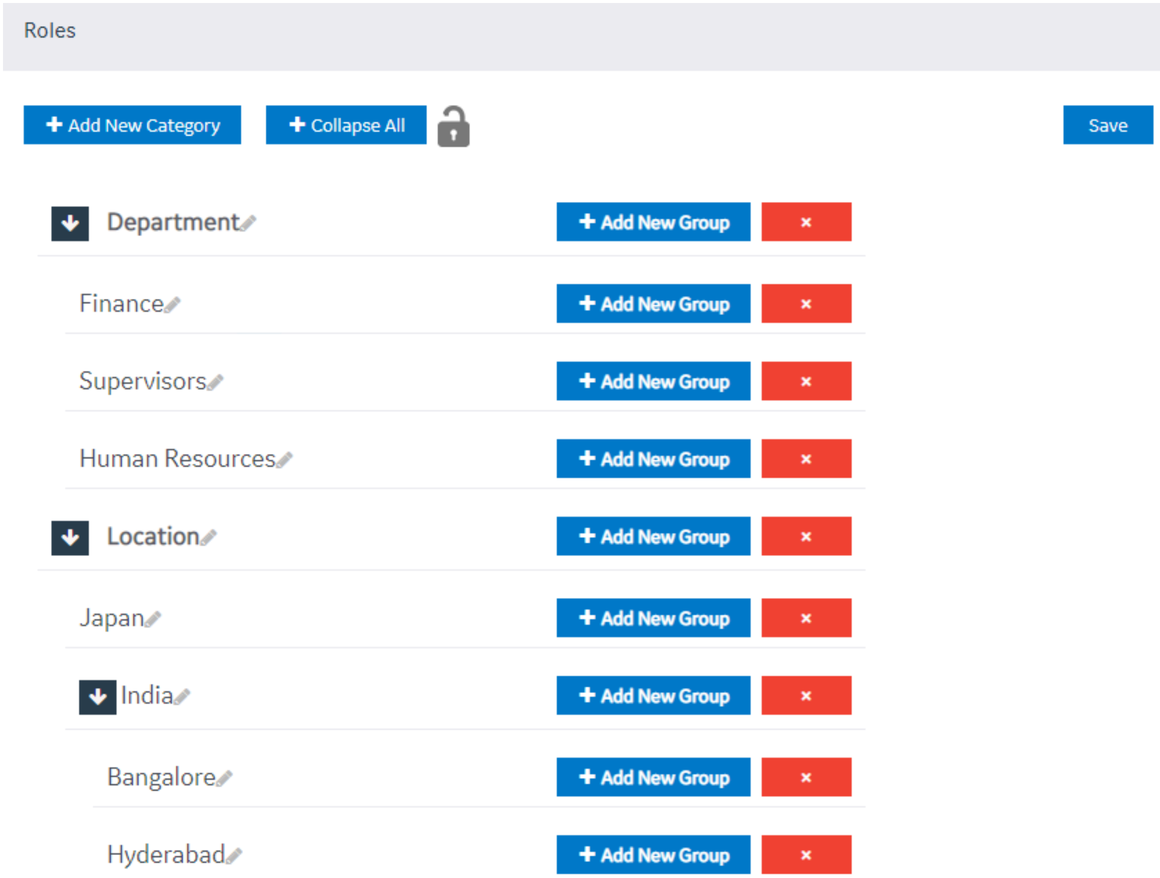
2. In the row containing the category in which you want to create a group, select **Add New Group**.
   A window appears, asking you to enter a name for the group.



3. Enter a name, and then select **OK**. The name must contain at least one uppercase or lowercase letter.
   The group is created.

Delete a Category or a Group

1. In the main navigation menu, select **MANAGE**, and then select **Roles**.
   The **Roles** workspace appears.



2. In the row containing the category or group that you want to delete, select .
   A message appears, asking you to confirm that you want to delete the category or group.

> **Tip:**
>
> To access a list of groups in a category, select in the row containing the category.

3. Select **OK**.
   The category or group is deleted.

Administration

Runtime Model

Create a model to build the runtime structure and content.

You can set up the types of equipment to use, the instances of equipment to appear in the runtime context, the information to display about the equipment, and the data sources for supplying data. The Model Editor user interface helps you create and modify your model.

Model Editor

Use the Model Editor to create and modify asset object types and asset objects in your model.

To begin building a model, follow these tasks:

- Create Data sources *(on page 285)*
- Configure Data Distributor Settings *(on page 271)*
- Set Up the Data Model Structure *(on page 272)*
- Define Objects *(on page 273)*
- Set Up Runtime Navigation *(on page 275)*

Supported Characters for the Model

Before creating object types, objects and data variables, review the following tables to see which characters are supported as well as restricted.

Supported Characters

<table>
<tr><th>Character</th><th>Description</th></tr>
<tr><td>!</td><td>Exclamation Point</td></tr>
<tr><td>@</td><td>At sign</td></tr>
<tr><td>^</td><td>Caret</td></tr>
<tr><td>$</td><td>Dollar Sign</td></tr>
<tr><td>()</td><td>Parentheses</td></tr>
<tr><td>|</td><td>Pipe</td></tr>
<tr><td>.</td><td>Period</td></tr>
<tr><td>`</td><td>Grave Accent</td></tr>
<tr><td>~</td><td>Tilde</td></tr>
<tr><td>-</td><td>Hyphen</td></tr>
<tr><td>_</td><td>Underscore</td></tr>
</table>

> **Note:**
> A single space is allowed but a succession of spaces is not.

Unsupported Characters

Character	Description
#	Number Sign
%	Percent Sign
\	Backslash
,	Comma
?	Question Mark
;	Semicolon
+	Plus Sign
:	Colon
"	Quotation Marks
'	Apostrophe
< >	Greater than/Less than Symbols
{}	Braces
/	Slash
=	Equal Sign
*	Asterisk
&	Ampersand

Manage Data Source Servers

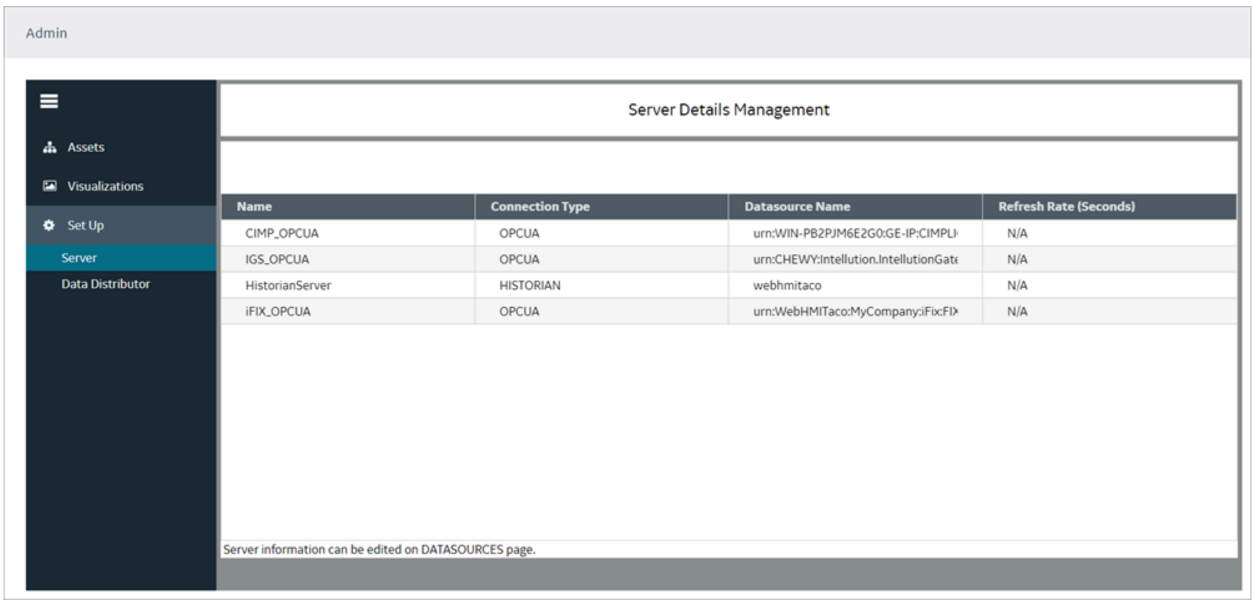
Access the details for the data source servers that are used to populate data in your model.

This is a view-only section in Operations Hub.

To access the data source server details:

1. In the Administration environment, select **Set Up** and then **Server**.
2. The **Server Details Management** screen appears with a list of servers set up in your system along with their details:

Column	Description
Name	The server name.
Connection Type	The connection type, whether OPC UA or Historian.
Datasource Name	The data source name associated to the server.
Refresh Rate (Seconds)	The time set for refreshing the application, for example, every 5 seconds.



To configure data sources for Historian and OPC UA, refer to Create a Data Source *(on page 285)*.

Configure Data Distributor Settings

Create a Data Source *(on page 285)*.

Data distributor is a component in Operations Hub that communicates with the Historian servers configured with Operations Hub. It performs the following tasks:

- Fetches a list of Historian tags.
- Fetches Historian data based on the parameters that you have specified.
- Reads and updates notes.
- Subscribes for updates on Historian tag value changes.

Using the data distributor settings, you can specify the log level of the data distributor. For example, you can choose a verbose log level to help you troubleshoot issues with fetching data from the Historian server.

1. In the administrative environment, select **Set Up > Data Distributor**.
2. In the **Logging level** box, select one of the following log levels:
    - Info
    - Error
    - Warn
    - Debug
    - Verbose

   The data distributor settings are configured.

Set Up the Model Structure

Object types define the structure of the equipment pieces within your model. For each object type, such as a StorageTank, you set up all the data variable names, such as TankLevel, that any asset object associated with this type can reuse in its own definition.

Using the **Contained Types** area, you set up the parent/child relationship of asset object types in the model. For example, StorageTank1 and SuctionValve2 are the children that comprise the FinishedWaterPumpStation. In Runtime, the children appear under the parent in the navigational context.

1. In the Administration environment, navigate to **Assets > Object Types > New**.
   The **Object Type Information** screen appears.
2. Enter a unique name for the new object type and provide a description.
3. Select **Save**.
4. Select **Data Variables** to add variable names whose data will come from the data sources.
5. To add a variable name for this object type, do the following:
    a. Select **+** above the table.
    b. In **Variable**, enter the name of the data variable, such as Pressure.
    c. In **Data Type**, select the type of data this variable stores: Boolean, String, or Number.
    d. In **Description**, explain the purpose of the data variable.
6. Repeat the above steps for each new object type.

7. To define an asset object type as a parent of other types, do the following:
    a. Select **Contained Types**.
    b. Choose the parent by selecting an object type on the left panel.
    c. Select **+** above the table to add children to the parent.
    d. Select the object type to become a child and provide an alias name.
8. Select **Save**.

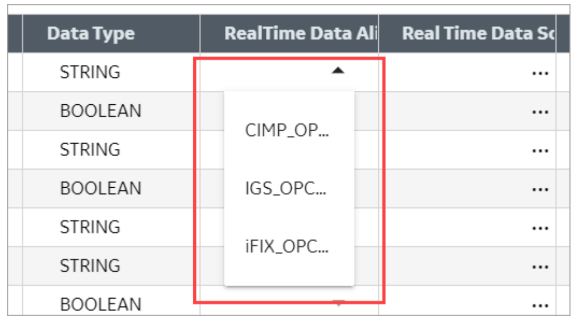
Define Objects

Asset objects are the instances of equipment pieces, such as StorageTank1, to appear in the model. For each object, you determine which data variables derived from its object type to reuse, and then define them accordingly.

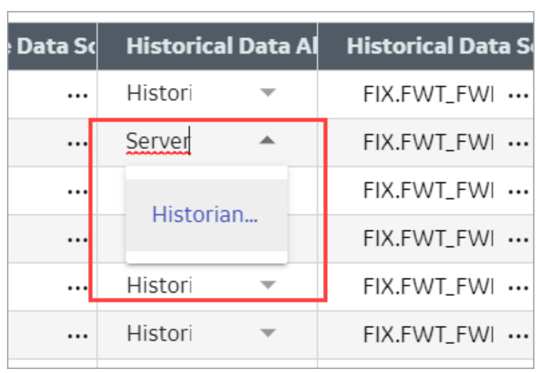
- Objects appear alphabetically.
- Always use a unique object name.

1. In the Administration environment, navigate to **Assets > Objects**.
   If objects are already defined, the left panel lists them.
2. To add a new object, select **New**.
   The **New Object** screen appears.
3. Select the object type for this object.
   The children of the object type appear under **Contained Objects** if defined. The system automatically generates a contained object name from the alias and appends an instance number to it, such as DPump1_1. The next time another asset object reuses the object type with this contained object, the instance number is increased by one, which in this example is DPump1_2.
4. Type a unique name for the new object and provide a description.
5. Select **Save**.
   The new object appears with the data variables of its object type.
6. Define each data variable that you want to use for this object by doing the following:

Column	Description
RealTime Data Alias	You receive real time data from data sources such as iFIX, CIMPLICITY, IGS, or any other third party OPC UA server. Select ▼ to choose a data source from the list of available data sources.

<table>
<tr><th>Column</th><th>Description</th></tr>
<tr><td></td><td>
</td></tr>
<tr><td>RealTime Data Source</td><td>Select to browse the data source and select items that feed live data to this variable, which can appear in the trend chart or a widget that is configured with this model property.

Refer to Browse Data Sources (on page 299).</td></tr>
<tr><td>Historical Data Alias</td><td>You receive historical data from the Historian data source.

Select to choose a data source from the list of available Historian data sources.

</td></tr>
<tr><td>Historical Data Source</td><td>Select to select Historian tags that feed Proficy Historian data to this variable, which can appear in the trend chart or a widget that is configured with this model property.</td></tr>
</table>

Column	Description
	Refer to Browse Data Sources *(on page 299)*.

7. Select **Save**.

Duplicate Objects

When an object uses similar data variables and contained objects as a configured object, you can duplicate the configured object to create new objects for your model.

1. In the Administration environment, navigate to **Assets > Objects**.
2. Select **Duplicate**.
   The duplicated object appears highlighted in the left panel with Copy appended to its name.
3. Change the name in the **Name** field and select **Save**.
   The renamed asset object appears in the left panel. You cannot rename the asset after selecting **Save**.
4. To duplicate more instances of the same object, continue to select **Duplicate** and repeat step 3.
   The duplicated objects appear highlighted in the left panel with Copy and a number appended to their names, such as pump1_copy(1), pump1_copy(2), and so on.

Set Up Runtime Navigation

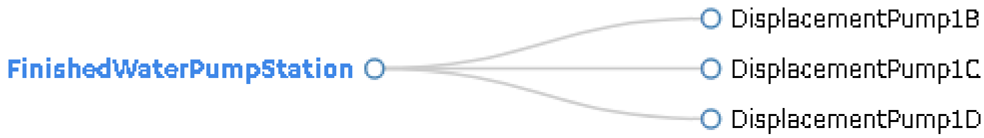
Use the Navigation app to visually structure the runtime hierarchy of objects.

Changing the root of an existing runtime navigation hierarchy requires that you clear the entire hierarchy and then rebuild it.

1. In the Administration environment, navigate to **Visualizations > Navigation**.
   All objects appear in the left panel with check boxes.
2. Select the parent check box and then select **+** at the top of the left panel.
   The parent object instance appears in the app area. The following shows the FinishedWaterPumpStation parent.

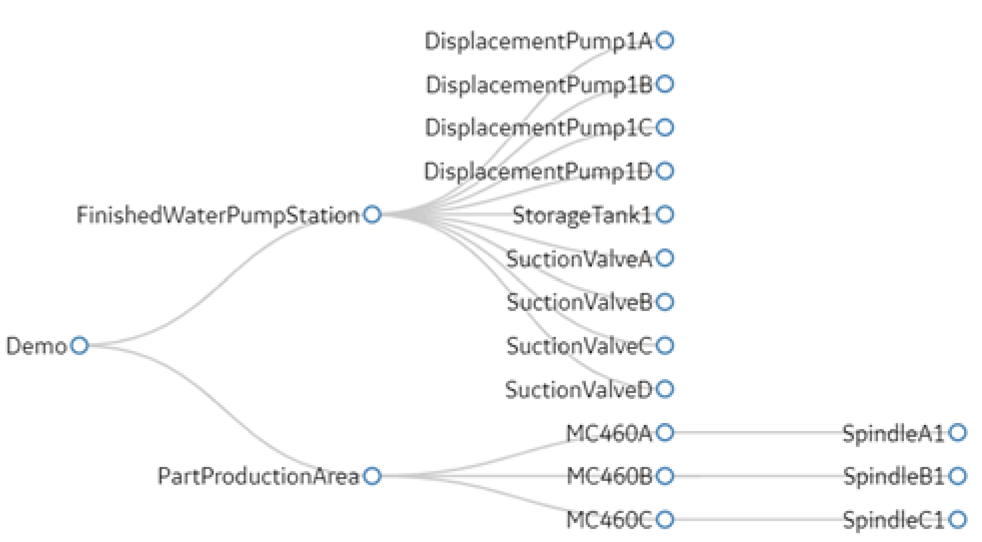
3. Select the parent object in the app area, select its children in the left panel and select **+**.
4. In the app area, expand the parent object to show its children by selecting its filled circle.

In this example, the FinishedWaterPumpStation has three DisplacementPump

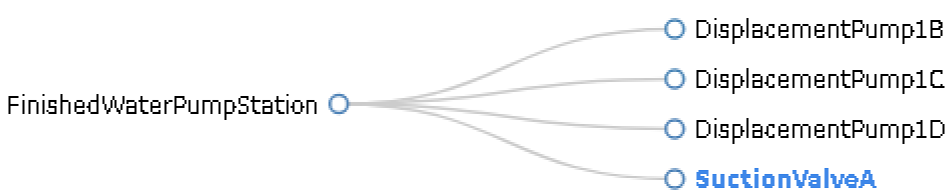


children.

5. To add object instances to a child, select the child in the app area and select its descendants in the left panel.
   In this example, SpindleA1, B1, C1 are descendants of MC460A, B, C.



6. You can also drag and drop objects within the hierarchy to change their order, as shown in this example. SunctionValveA is now a child of FinishedWaterPumpStation.



7. **Optional:** To delete an object from the hierarchy, select its check box and then **-** at the top of the left panel.
8. **Optional:** At any time, you can remove the hierarchy and start with a blank app area by selecting **Clear Hierarchy**.
9. To save the runtime hierarchy that you created, select **Save**.

Modify Object Types

You can remove an asset object type and delete and modify its data variable names but you cannot change the name of an object type. All changes made to an object type are reflected in its object instances.

You cannot delete an asset object type that has existing objects using its data structure.

1. In the Administration environment, navigate to **Assets > Object Types**.
   The **Object Type Information** screen appears listing the object types.
2. In the left panel, select the object type to modify.
3. Make changes as needed and select **Save**.
4. To remove an object type, select it in the left panel, select **Delete**, and confirm the delete.

Remove Contained Types

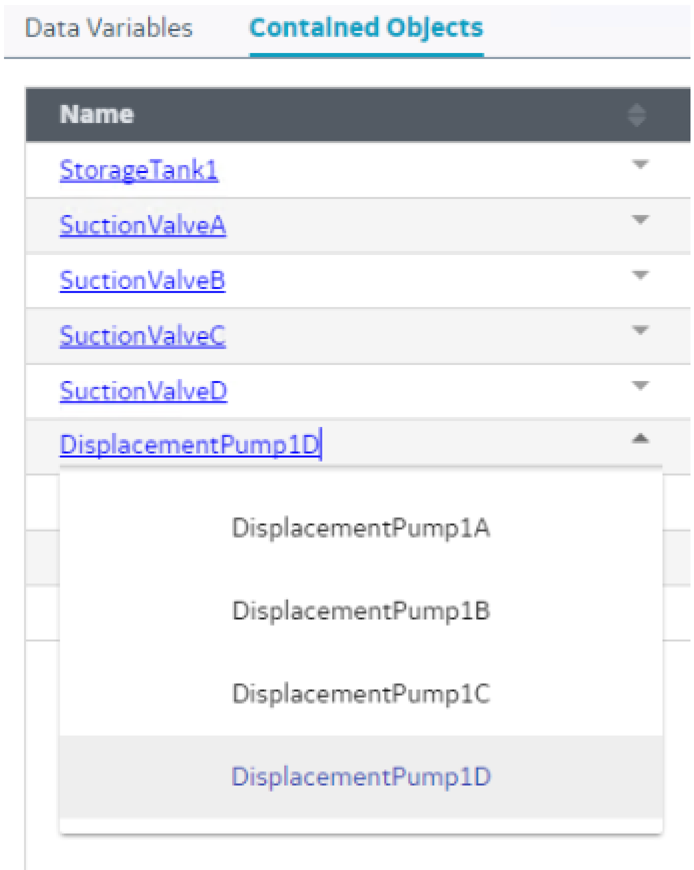
When you delete a child from an asset object type, it is also removed from all objects using it.

1. In the Administration environment, navigate to **Assets > Object Types**.
   The **Object Type Information** screen appears listing all the asset object types.
2. In the left panel, select the asset object type whose children you want to modify.
3. Select the **Contained Types** tab.
4. To remove children from a parent, select the check box next to each child you want to remove, and select **-** above the table.
5. Select **Save**.

Replace Contained Objects

You can quickly replace contained objects by browsing through a list of similar objects that are assigned to the same object type.

1. In the Administration environment, navigate to **Assets > Objects**.
2. Select the object type.
3. Select **Contained Objects**.
4. Select the arrow next to the contained object that you want to replace. A list appears with similar objects that are associated with the selected object type, as shown in the following image:



5. Select the object to replace the contained object. This selected object is now a contained object for the object type.
6. **Optional:** To view the details of a contained object, such as its data variables, select its hyperlinked name in the **Name** column.
7. Select **Save**.

Modify Objects

You can remove an asset object as well as change its data sources.

If an object has contained objects, you can change their auto-generated names but not their aliases.

1. In the Administration environment, navigate to **Assets > Objects**.
   The **Object** screen appears.
2. In the left panel, select the object to modify.
3. Make the changes as needed and select **Save**.
   You cannot modify data variables.
4. To remove an object, select it in the left panel, select **Delete**, and confirm the delete.

Export the Model

Model configuration is exported and saved to a CSV format for later use.

1. Go to **ADMIN > Import/Export**.
2. Provide a file name for the model you want to export.

3. Select **Export**.

   The model data is exported to a .csv file.

> **Note:**
> The data source connectivity information in the model is not preserved during export. As an alternative, export the application *(on page 149)*.

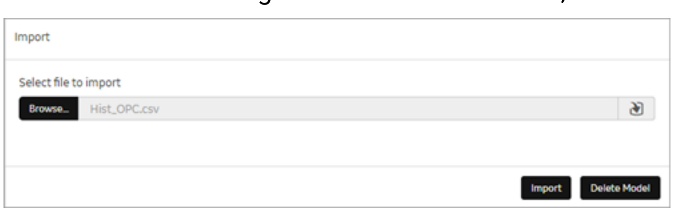
4. Retrieve the model file from the Windows Downloads folder.

Import a Model

If you want to replace an existing model, you must first delete *(on page 281)* the old one before importing the new one. You can also merge the new model with the existing model during import.

> **Note:**
> Data source connectivity information is not preserved in the model you import to your system. After importing the model, reconfigure the data source properties in the model.

1. Go to **ADMIN > Import/Export**.
2. Select **Browse** to navigate to the .csv model file, and then select **Import**.



> **Note:**
> Always import files that are of size 13 MB or less at a time. If the CSV is larger than 13 MB, split the file into multiple smaller files and import them one by one to Operations Hub. You can use a free .csv splitter tool to break the large file into smaller files.

3. Follow these instructions to view and download the log file in these browsers:

Option	Description
Chrome	◦ To view the log file, right-click **[log]** to open it in a new tab. ◦ To download and then view the log file, click **[log]**. You can view the file in the Downloads folder.
Microsoft Edge	◦ To view the log file, click **[log]**, and then **Open**. ◦ To download and view the log file, click **[log]**, and then **Save**. You can then view the log file by selecting **View downloads**.

4. To view the model in runtime, select **Runtime** from the user icon drop-down list at the top right of the screen.
   By default, the highest asset point in the model hierarchy appears.
5. To navigate through the asset objects in the hierarchy model, select the Asset Context Selector, . The model displays the relevant data in context to each asset object selected in the navigation scheme.

Define Trend Data

You can view trend-line analysis of variable data for a selected time frame in Historian. You select which historical variables to view.

1. In the Administration environment, navigate to **Visualizations > Designer**.
2. Select **Types**.
3. In the left pane, select the asset object type containing the data variables to display in trend lines.
4. Select **Trend Card**.
5. Select the check box next to each variable containing the data to use as a trend point.
6. Select **Save**.

Delete a Model

If importing a model fails or you want to replace a model with a new one, you may choose to delete the model. Before deleting the model, we recommend that you export *(on page 279)* it for a backup. You can then import it again or import a new model.

1. In the main navigation menu, select **ADMIN**.
   The **ADMIN** workspace appears.
2. Select **Delete Model**.
   A message appears, asking you to confirm that you want to delete the model.
3. Select **Delete**.
   The model is deleted.

Import Mimics

HMI graphics are imported as mimics to Operations Hub.

Verify iFIX pictures or CimEdit screens were exported as JSON files.

- In Proficy iFIX, go to **Tools > Publish Picture** to export pictures.
- In Proficy CIMPLICITY, export CimEdit screens.

Process diagrams created in an HMI/SCADA system are imported and used as mimics in Operations Hub.

1. Go to **ADMIN > Visualizations > Mimic Management**.
2. Select **Import**.
3. In the **Import Mimics** screen, browse and select the JSON zip file you want to import to Operations Hub, then select **Import**.
   The zip files contain exported iFIX pictures or CimEdit screens.
4. Repeat the steps to import more files.

All the imported files are listed on the **Mimic Management** screen.

Assign Mimics to Assets

Assign a mimic to object types and objects.

Import Mimics *(on page 281)*.

When you assign a mimic to an object type, the mimic is assigned to all the objects that belong to the object type.

1. Go to **ADMIN > Visualizations > Designer**.
2. Select an item under the **Object Types** tab and perform these tasks:

Details tab	a. Select a **Mimic** from the drop-down list to associate with this object type. b. Select **Save**.
Mimic Card tab	Mimic fields represent animation sources within a mimic. For example, `@Flow@` and `@OpenClose@` are mimic fields for displaying data for the *Suction Value* object type. Choose any of these: ◦ On the **Mimic Binding** tab, for each **Mimic Field**, select a **Data Variable** from the drop-down list. ◦ Select **Autobind** tab to allow automatic binding of data by matching the data variables to the mimic fields. For example, the *TPump* object type with `Flow` variable is auto binded to a picture representing a pump with the `@Flow@` animation.

3. Repeat the steps to assign a mimic to another object type.

The selected mimic is assigned to the object type and their objects. You can choose to override and assign a different mimic *(on page 282)* for a particular object.

Override an Assigned Mimic

Assigning a new mimic to an object overrides the mimic assigned at the object type level.

A mimic is already assigned at the object type level, which applies to all the objects belonging to that type.

At runtime, the newly assigned mimic appears for the object instead of the mimic assigned for the object type.

1. Go to **ADMIN > Visualizations > Designer**.
2. Under **Objects**, select the object for which you want to modify the assigned mimic.
3. On the **Details** tab, for the **Mimic** field, select a different mimic from the drop-down list.
4. Select **Save**.

A new mimic is assigned to the object. The original mimic appears in the list with 'default' before its name, such as *Default - FWPS*, *Pump*.

Set Up Mimic Target Zones

Target zones represent areas on a mimic that were set as selectable in the HMI/SCADA system. You set the navigation of these target zones for an operator.

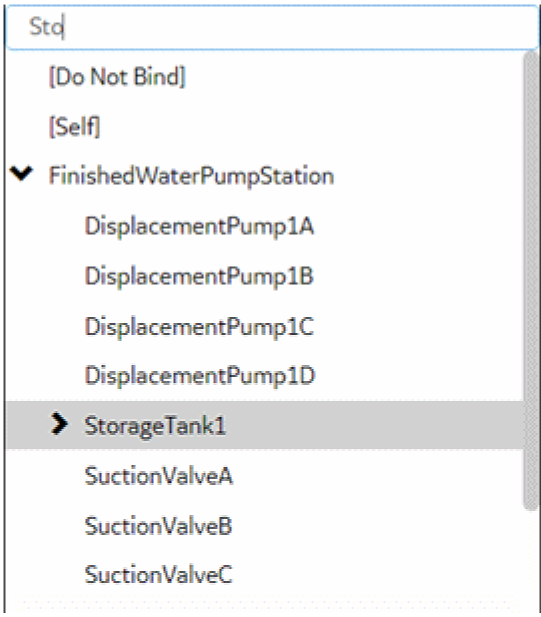
You define a target zone to navigate to any asset in the model and view historical data.

> **Note:**
> These steps are also applicable for mimics bound at the asset level.

- In iFIX, set regions on a picture as Is Selectable to appear as clickable targets on the Mimic Card.
- In CIMPLICITY, only groups with the mouse-up or mouse-down event show as selectable targets on the Mimic Card. When defining a mouse-up or mouse-down event for a group, you must specify the script action, and then create an empty script.
- Assign the mimic to an asset type.

1. Go to **ADMIN > Visualizations > Designer**.
2. Under **Object Types**, select an object type.
3. For the selected item, go to **Mimic Card > Click Target Binding**.
4. To enable an operator to navigate to a particular asset object in the model, do the following:

a. In the **Referenced Object** column and next to the target name, select or search for the asset object in the model hierarchy tree. You can do a partial search, such as `Sto`, and Operations Hub highlights all assets containing Sto, as shown in this example.



b. Select the related **Action** field and then **Navigate**.

In Runtime, the background of a target zone changes to blue when an operator hovers over it. After an operator selects a target on the mimic card, the target asset becomes the active one, changing the mimic and content in the trend and alarm cards accordingly.

5. Select **Save**.

Data Sources

About Data Sources

To create applications in Operations Hub, you can fetch data from the following sources:

- Data stored in Operations Hub: This data is created and stored in entities, which are database tables. To create data, you can:
  - Manually enter the data in an entity.
  - Import data using a Microsoft Excel spreadsheet.
  - Insert data into entities using insert queries, which you can create using Operations Hub.
  - Send data from an MQTT client to an M2M entity. In addition, you can also use pivot tables to send data dynamically.
  - Create an API that will work with the Operations Hub APIs to send data to an entity.

- Data stored externally: This data is stored in an external database, such as a Historian server. You can use this data in an Operations Hub application. To do so:
    1. Create a data source to provide the details of the external database whose data you want to use.
    2. Create a REST or SQL query to specify the expected inputs and outputs of a REST endpoint (as defined in the REST API) .
    3. Run the query to fetch the data from the external database.

    Note:
    The data will still be stored only in the external database; it will not be stored in Operations Hub.

Access a Data Source

1. From the main navigation menu, select **DATASOURCES**.
   The **DATASOURCES** workspace appears, displaying a list of data sources.
2. Select the data source that you want to access.
   The data source appears.

Create a Data Source

1. From the main navigation menu, select **DATASOURCES**.
   The **DATASOURCES** workspace appears, displaying a list of data sources.
2. Select **Add New Data Source**, and then enter values as specified in the following table.

Field	Description
Name	Enter a unique name for the data source.
Product	Select one these products for the data source: ◦ Proficy CIMPLICITY ◦ Proficy Historian ◦ Proficy iFIX ◦ OPC UA ◦ Relational Database ◦ REST API ◦ Proficy Workflow ◦ Proficy Batch

Field	Description
Description	Enter a brief description of the new data source.

3. For relational database, refer to Add Relational Database Data Source *(on page 286)*.
4. For Historian and REST API, refer to Add Historian or Custom REST Data Source *(on page 288)*.
5. For CIMPLICITY, iFIX, and OPC UA, refer to Add a Data Source with OPC UA Configuration *(on page 293)*.
6. For Batch, refer to Add a Batch Data Source *(on page 298)*.
7. Save the data source.

Option	Description
Save	Select to save the data source details and remain on the screen.
Save As New	Select to copy the details and save as a new data source.
Save And Exit	Select to save the data source details and exit the screen.

Add Relational Database Data Source

Creates a relational database data source.

Provide a name, product, and description for your data source *(on page 285)*.

1. Select the check box for **Enable Relational Database Connection** and enter these details:

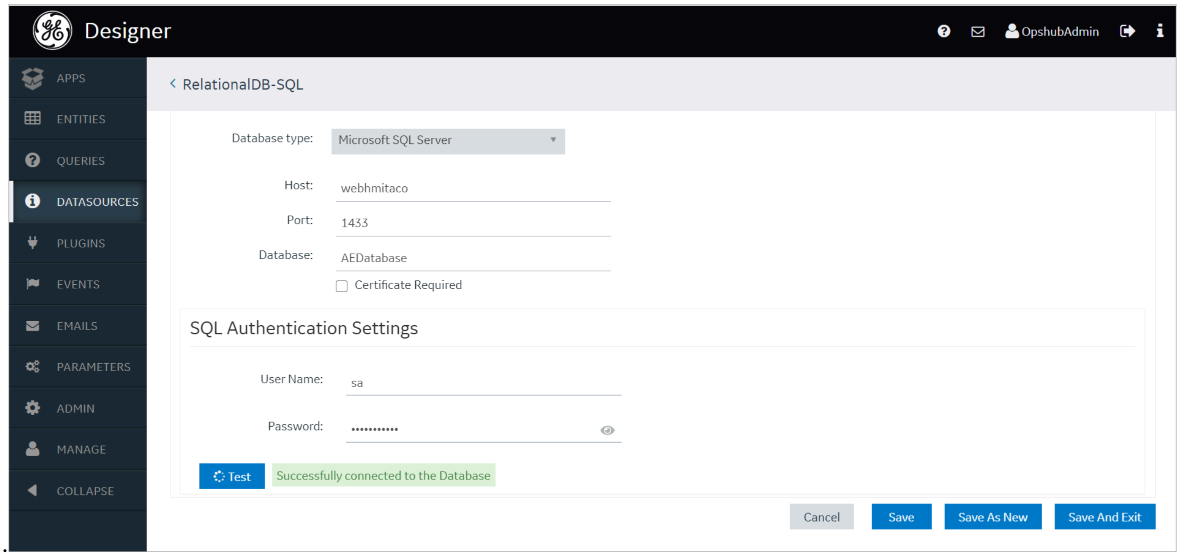
Field	Description
Database Type	Currently, Microsoft SQL Server is the only supported database type.
Host	Enter the IP address or host name of database server. *For example: 10.181.213.211 or databaseserver01.* **Note:** If using a SQL named instance, enter the host name in the format `ServerName\InstanceName`. *For example: databaseserver01\SQLEXPRESS.*

Field	Description
Port	Enter the port number to connect to the SQL Server. **Note:** If using a SQL named instance, enter the exact port of the SQL named instance.
Database	Enter the database name to connect.
Certificate Required	Select the check box if connecting to the data source requires SSL certificates. Select **Choose Certificate** to browse to your system and add certificates.

2. Provide SQL server authentication details:

Field	Description
User Name	Enter the user name for the database you want to access.
Password	Enter the password of the user configured in the database.
Test	Select to check whether the database connection is established using the server and authentication details. A message confirms on a successful connection to the database. If test fails, the message provides more details on the failure.

A successful SQL Database connection.



3. Select **Save**.

Add Historian or Custom REST Data Source

Creates a Historian or Custom REST data source.

Provide a name, product, and description for your data source *(on page 285)*.

1. Select the check box for **Enable System Connection** and provide these details to authenticate the Historian system API:

Field	Description
Hostname	Enter the hostname of the Historian data source.
Authentication Required	Select the check box if connecting to the data source requires authentication. Enter the **Username** and **Password** of the user who can access the APIs.
Test	Select to verify the authentication details. A message appears, confirming whether connection to the system API is established.

2. Select the check box for **Enable REST Connection** and provide these details:

Field	Description
Base URL	Enter the URL of the data source in the following format: https://<host name or IP address of the data source>:<port number> **Note:** The port number should not be used if your data source is Historian 8.x.
REST Authentication Required	Select the check box if authentication to a REST API is required. If selected, Operations Hub sends authorization details along with a request while connecting to a data source.
Auth Type	Appears when the **REST Authentication Required** check box is selected. Select one of the following types of authentication: ◦ **Basic Auth**: Sends a verified user name and password along with the request. ◦ **Bearer Token**: Sends an access key along with the request. ◦ **OAuth**: Retrieves an access key to access an API, and then uses the key to authenticate future requests. **Important:** For connecting to a Custom REST data source such as eAndon, select **OAuth** for authentication. Depending on the authentication type you select, a few boxes appear.
Auth Token	Appears when the **Bearer Token** authentication type is selected. Enter the access key required to authenticate the APIs. The access key is included in the request header.
Auth Grant Type	Appears when the **OAuth** authentication type is selected. Select one of the following types of granting the authentication: ◦ **client_credentials** ◦ **password**

Field	Description
Auth URL	Enter the URL for the endpoint of the authentication server. This value is used to exchange the authorization code for an access token.
Auth Client Id	Appears when the **OAuth** authentication type is selected. The client identifier issued to the client during the application registration process.
Auth Client Secret	Appears when the **OAuth** authentication type is selected. The client secret issued to the client during the application registration process.
Ignore TLS/SSL	Select the check box if verifying SSL certification can be ignored. Normally, this check box is cleared when using the data source in a production environment, which implies that SSL certification will be verified while connecting to the data source. If, however, you want to troubleshoot issues with connecting to a data source, you may select this check box to isolate certification issues.
Certificate Required	Select the check box if connecting to the data source requires SSL certificates. Select **Choose Certificate** to browse to your system and add certificates.
Auth Certificate	If you want to provide a certificate for authentication, select **Choose Certificate** and navigate to the certificate. Alternatively, you can select the **Use Datasource Certificate** check box if you want to use the same certificate that is used by the data source. **Note:** You can use certificates only in the base-64-encoded format. A DER-encoded certificate is not supported.
Test	Select to test the connection. A message appears, confirming whether token from the OAuth data source is retrieved. The connection is tested using the authentication details of the REST APIs, including the authentication URL; the data source base URL is not used. **Note:** You can create multiple data sources with the same URL. After you restart the services, the Data Distributor service uses the most recently saved System API au-

Field	Description
	thentication settings for the URL. Therefore, if the most recently saved credentials do not work, you cannot connect to the data source. To fix this issue, modify the data source to specify working credentials, and then test the data source. We recommend that you do not save the data sources that do not pass the test or data sources with the same URL.

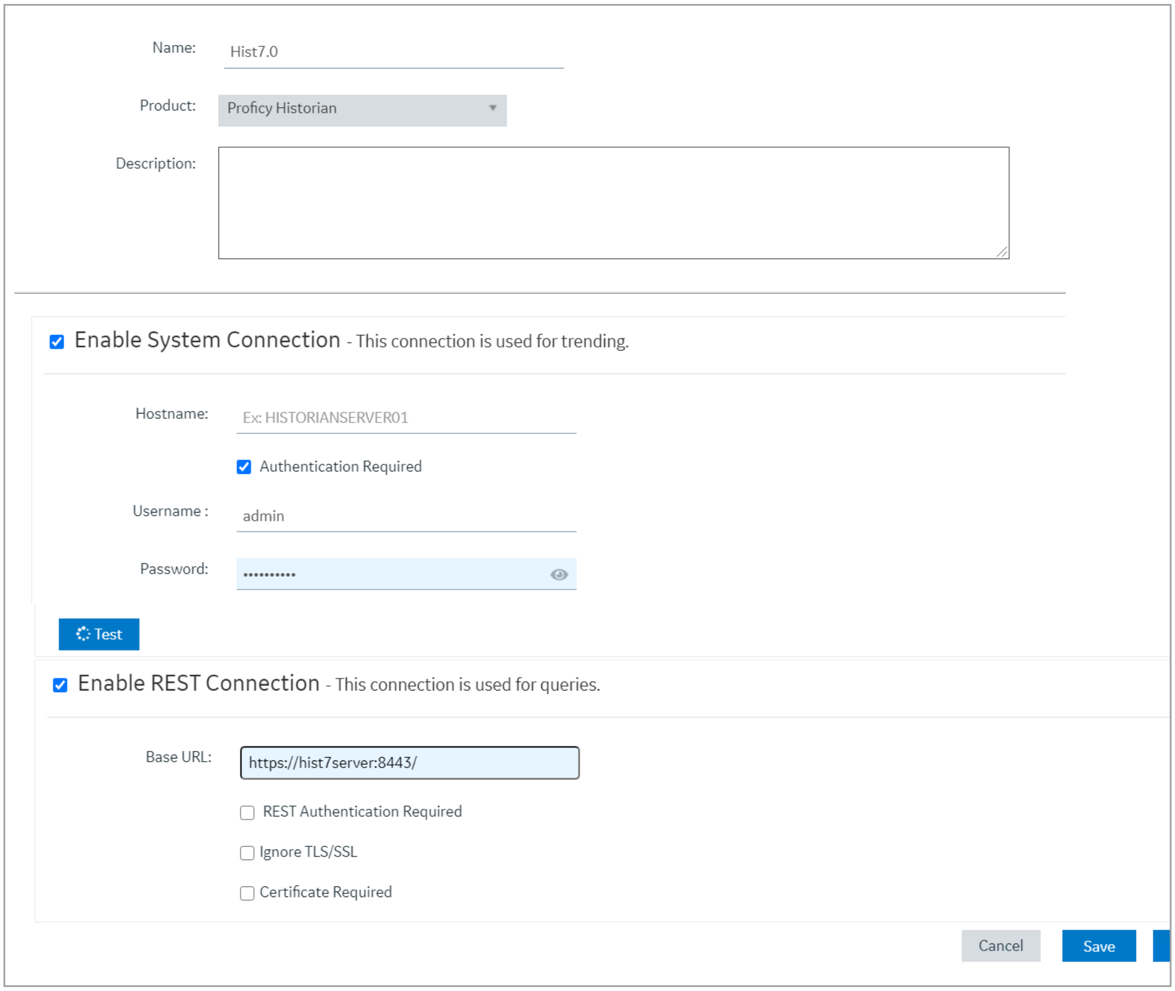
3. Select **Save**.

   Look at the following examples for configuring a data source for Historian 7.x and Historian 8.x.

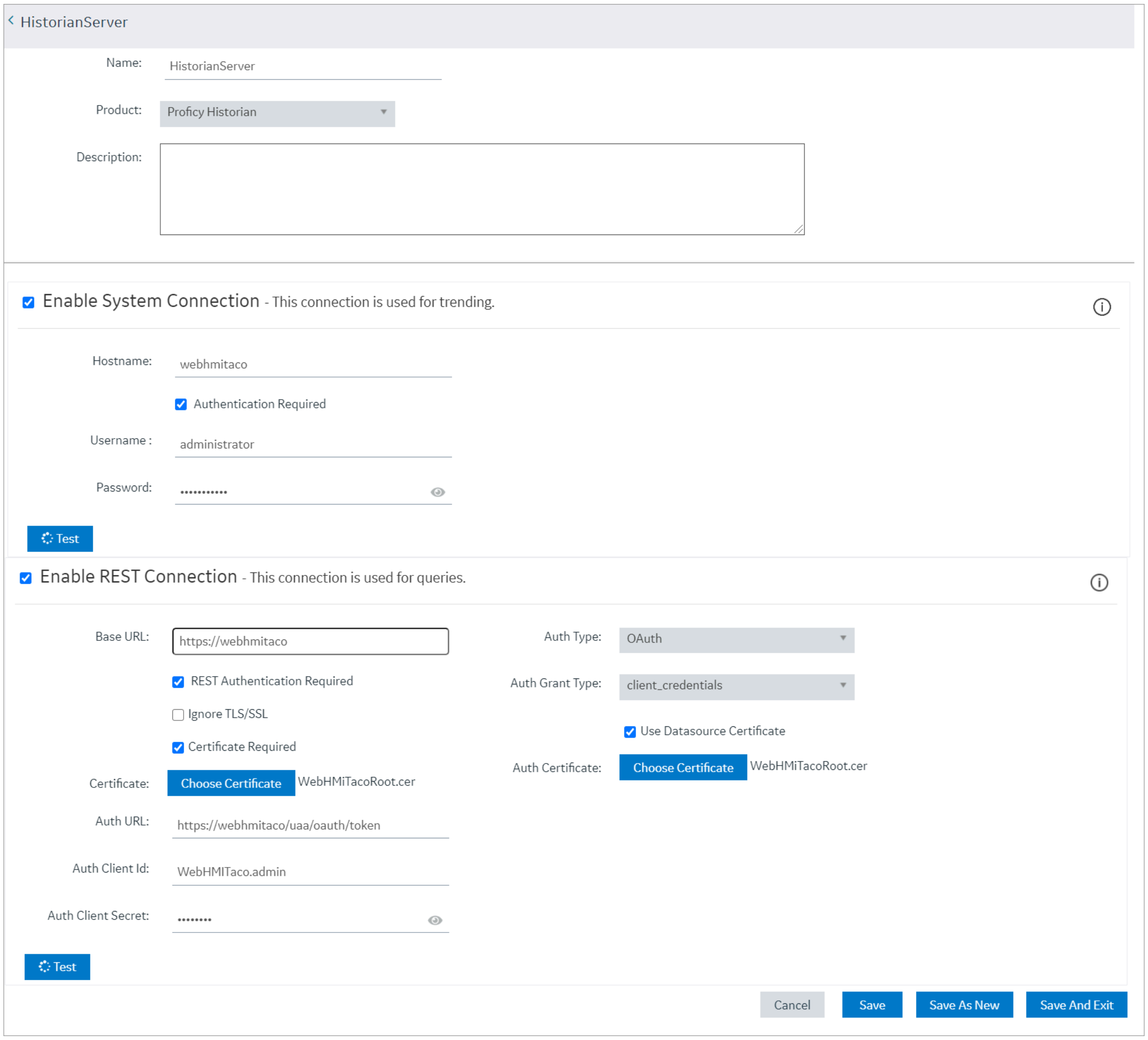
   Historian 7.x requires entry of port used – in this instance, port 8443 – whereas Historian 8.x does not require any port to be specified.

   The Auth Client ID is admin for Historian 7.x, whereas Historian 8.x requires the Auth Client ID to be of the form `MachineName.admin`, where MachineName is case sensitive.

   Example of Historian 7.2 Data Source:



Example of Historian 8 Data Source:



Note:
The Auth Client ID field is case sensitive. For example, if the Historian server name is `hist8Server`, the user must use `hist8Server.admin` and not `HIST8Server.admin` or `Hist8Server.admin`, otherwise REST authentication will fail.

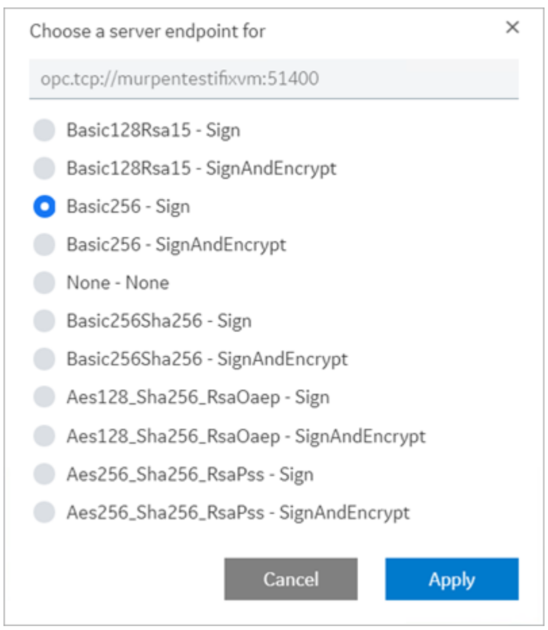
Add a Data Source with OPC UA Configuration

Creates a data source with OPC UA configuration.

Provide a name, product, and description for your data source *(on page 285)*.

You cannot add multiple data sources to use the same database connection. Make sure that the Endpoint URL and Application URI configuration is unique to every data source.

1. If you selected Proficy iFIX, Proficy CIMPLICITY, or OPC UA as the product, provide these details to **Enable OPC UA Connection**.

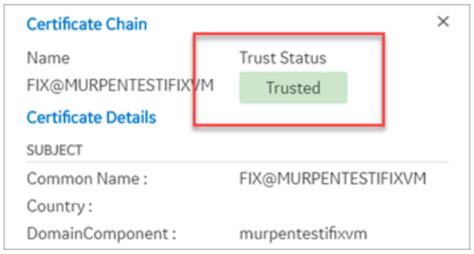
Field	Description
Endpoint URL	Enter the machine name and port number to connect to an OPC UA server. For example: `opc.tcp://MyServer:51400`. In iFIX, you can copy the URL from here: ◦ **Applications > OPC UA Configuration** screen. In CIMPLICITY, you can copy the URL from here: ◦ **Project > Properties** screen.
Discover policies	Select to discover and display all the security profiles supported by the OPC UA server to establish a secure connection. The display list is based on the entered endpoint URL; the security modes and policies supported by either iFIX, CIMPLICITY, or IGS.  From the discovered list for the endpoint URL, select the security profile you want to use for this connection, then select **Apply**.
Application URI	This field is auto populated after defining a security profile for the OPC UA server.

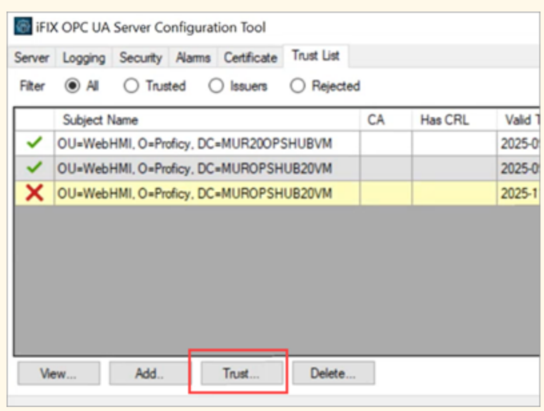
<table>
<tr><th>Field</th><th>Description</th></tr>
<tr><td>Security Mode</td><td>This field is auto populated after defining a security profile for the OPC UA server.

Note:
If security mode is <code>None</code>, the connection is not secured. This is acceptable if you simply want to test a connection. Make sure to change this setting later to ensure that you have adequate security enabled for your connections.</td></tr>
<tr><td>Security Policy</td><td>This field is auto populated after defining a security profile for the OPC UA server.</td></tr>
<tr><td>View Certificate</td><td>For a secured connection, security certificates must be exchanged between Operations Hub and the OPC UA server.

Select to view the OPC UA server certificate, and if <code>Untrusted</code>, select Trust.

The server certificate gets added to the <code>C:\ProgramData\GE\Operations Hub\pki\trusted\certs</code> folder in your machine running Operations Hub.</td></tr>
</table>

Field	Description
	The certificate status now appears as `Trusted`.  Select **Cancel** to close the trusted server certificate screen.

> **Important:**
> Operations Hub client certificate must also be trusted on the OPC UA server (iFIX, CIMPLICITY, IGS) to establish a secured connection.
>
> - To trust the certificate on the CIMPLICITY server,
>   a. Start the CIMPLICITY project.
>   b. Attempt to connect via the Data source dialog box.
>   c. Trust the certificate on the Data source dialog box.
>   d. Go to the CIMPLICITY project's `\pki\rejected\certs` folder, and copy the rejected certificate to the `\pki\trusted\certs` folder.
>   e. Test the connection again; it should now work.
> - To trust the certificate on the iFIX server,
>   a. Access the iFIX OPC UA Server Configuration Tool dialog box.
>   b. On the **Trust List** tab, select the failed entry and trust it.
>
> 
>
>
> The failed entry appears when you attempt to test the connection in Operations Hub client.

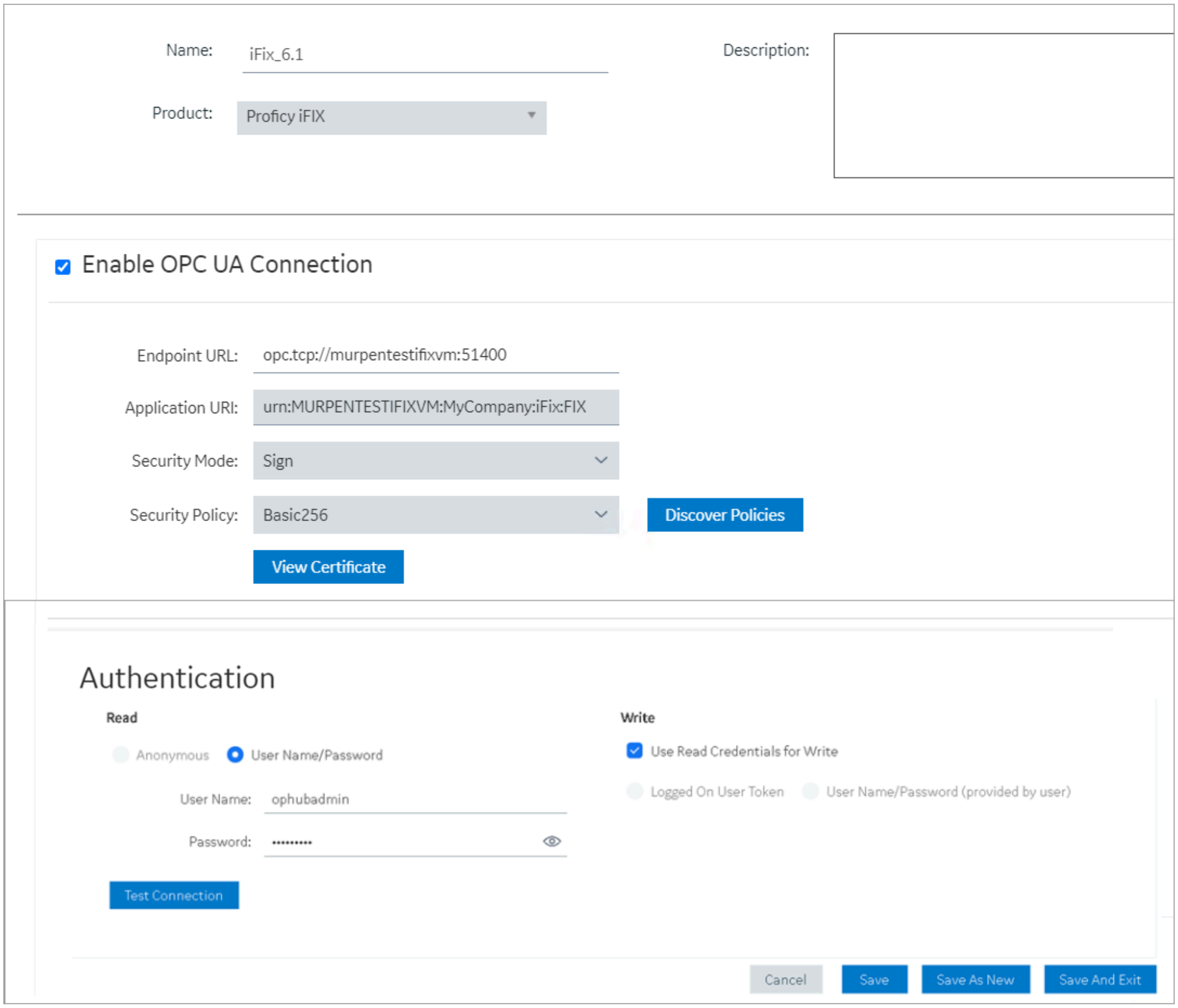
Field	Description
	Another option is to directly copy the Operations Hub certificate from the client location (`C:\ProgramData\GE\Operations Hub\pki\own\certs`) to server location (`\pki\trusted\certs`). Ensure that you modify the certificate file name if you plan to copy more than one Operations Hub certificate to the CIMPLICITY trusted folder, to avoid replacing the already trusted clients.

2. Select the authentication type for read and write access to the database.

   It is recommended that you select Username/Password to provide the highest level of encryption. Anonymous does not provide any protection for accessing data or login.

Field	Description
Read	To authenticate read access: ◦ Select **User Name/Password** and enter the credentials in the text field. ◦ Enter the user name to connect to the OPC UA server (iFIX, CIMPLICITY, IGS). ◦ Enter the password for the user name to connect to the OPC UA server.
Write	To authenticate write access: ◦ Select **Logged On User Token** if you want to use token-based authentication. **Note:** To validate tokens, make sure to configure the OPC UA server with Proficy Authentication (UAA). ◦ Select **User Name/Password (provided by user)** if you want to enter credentials to authenticate. ◦ Select the check box for **Use Read Credentials for Write** to use the same user name and password that you provided for read access.
Test Connection	Select to test the OPC UA connection. If the details provided to establish the connection are correct, a message appears confirming the successful connection. To troubleshoot connection related issues, refer to Error Messages *(on page 635)*.

3. Select **Save**.



Add a Batch Data Source

Provide a name, product, and description for your data source *(on page 285)*.

1. Select the check box for **Enable Batch Connection**.
2. Enter the **Endpoint URL** of the Batch server you want to access.
   Only REST URLs are allowed. For example, `https://perfbatch2vm:4867/BatchRESTAPI`. The host name is the machine where you installed the Proficy Batch application.
3. Select **Save And Exit**.

Rename a Data source

Data source aliasing is necessary for renaming a data source.

- After upgrading from Operations Hub 2.0, resave all the queries and their respective pages. This practice directs them to use the data source aliasing instead of the machine name. This also ensures that the queries and pages created in 2.0 are compatible with renaming data sources in the current version.
- If importing an application *(on page 151)* that was exported from version 2.0, resave all the queries and pages after importing to the upgraded version of Operations Hub.

1. From the main navigation menu, select **DATASOURCES**.
   The **DATASOURCES** workspace appears, displaying a list of data sources.
2. Select the data source that you want to rename.
   The data source appears.
3. Enter the new name for the data source in the **Name** text box.
   The new name must be a unique name.
4. Select **Save**.

The data source is successfully renamed.

In case you want to export an application *(on page 149)* after renaming a data source, save all the associated queries and pages before application export. The application and the queries have references to the renamed data source.

Delete a Data Source

1. From the main navigation menu, select **DATASOURCES**.
   The **DATASOURCES** workspace appears.
2. Select , and then select **Delete**.
   A message appears, asking you to confirm that you want to delete the data source.
3. Select **Delete**.

The data source is deleted.

Browse Data Sources

Allows to browse a data source and select the properties or tags.

1. From the **select** drop-down, select a server alias and its data source to browse through the server properties and tag IDs.

Option	Description
Assets / Objects	This is the asset model configured in the system. You can browse through the asset hierarchy, and add properties to the trend chart from any hierarchy level. You can add or remove data variables of the asset from the trend chart.
Historian	The Historian servers configured in the system. You can browse through the servers for tags that you want to add to the widgets.
Proficy iFIX	The iFIX servers configured in the system. You can browse through the servers for tags that you want to add to the widgets.
Proficy Cimplicity	The Cimplicity servers configured in the system. You can browse through the servers for tags that you want to add to the widgets.
OPC UA	The OPC UA servers configured in the system. You can browse through the servers for tags that you want to add to the widgets.

A list of server nodes appear in a tree structure. For the Historian data source, a list of native tags from the data source appear.

2. Expand the tree structure and select the check box for only value  to pull data from the data source.
The tree structure is made up of nodes, each with a unique NodeID.

Icon	Description
	Objects are assets from a data source.
	The Alarms folder contains alarm area nodes.
	Servers
	Data arrays

Icon	Description
	The Tags folder provides access to the tag types and fields. Each tag has a value node, which represents the current value of the tag.

3. For Historian, you can search and select *(on page 303)* from the list of native tags.
4. Save or close the screen.

The selected properties or tags are applied.

Create a SQL Data Source

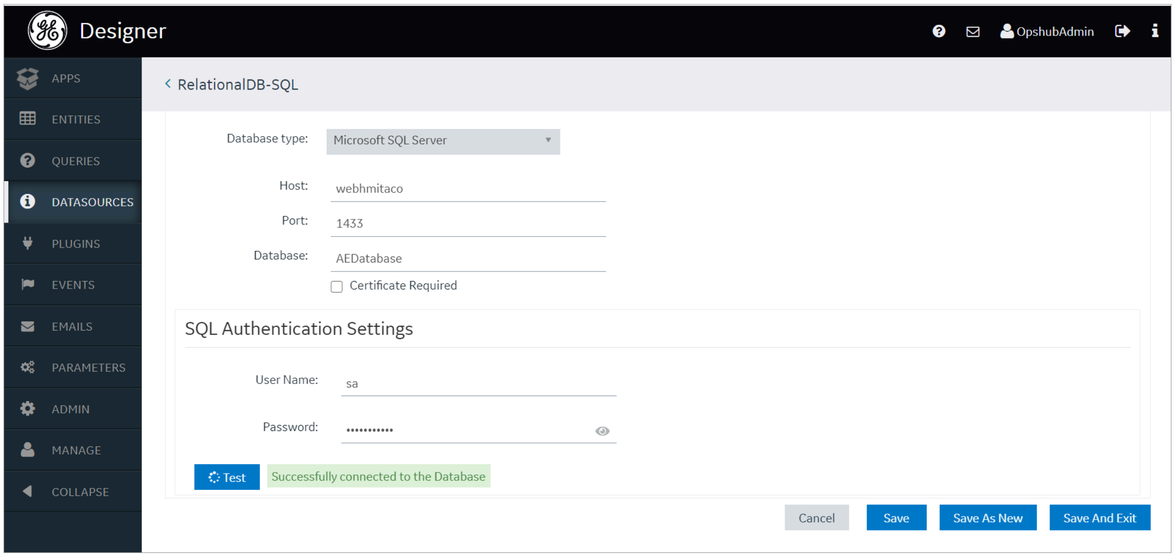
1. From the main navigation menu, select **DATASOURCES**.
   The **DATASOURCES** workspace appears, displaying a list of data sources.
2. Select **Add New Data Source**, and then enter values as specified in the following table.

Item	Description
Name	Enter the unique name of the data source.
Description	Enter the description of the data source.
Datasource Type	Select **Relational Database**.
Database Type	Observe that this field defaults to Microsoft SQL Server, currently the only supported database type.
Host	Enter the IP address or host name of database server. *For example: 10.181.213.211 or databaseserver01.* This field only appears if you select Relational Database as the Datasource Type.
Port	Enter the port you want to use to connect to the SQL Server. This field only appears if you select Relational Database as the Datasource Type.
Database	Enter the database name that you want to connect to.

Item	Description
	This field only appears if you select Relational Database as the Datasource Type.
Certificates Required	Select the check box if connecting to the data source requires SSL certificates. If you select this check box, the **Choose Certificate** button appears, allowing you to select the certificate.
User Name	In the SQL Authentication section, provide the user name for the database you want to access.
Password	In the SQL Authentication section, provide the password of the user configured in the database.
Test button	After the required fields are filled in, click the **Test** button. On a successful connection check, a message is shown beside the Test button as "Successfully connected to the Database" indicating that test connection to database can be established using the above details. If it fails, it reads: "Failed to connect to the Database. More Details." Click the "More Details "link to view detailed reason in a popup.

3. Select the **Test** button.

   The following example shows a successful SQL Database connection.



If it fails, a message appears stating: Failed to connect to the Database. Click on **More Details** link to view detailed reason in a popup.

4. Select **Save**.

Search for Tags

Allows to search for tags by tag name and description.

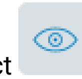
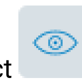
1. Enter a keyword in **Search** and select .

> **Tip:**
> You can also perform a wild card search by entering *.

By default, only tags that match the keyword in their name and description are displayed.

2. To streamline your search, use these options:

Field	Description
Tag name	This is the default search filter. Select the check box to match the keyword only to tag names.

Field	Description
	Additionally, to view the description for tags returned in keyword search, select  next to **Description**.
Description	Select the check box to match the keyword only to tag descriptions. Additionally, to view the names of tags returned in keyword search, select  next to **Tag name**.
Both	Select the check box to match the keyword with tag name or description, and return results.

Pages

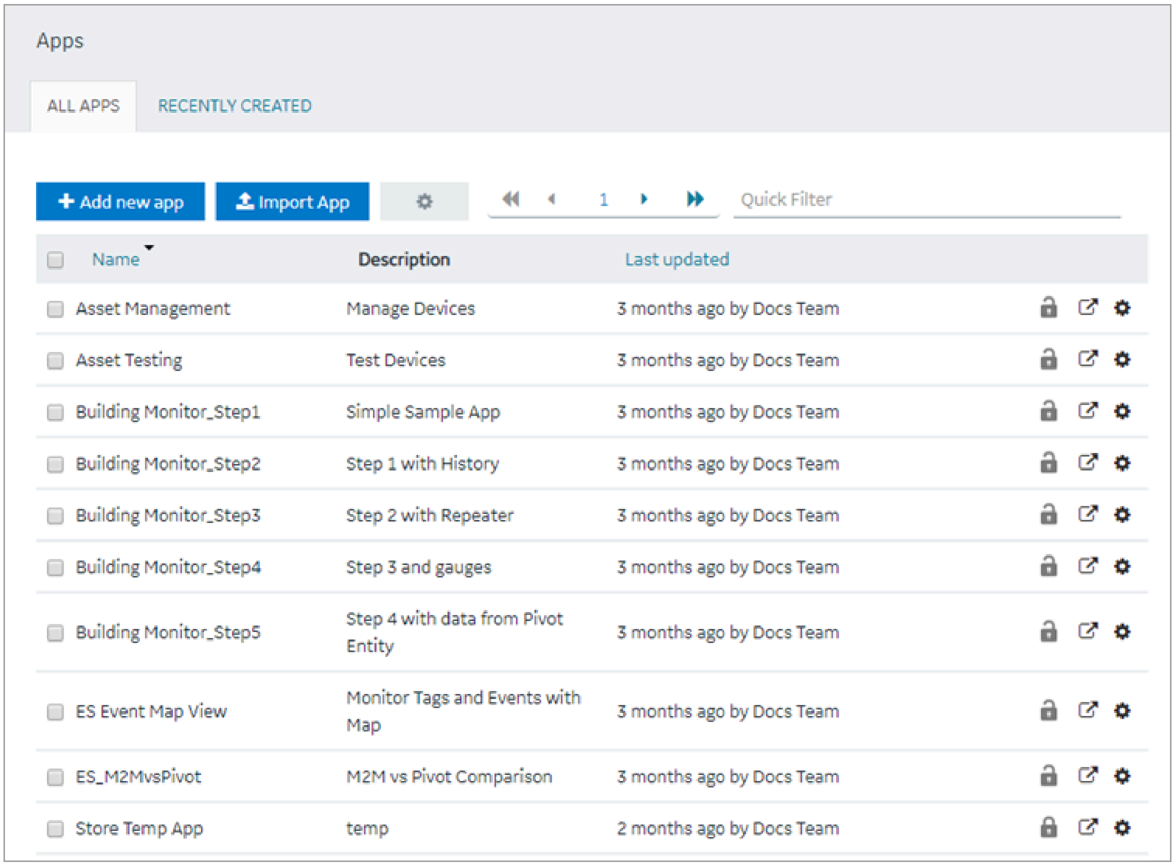
About Pages

Using Operations Hub, using the application editor, you can create pages that appear in an application. You can use pages in multiple ways, such as:

- Display information to users in the application. Information can be displayed in plain text or using multiple components, such as tables, images, graphs, and other components.
- Display a form to allow application users to enter or modify data. Forms can include items such as text, numbers, dates, times, and uploaded images from a mobile device.
- Allow application users to control assets by sending commands via MQTT or REST services.

Grant Group Access to Page within an Application

1. In the main navigation menu, select **APPS**.
   The **APPS** workspace appears.



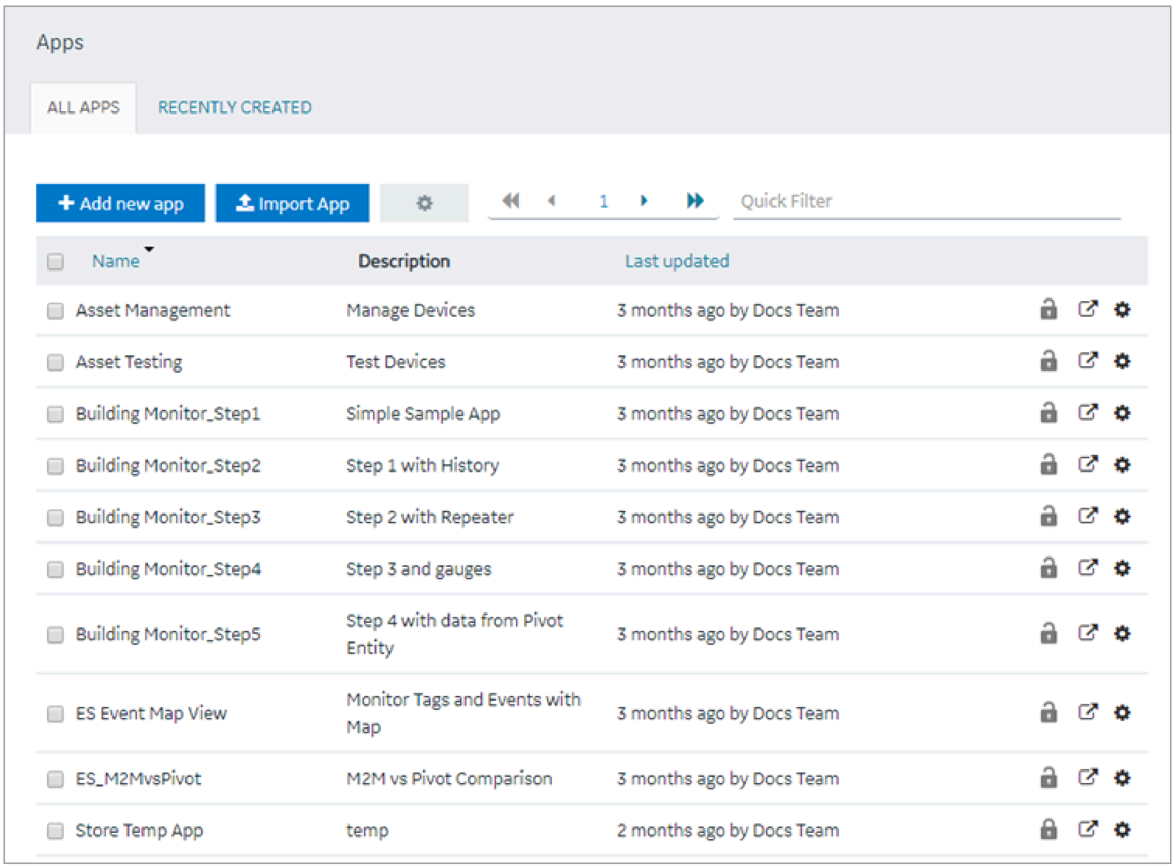
2. In the **Name** column, select the application to which you want to grant access.
   The **PAGES** workspace appears, including a column summarizing the current page permissions. By default, newly created pages display “All users”, indicating all users who have access to the application will have access to the page.
3. In the **Permissions** column, select the page to which you wish to grant access.
   The page permission dialog appears.
4. In the **Manage Page Permissions** dialog box, if you wish to grant visibility to select groups only, select the “Selected Groups” option.
5. In the groups field, select the group or groups you would like to grant access to this page and then select **Submit changes**.
   The selected groups can now access the page. Please note these users must already have the ability to access the app.
6. In each row containing an application user to whom you want to grant access, select the check box, and then select **Submit changes**.

The selected users can now access the application.

> **Note:**
> It is possible to create a circular reference by nesting a parent group into its child. If there are circular references, the child groups will not display in the permissions dialog box.

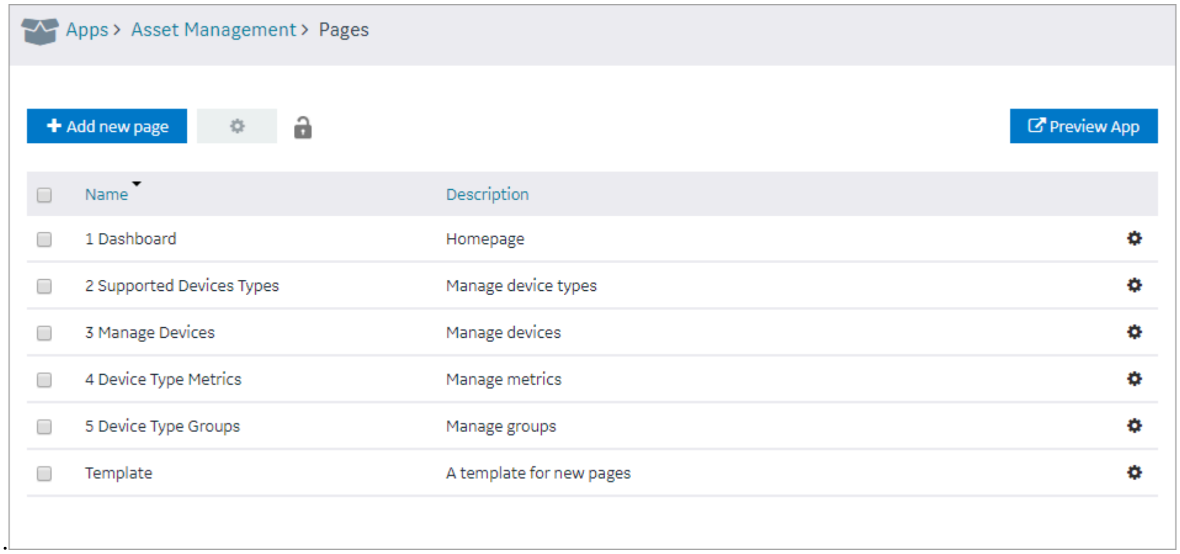
Access a Page

1. In the main navigation menu, select **APPS**.
   The **APPS** workspace appears, displaying a list of applications created in the site.



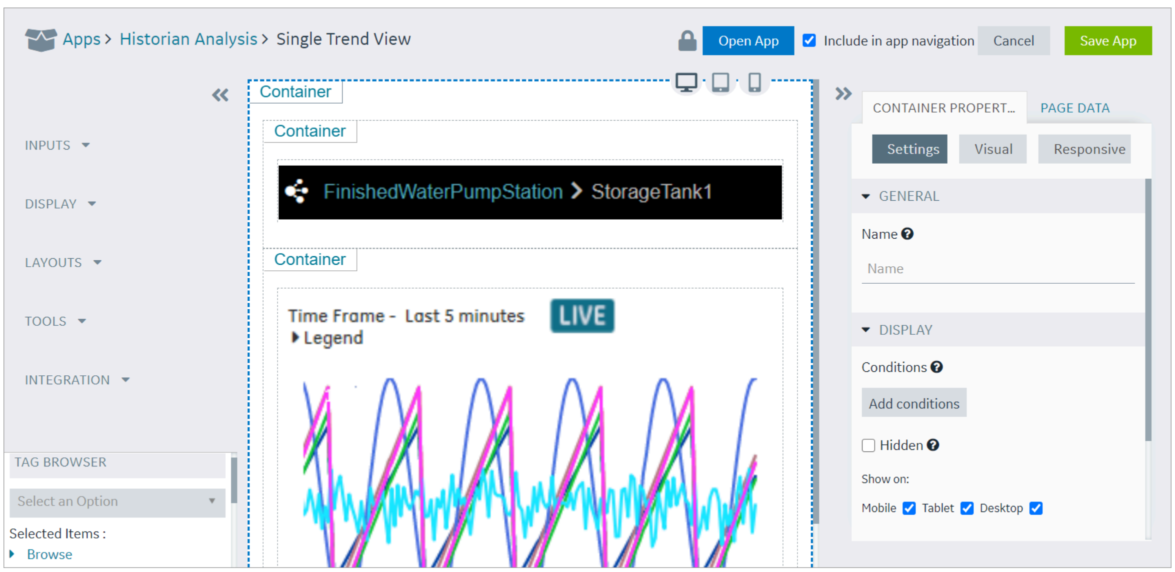
2. In the **Name** column, select the application that contains the page that you want to access.

The **PAGES** workspace appears, displaying a list of pages created in the application.



3. In the **Name** column, select the page that you want to access.

   The page designer appears, displaying the elements in each container in the page.

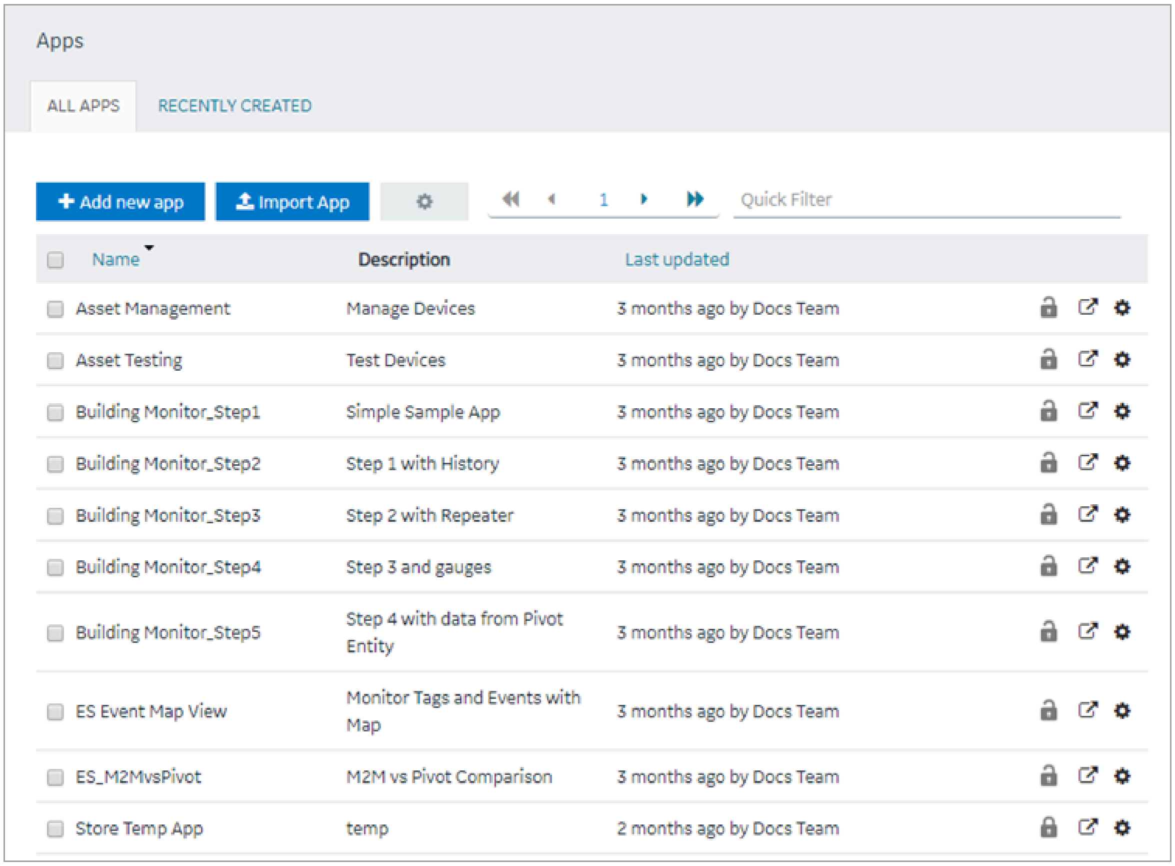


Tip:

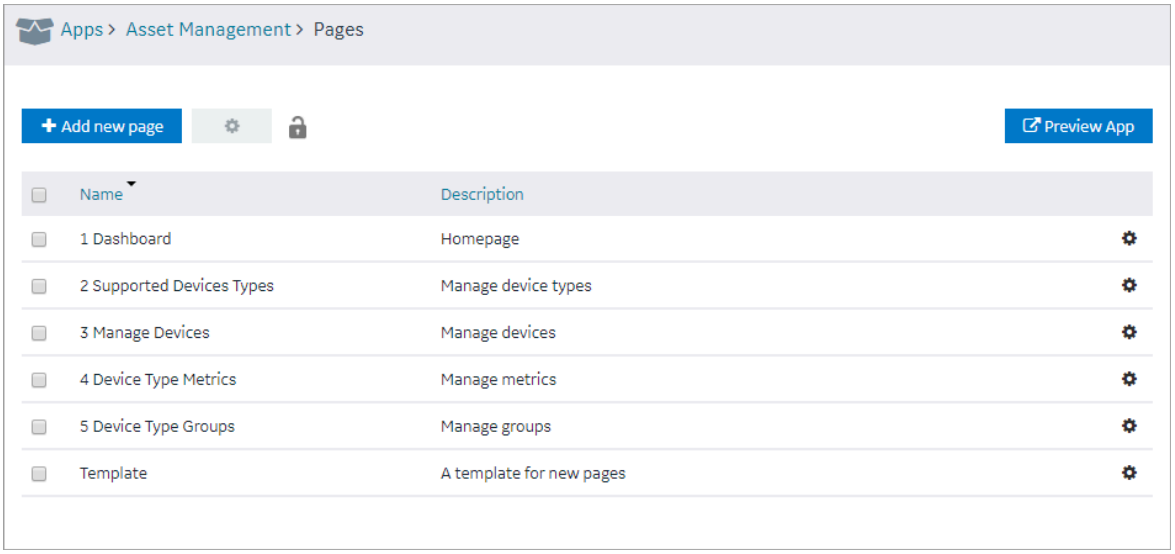
If needed, you can add or remove components from a container in the page, or modify the properties of a container *(on page 575)*, and then select **Save App** to save your changes.

Create a Page

1. In the main navigation menu, select **APPS**.
   The **APPS** workspace appears, displaying a list of applications created in the site.

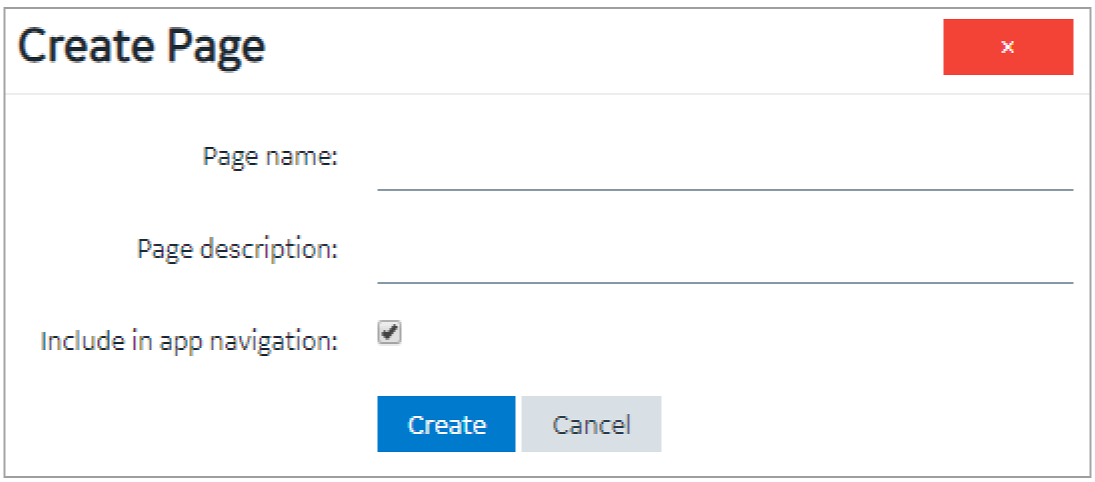


2. In the **Name** column, select the application in which you want to create a page.
   The **PAGES** workspace appears.



3. Select **Add new page**.

   The **Create Page** window appears.

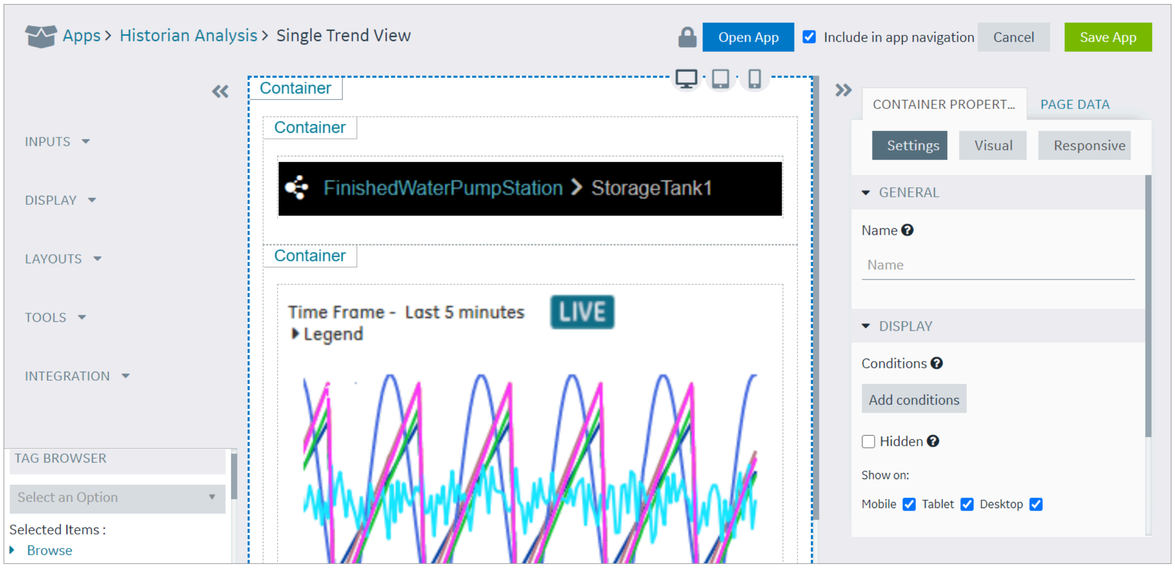


4. Provide values as described in the following table.

Field	Description
Page name	Enter a name for the page. The name must contain at least one uppercase or lowercase letter.
Page description	Enter a description for the page.
Include in app navigation	Select this check box if you want this page to be included in the application navigation. By default, this check box is selected.

5. Select **Create**.

   The page is created, and the page designer appears.



   The container and the left/right panels on the page designer are flexible to use.

   ◦ Drag the left/right sides of the container to resize for a wider view.

   ◦ Select  and  to show or hide left/right panels.

6. As needed, add components to the page *(on page 575)*.
7. As needed, add queries to the page. Set options for the query, including query submission options.

   Several queries require the multi-select parameter to be selected on the App Page, otherwise no output data will be displayed.

   The following Historian REST queries require the multi-select input to be enabled on the EndApp page for output data to be displayed:

   ◦ Get > Raw Data
   ◦ Get > Calculated Data
   ◦ Get > Sampled Data
   ◦ Post > Calculated Data
   ◦ Post > Interpolated Data
8. Bind the inputs and outputs of widgets to page data, such as manually entered values, queries, formulas, and globals.
9. Select **Save App**.

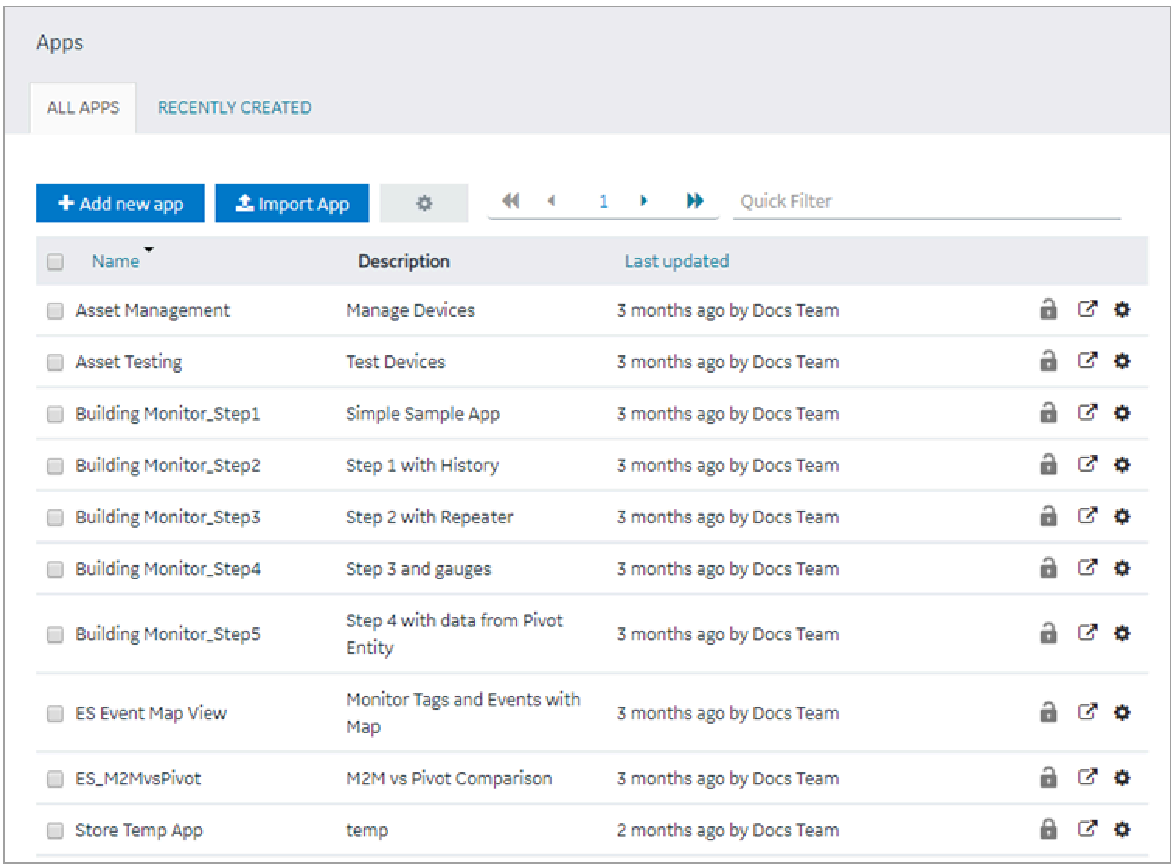
The changes made to the page are saved.

> **Note:**
> At any point in time, if you attempt to navigate away from the page, a confirmation message appears to confirm whether you want to stay on the page, and finish your work.

Copy a Page

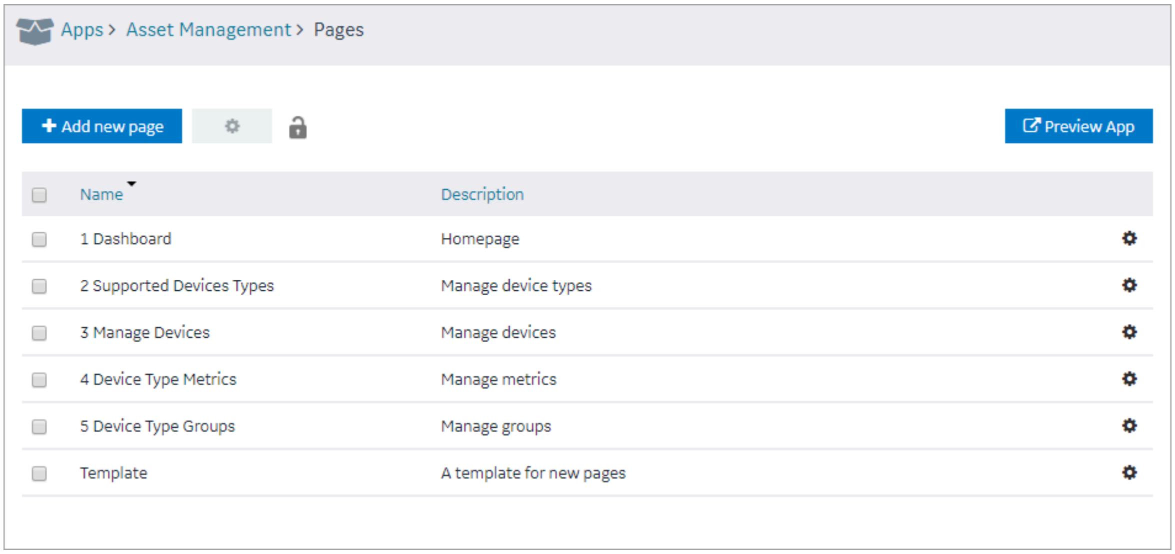
1. In the main navigation menu, select **APPS**.

   The **APPS** workspace appears.



2. In the **Name** column, select the application that contains the page that you want to copy.

   The **PAGES** workspace appears.



3. Select the check box for the page you want to copy and choose one of these options.

Option	Description
Copy a single page	Select ⚙ in the row, then select **Duplicate page**.
Copy multiple pages	Select ⚙ in the header, then select **Duplicate Pages**.

   A confirmation message appears.
4. Select **OK** to proceed to duplicate the page/s.

   Select an Application screen appears.
5. From the drop down, select the application to copy this page.

   You can copy page/s from one application to another, and also within the same application.
6. Provide a name for the page.

Option	Description
Copy a single page	Enter a name for the duplicate page. The name must contain at least one uppercase or lower-case letter.
Copy multiple pages	By default, unique names are assigned to each duplicate page.

7. Copying page/s from one application to another requests for handling globals.

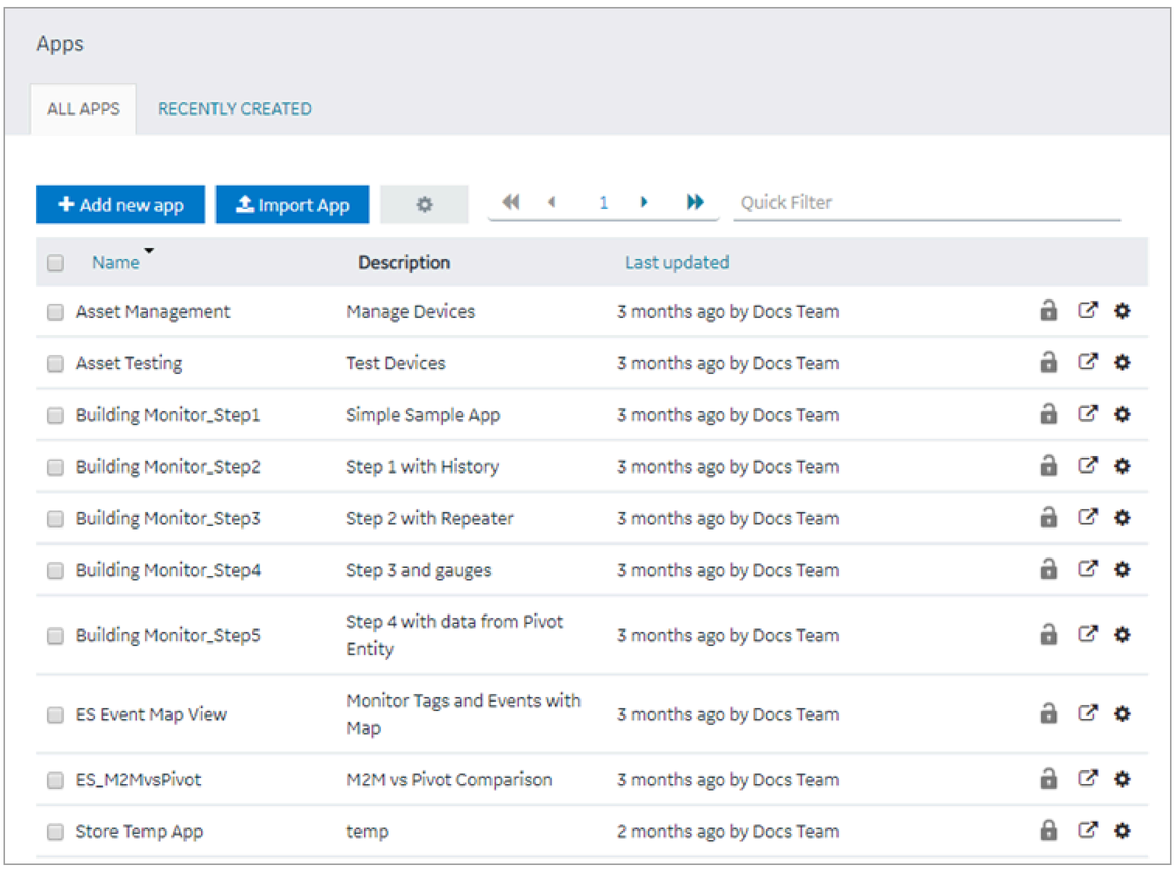
- **Duplicate Globals**: Creates page globals with a different name. Recommended when globals have the same name but are of different types.
- **Attempt to reuse Globals**: Reuses the page globals. Does not create new globals with the same or duplicate name.

8. Select **OK**.
   The pages, along with the UI components, queries, and global variables used in them, are copied.

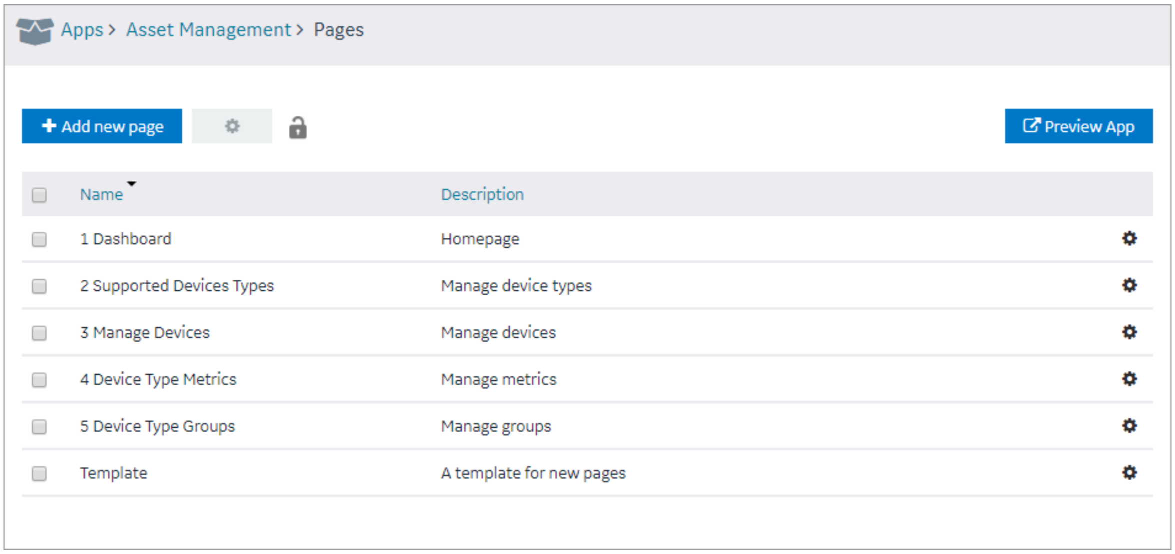
Delete a Page

When you delete a page, the global variables used in the page are also deleted.

1. In the main navigation menu, select **APPS**.
   The **APPS** workspace appears.



2. In the **Name** column, select the application that contains the page that you want to delete.
   The **PAGES** workspace appears.



3. In the workspace heading, select , and then select **Delete Pages**.
   A message appears, stating that the global variables used in the page will also be deleted.

> **Tip:**
>
> Alternatively, in each row containing a page that you want to delete, select , and then select **Delete page**.

4. Select **OK**.
   The pages are deleted.

Navigation

About Navigation

Using navigation, you can configure the navigation menu of an application by performing the following tasks:

- Add a page to the navigation menu of the application.
- Remove a page from the navigation menu of the application.
- Specify the name of the page that should appear in the navigation menu of the application.
- Specify the sequence of the pages that should appear in the navigation menu of the application.
- Select the icon that should appear for each page in the navigation menu of the application. By default, is selected.

When you access the application, a list of pages that you have added appear in the navigation menu of the application, displaying the icon that you have specified for each page. You can expand the navigation menu of the application by selecting . It will then display the name of each page along with the icon.

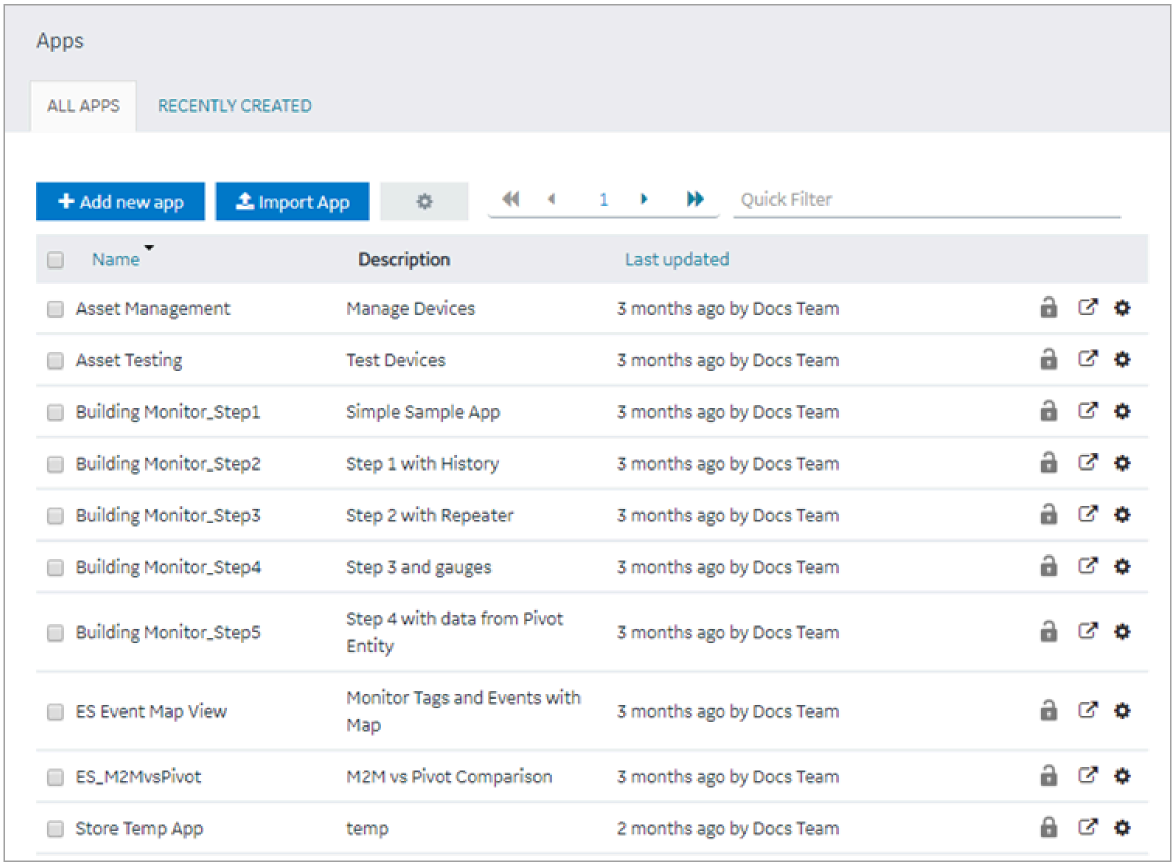
Using navigation, you can configure the navigation menu of an application by performing the following tasks:

- Add a page to the navigation menu of the application.
- Remove a page from the navigation menu of the application.
- Specify the name of the page that should appear in the navigation menu of the application.
- Specify the sequence of the pages that should appear in the navigation menu of the application.

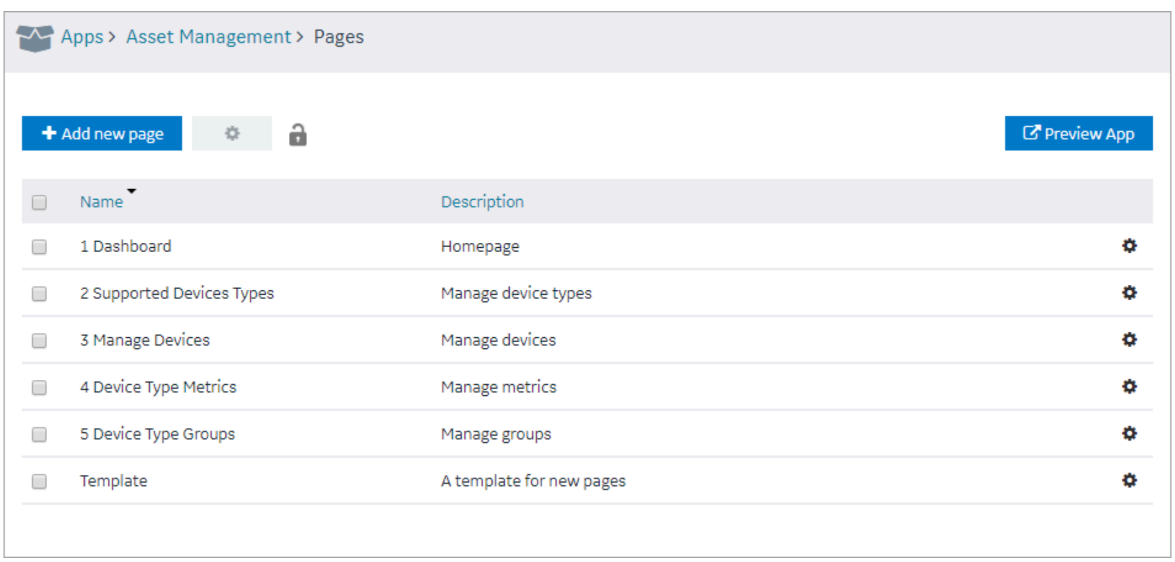
Add a Page to the Navigation Menu of an Application

By default, when you create a page, it is included in the navigation menu of the application. This topic describes how to add a page to the navigation menu of an application in case it has been removed from the navigation menu.

1. In the main navigation menu, select **APPS**.
   The **APPS** workspace appears, displaying a list of applications in the site.



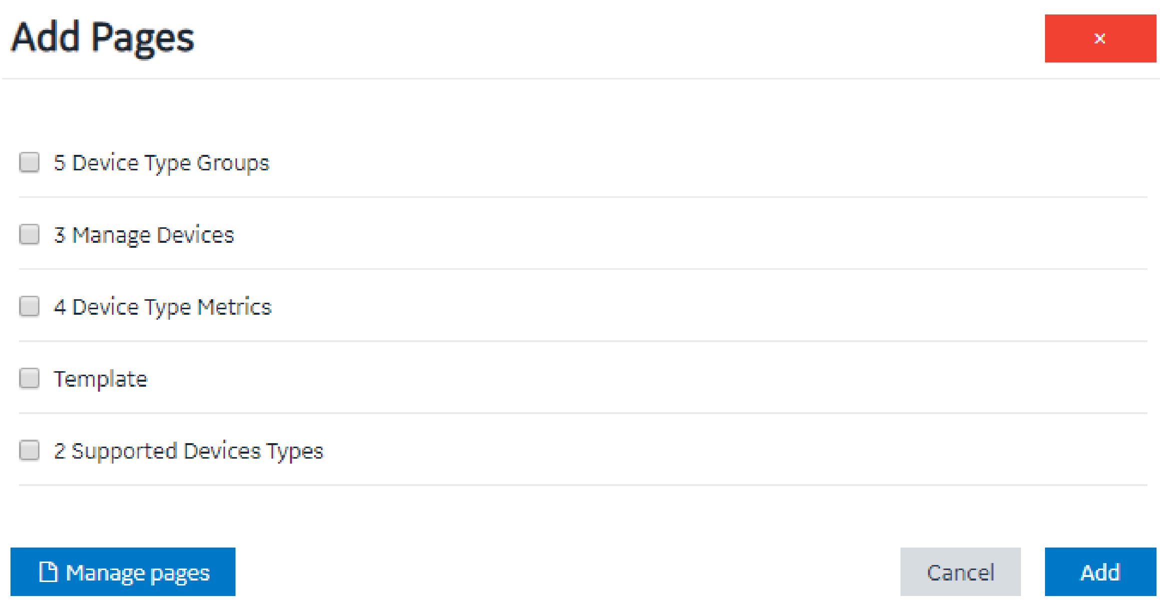
2. In the **Name** column, select the application for which you want to add a page to the navigation menu.
   The **PAGES** workspace appears.



3. In the main navigation menu, select **NAVIGATION**.

The **NAVIGATION** workspace appears, displaying a list of pages that have been added to the navigation menu of the application.

4. Select **Add Pages**.
   The **Add Pages** window appears, displaying a list of pages that have been created in the application, but have not been added to the navigation menu.

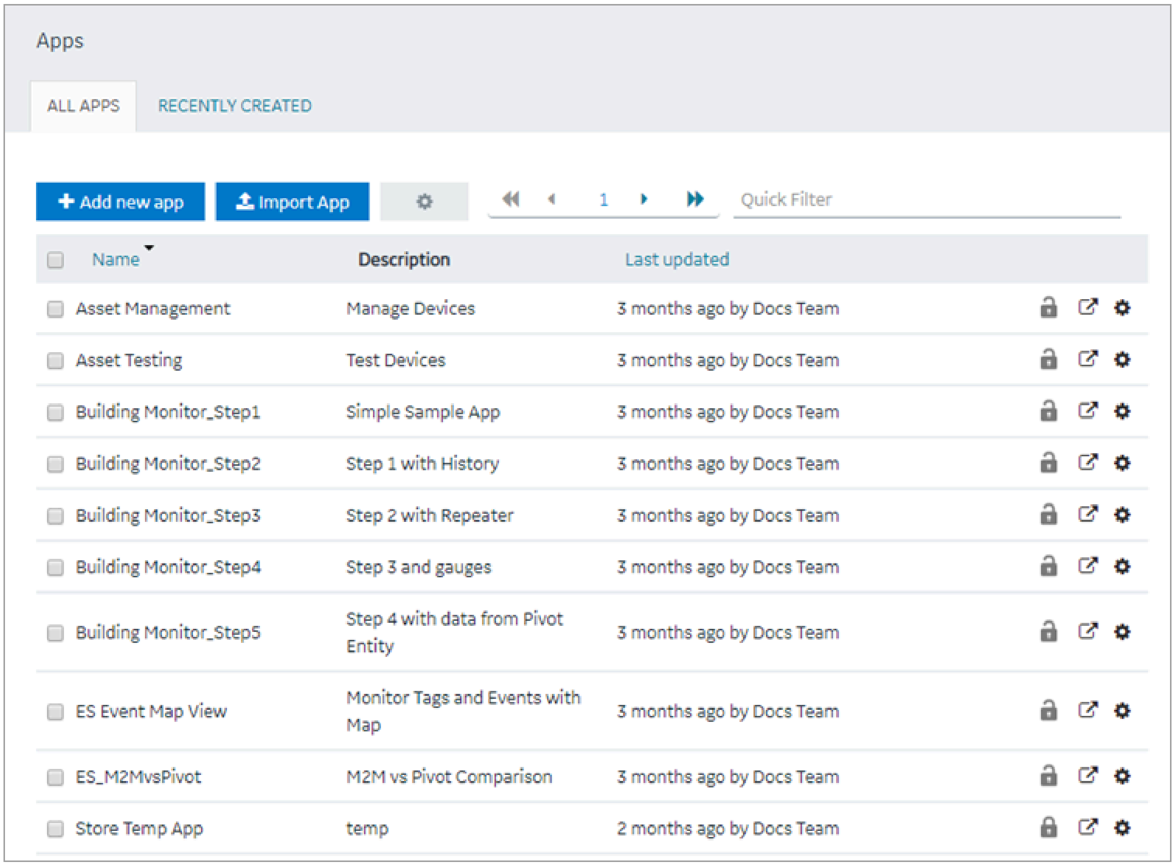


5. Select each check box that corresponds to a page that you want to add to the navigation menu of the application, and then select **Add**.
   The selected pages are added to the navigation menu of the application.

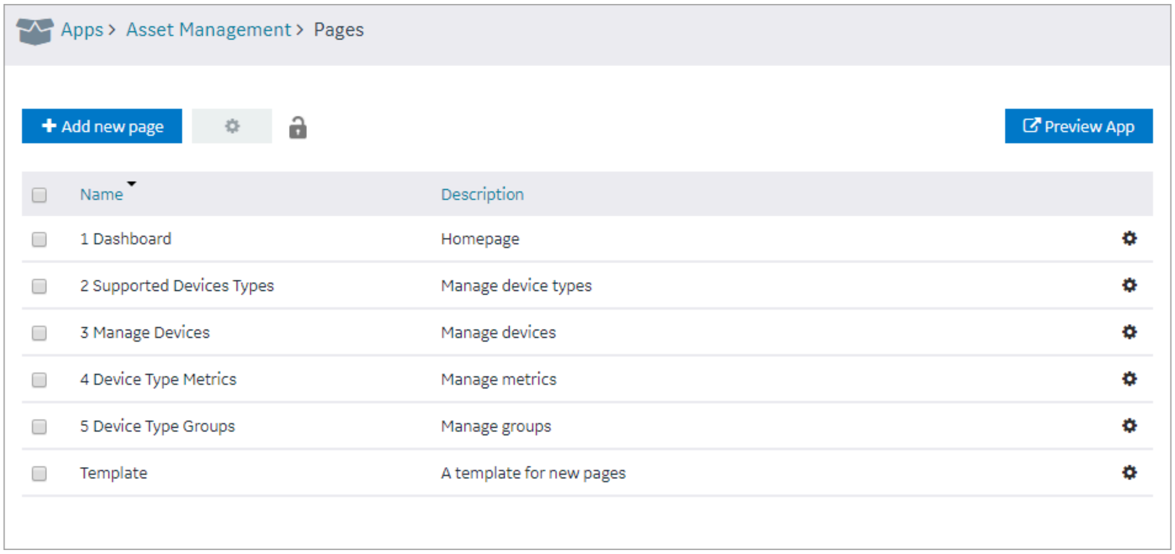
> **Tip:**
>
> - You can modify the display name of a page by selecting in the **DISPLAY NAME** column.
> - You can modify the name of a page by selecting in the **Page Name** column.
> - You can select the icon that should appear for the page in the navigation menu of the application by selecting an icon in the **Page Icon** column.
> - You can change the sequence of pages in the navigation menu of the application by dragging each page to the required location.
> - You can preview the application by selecting **Preview App**.

Remove a Page from the Application Navigation Menu

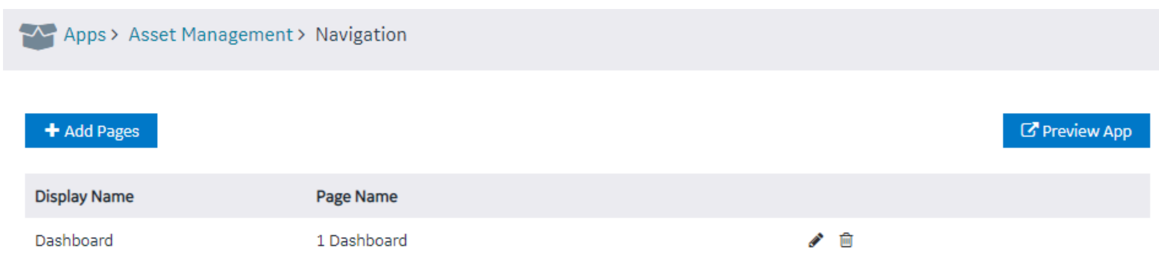
1. In the main navigation menu, select **APPS**.
   The **APPS** workspace appears, displaying a list of applications in the site.



2. In the **Name** column, select the application in which you want to change the application navigation menu.
   The **PAGES** workspace appears.



3. In the main navigation menu, select **NAVIGATION**.
   The **NAVIGATION** workspace appears, displaying a list of pages that have already been added to the application navigation menu.



4. In the row containing the page that you want to remove, select .
   The page is removed from the application navigation menu.

> **Note:**
> The page is removed only from the application navigation menu; it is not deleted. You can still access it in the application by performing an action such as selecting a button or an image.

Explorer

About Explorer

Explorer provides a hierarchical view of the following items:

- Containers and UI elements used in each page in the application, which appear in the Pages hierarchy.
- Variables defined in the application, which appear in the Globals hierarchy.

Using Explorer, you can view the links between variables and UI elements on application pages, which will help you follow the application structure.

The variables defined in an application are classified as follows:

- System
- Output
- UI
- Custom
- URL

When you expand a variable in the hierarchy, one of the following options appears:

- app global: true: Indicates that the variable is visible in every page of the application.
- app global: false: Indicates that the variable is visible only in the page where it is defined.

If a variable contains an initial value, that value also appears in the hierarchy.

Themes

About Themes

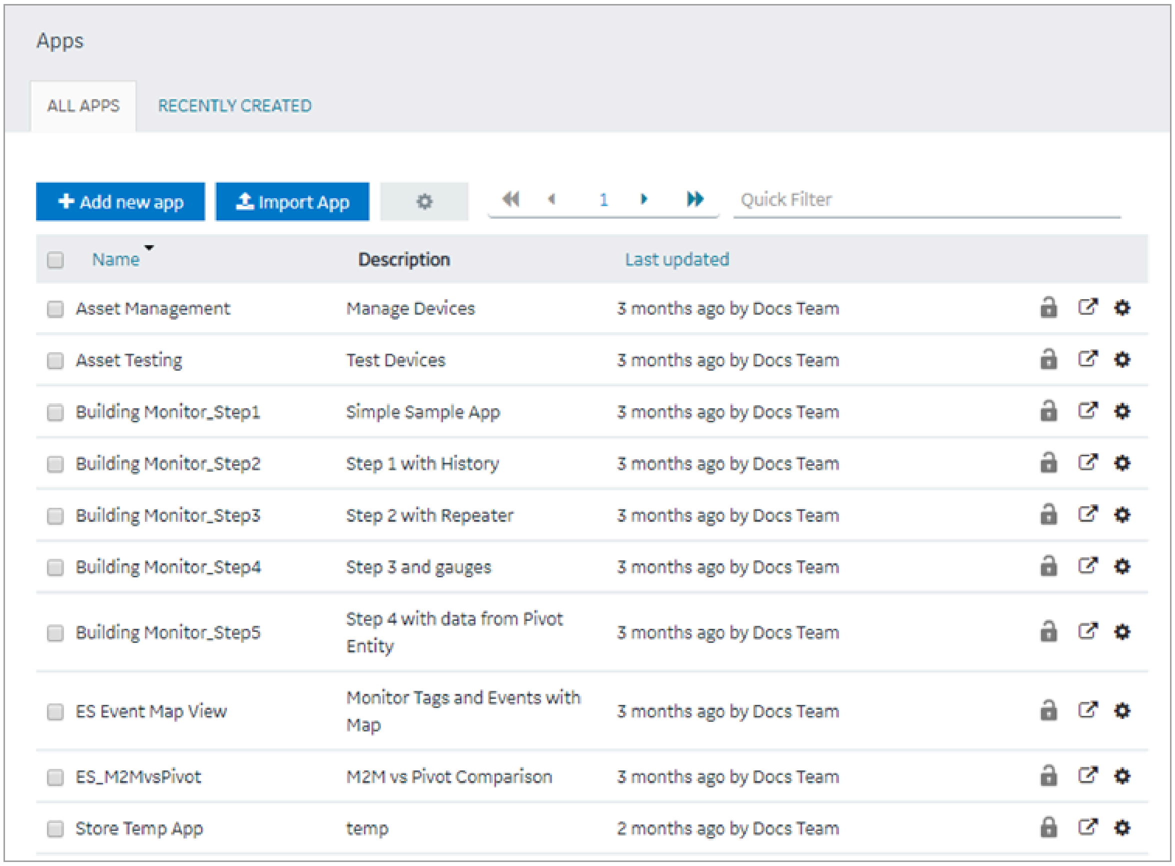
Themes are used to specify the default background color, font color and type, border color, style, width, and other attributes. These attributes are used in the headings, tables, containers, and other elements in an application. Themes help you create a common look and feel across all the pages in your application.

Operations Hub contains a few baseline themes. You cannot modify or delete them. You can, however, copy them.

Access a Theme

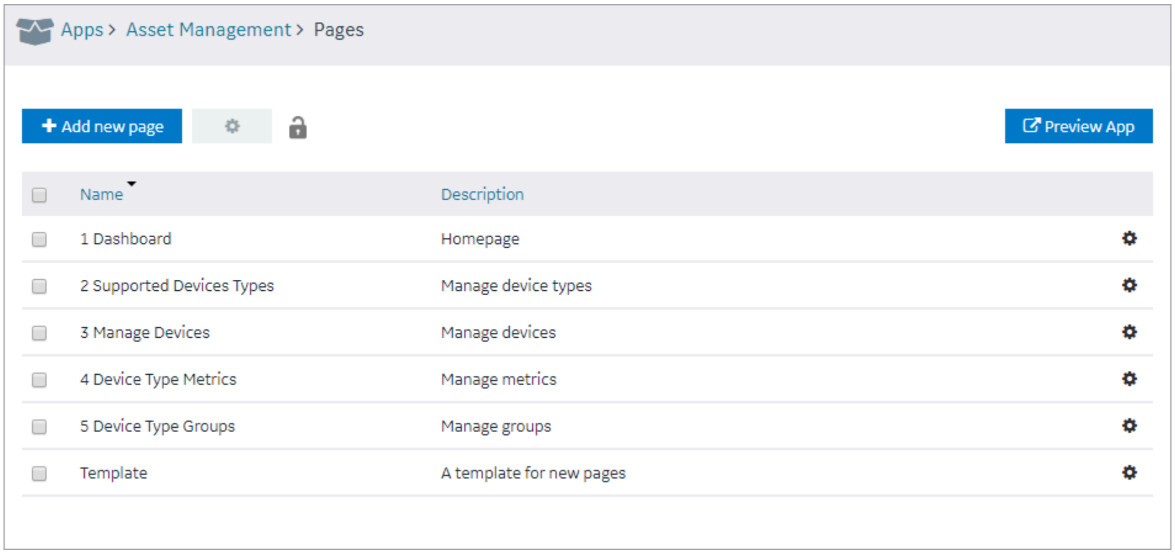
1. In the main navigation menu, select **APPS**.

   The **APPS** workspace appears.

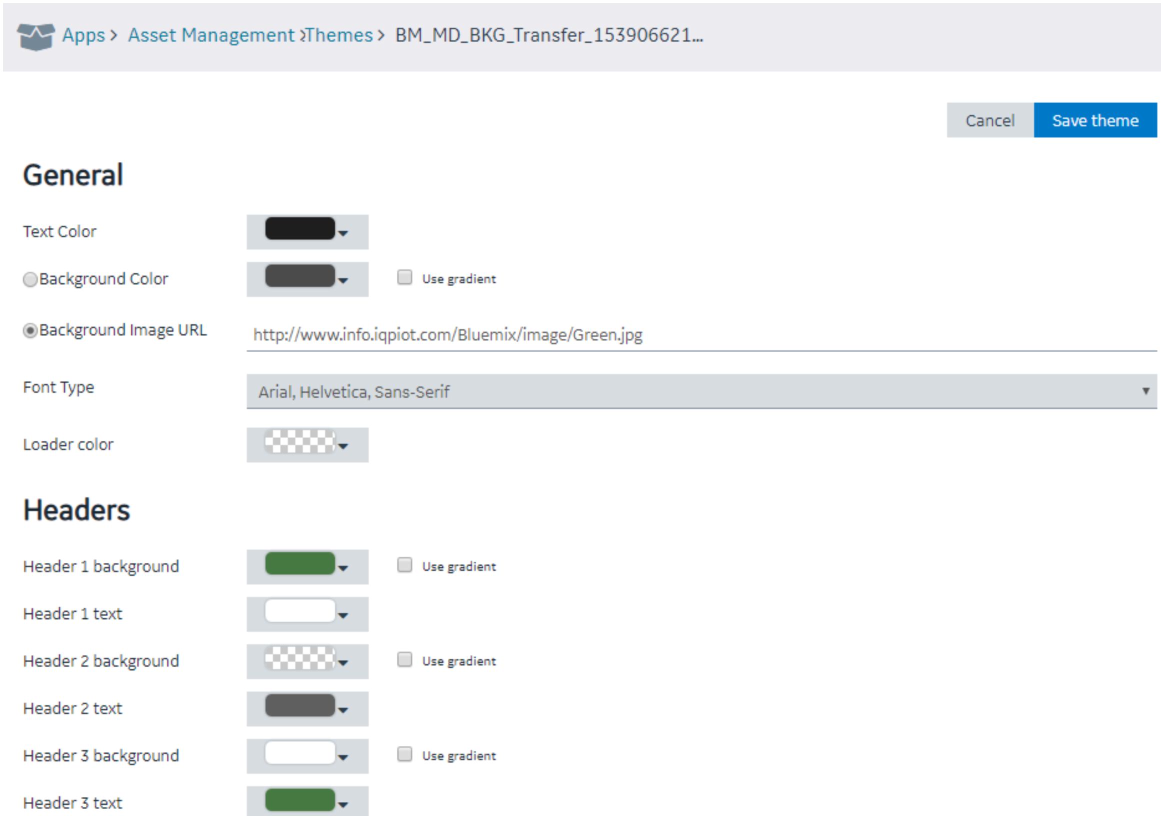
   

2. In the **Name** column, select an application.

   The **PAGES** workspace appears.



3. In the main navigation menu, select **THEME**.
   The **THEME** workspace appears, displaying a list of themes. The theme that is applied to the application is indicated by .
4. In the row containing the theme that you want to access, select .
   The workspace for the theme appears, displaying the settings for each attribute.



Tip:

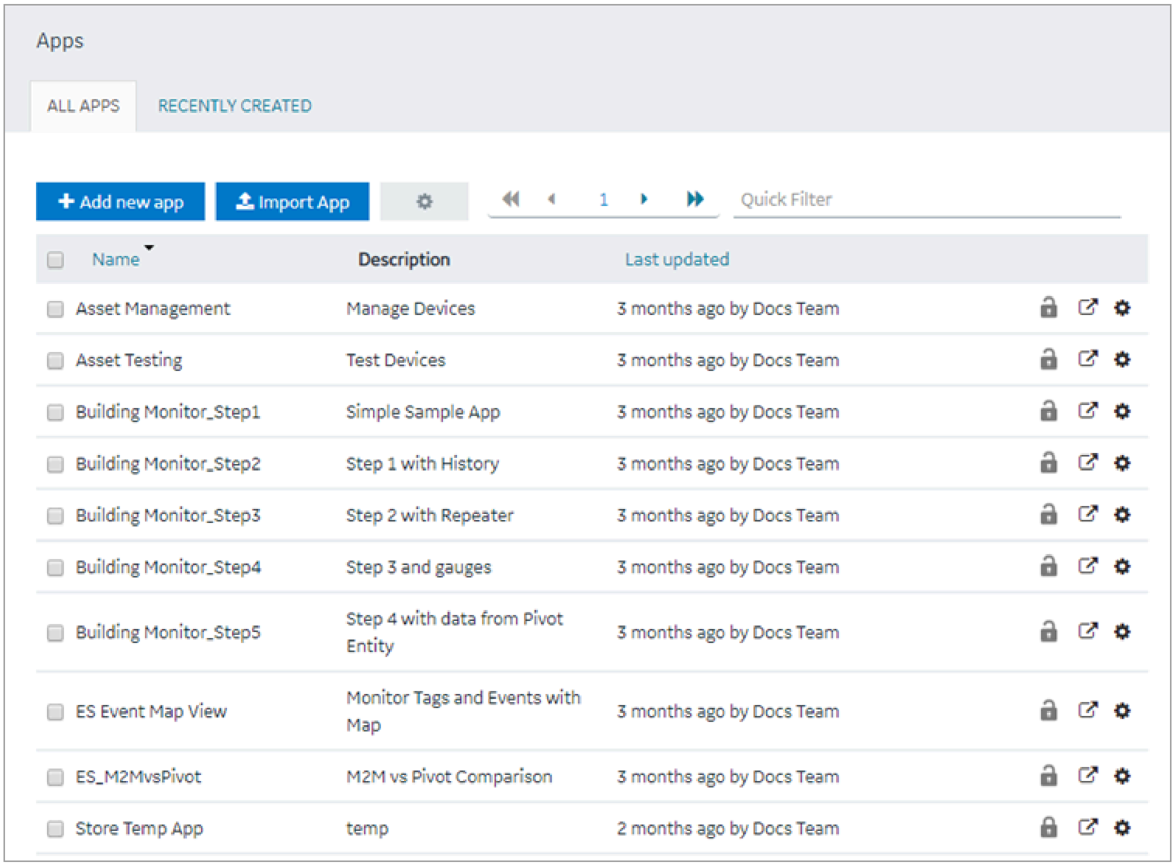
If needed, modify the settings, and then select **Save theme** to save your changes. You cannot, however, modify a baseline theme.

Create a Theme

When you create a theme, it is automatically used in the application that you have selected. You can, however, use a different theme in the application.

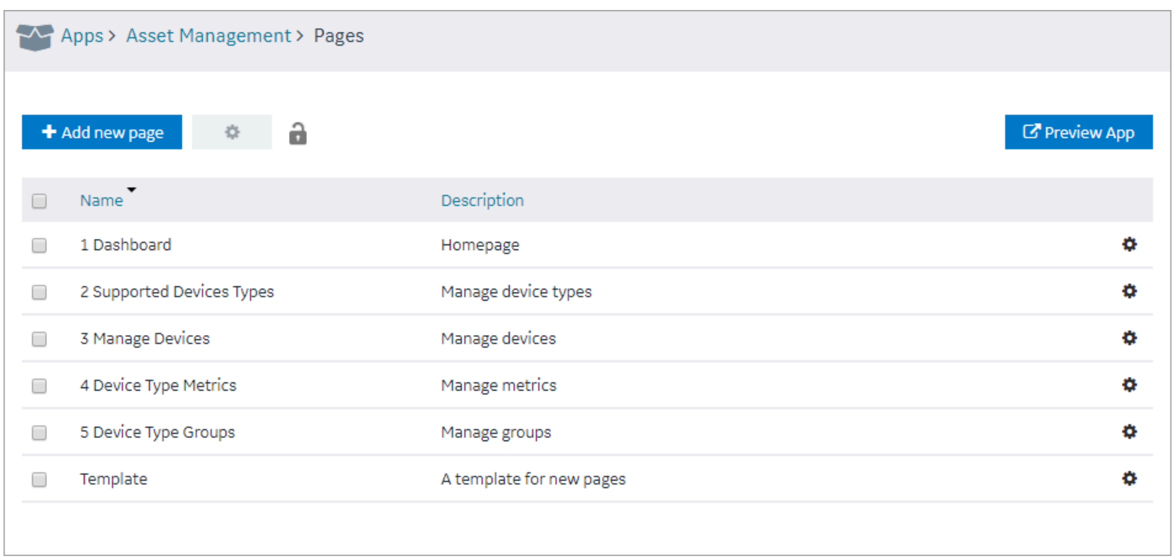
1. In the main navigation menu, select **APPS**.

   The **APPS** workspace appears.



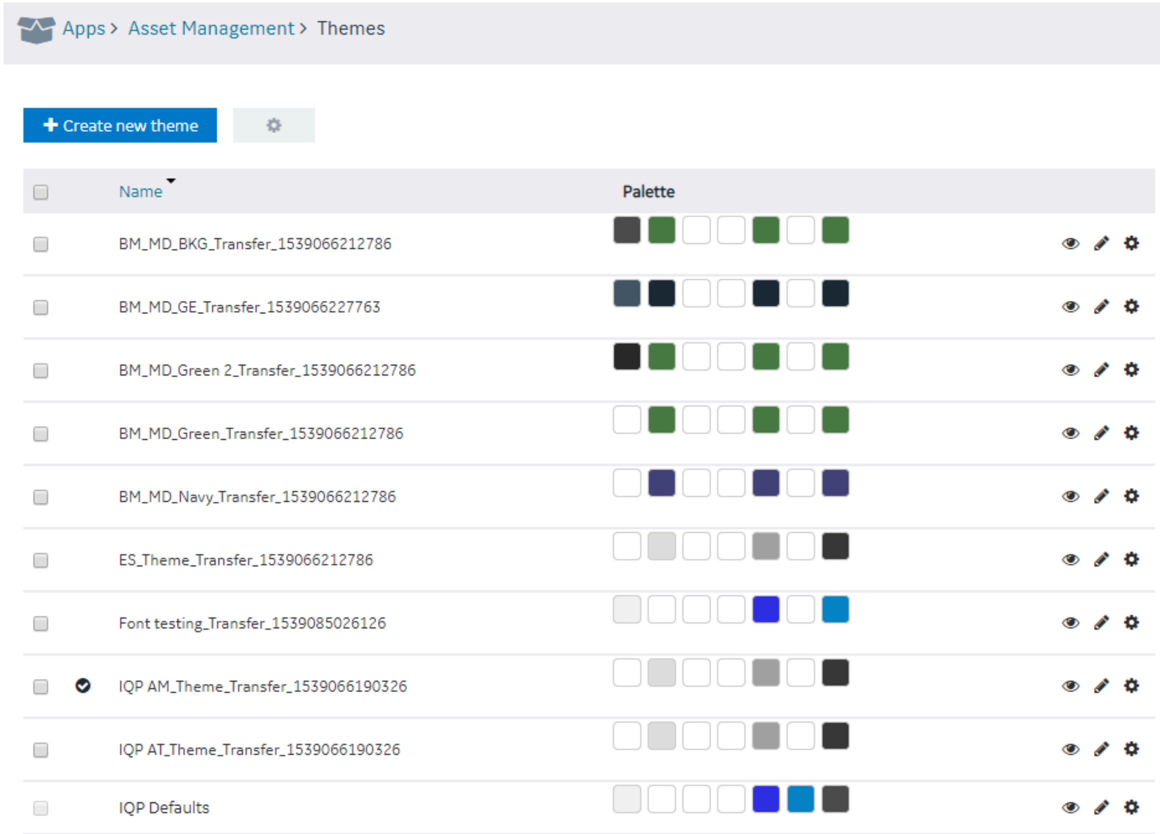
2. In the **Name** column, select an application.

   The **PAGES** workspace appears.



3. In the main navigation menu, select **THEME**.

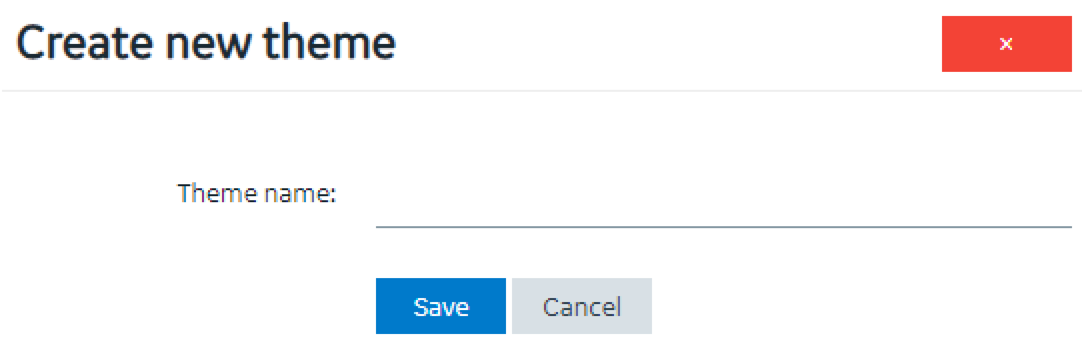
The **THEME** workspace



appears.

4. Select **Create new theme**.

   The **Create new theme** window appears.



5. Enter a name for the theme, and then select **Save**. The name must contain at least one uppercase or lowercase letter.

   The workspace for the theme appears, displaying the default settings for each attribute.

6. As needed, modify the settings, and then select **Save theme**.

   A message appears, asking you to confirm that you want to use the theme for the application.

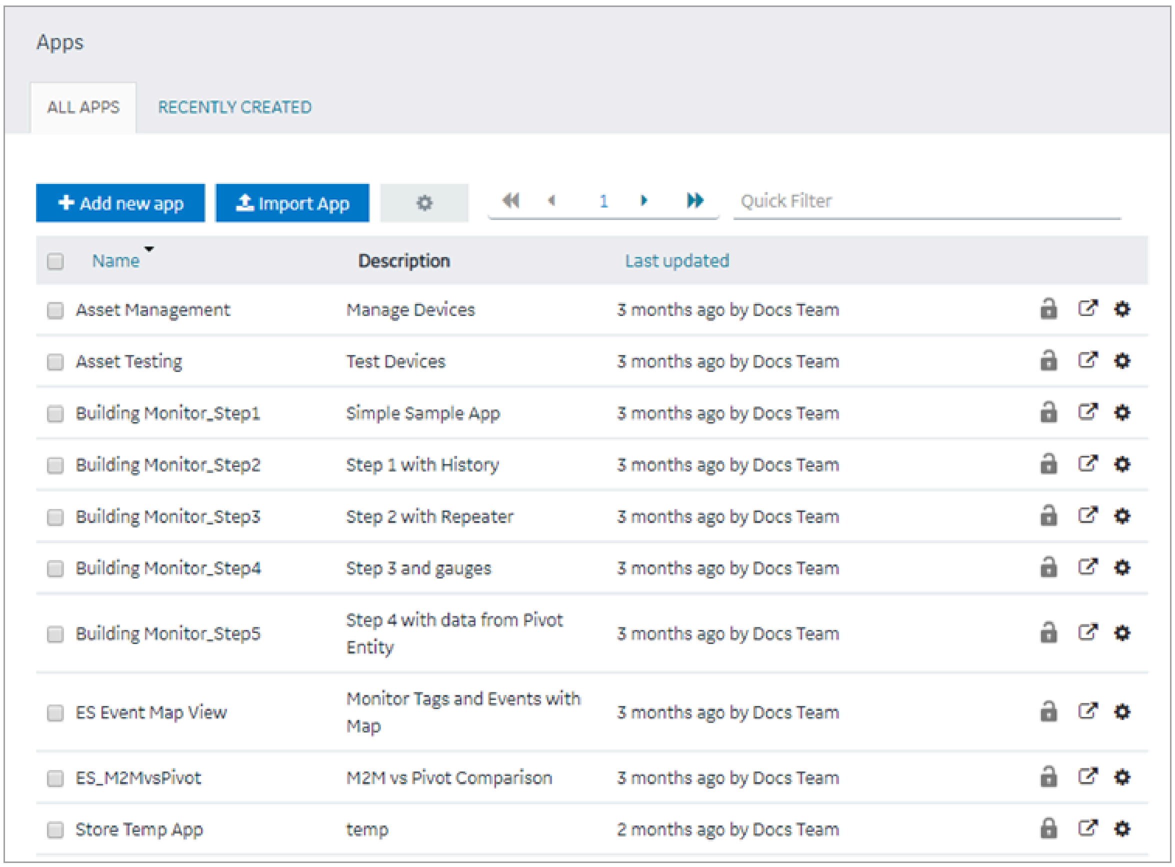
7. Select **Yes**.

   The theme is created and used in the application.

Copy a Theme

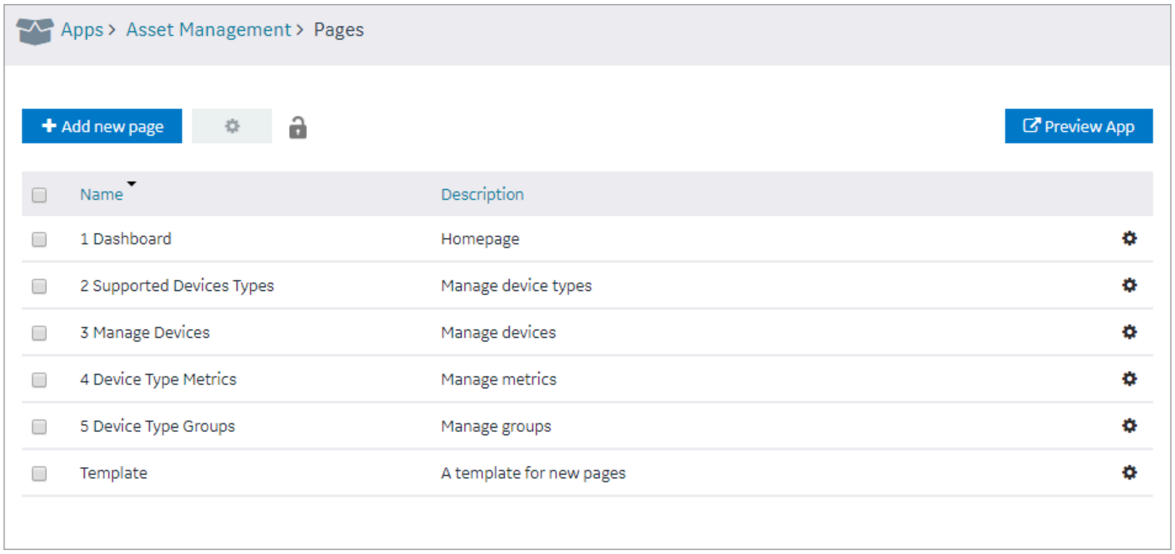
1. In the main navigation menu, select **APPS**.

   The **APPS** workspace appears.

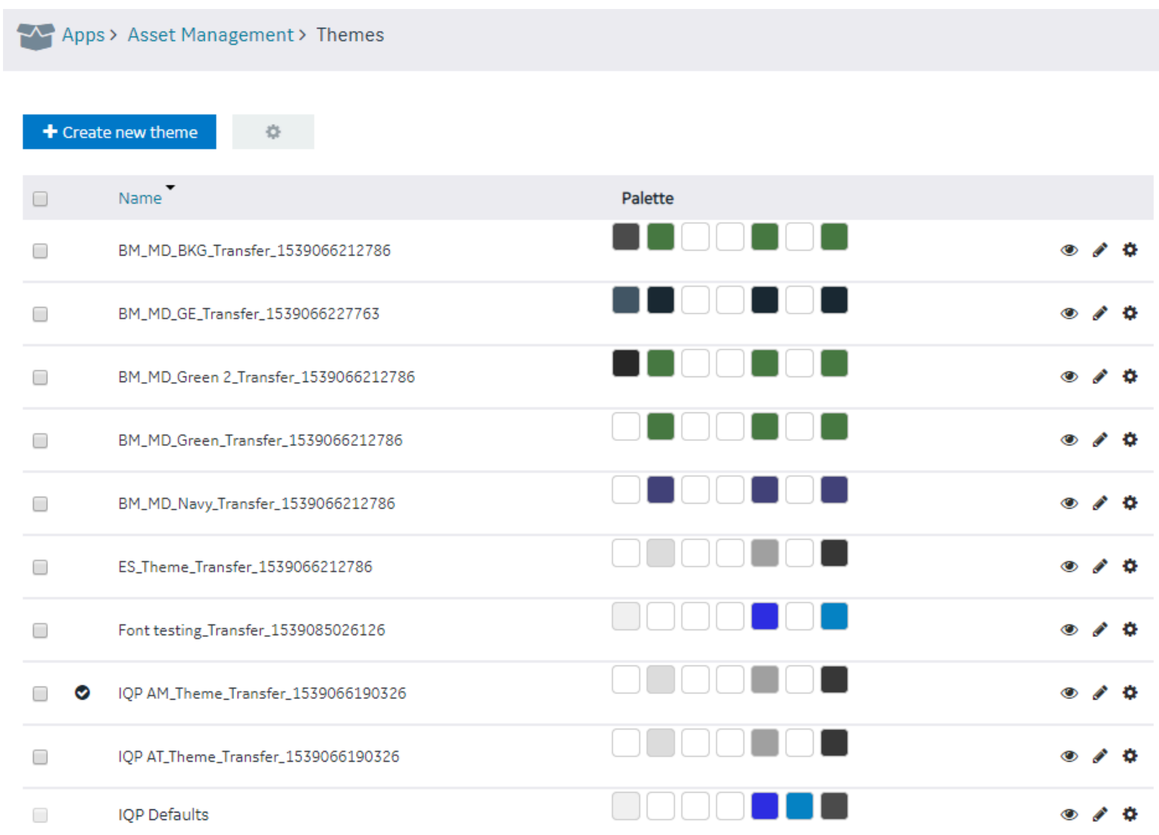
   

2. In the **Name** column, select an application.

   The **PAGES** workspace appears.

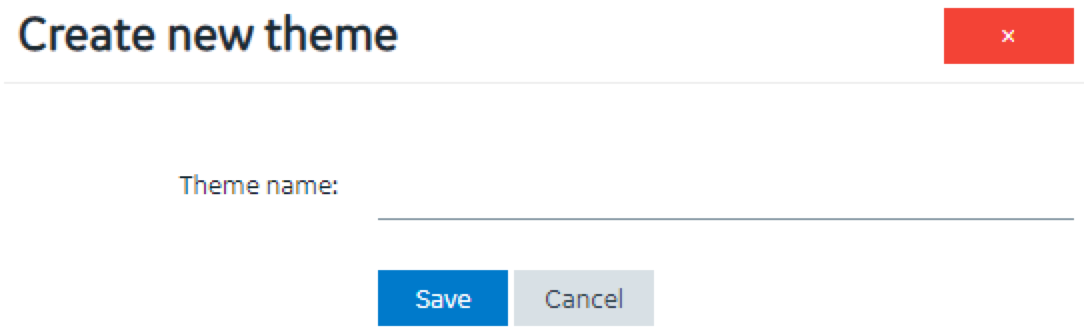


3. In the main navigation menu, select **THEME**.
   The **THEME** workspace appears.



4. In the row containing the theme that you want to copy, select ⚙, and then select **Duplicate theme**.

The **Create new theme** window appears, asking you to enter a name for the theme that you want to copy.

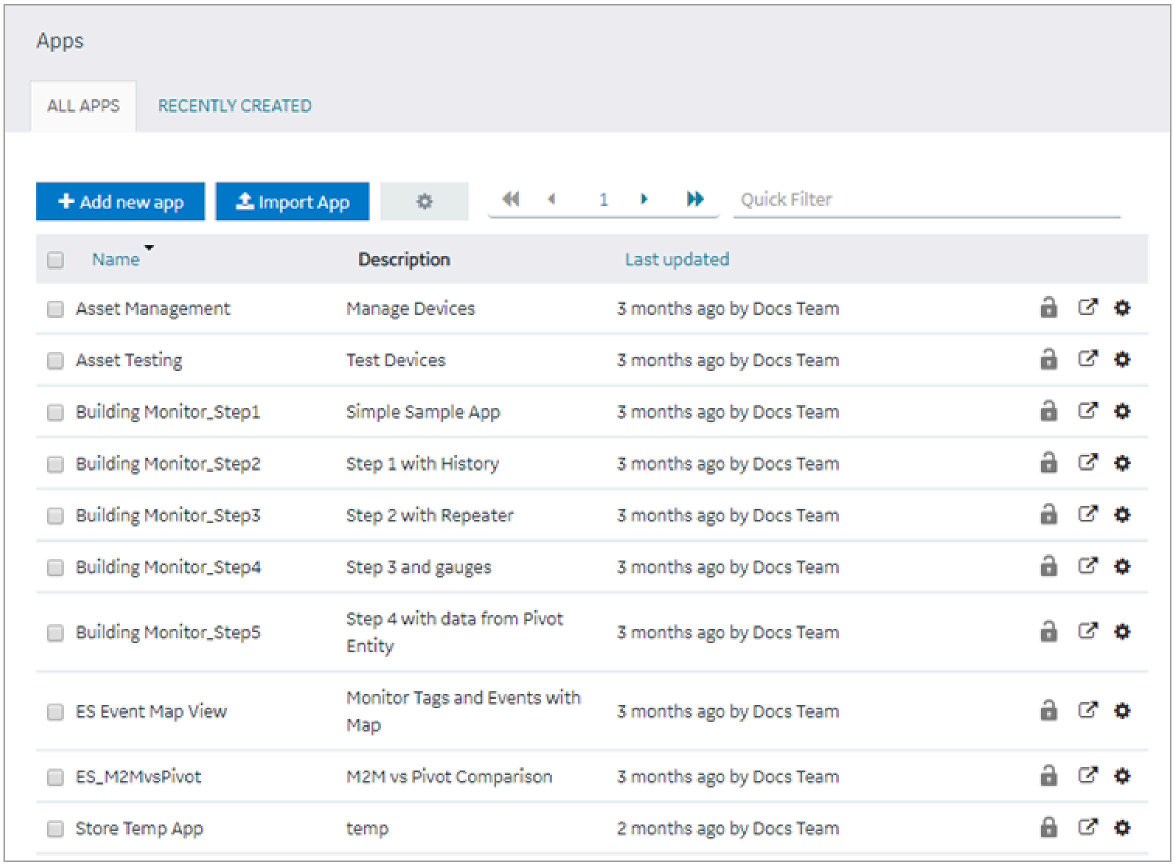


5. Enter a name for the theme, and then select **Save**. The name must contain at least one uppercase or lowercase letter.
   The theme is copied.

Delete a Theme

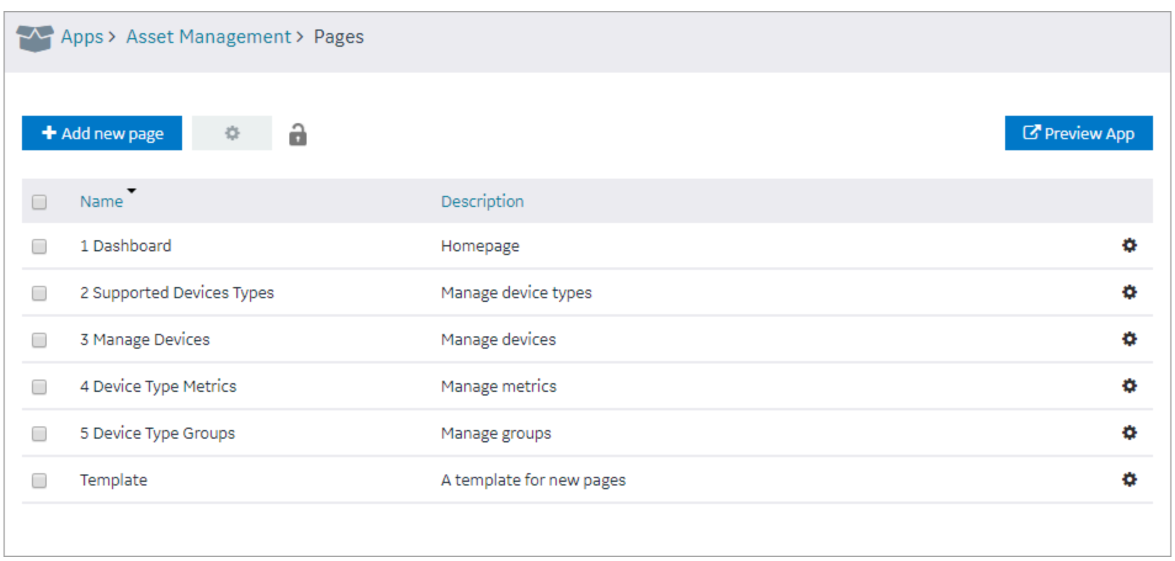
You cannot delete a baseline theme or a theme that is used in an application.

1. In the main navigation menu, select **APPS**.
   The **APPS** workspace appears.



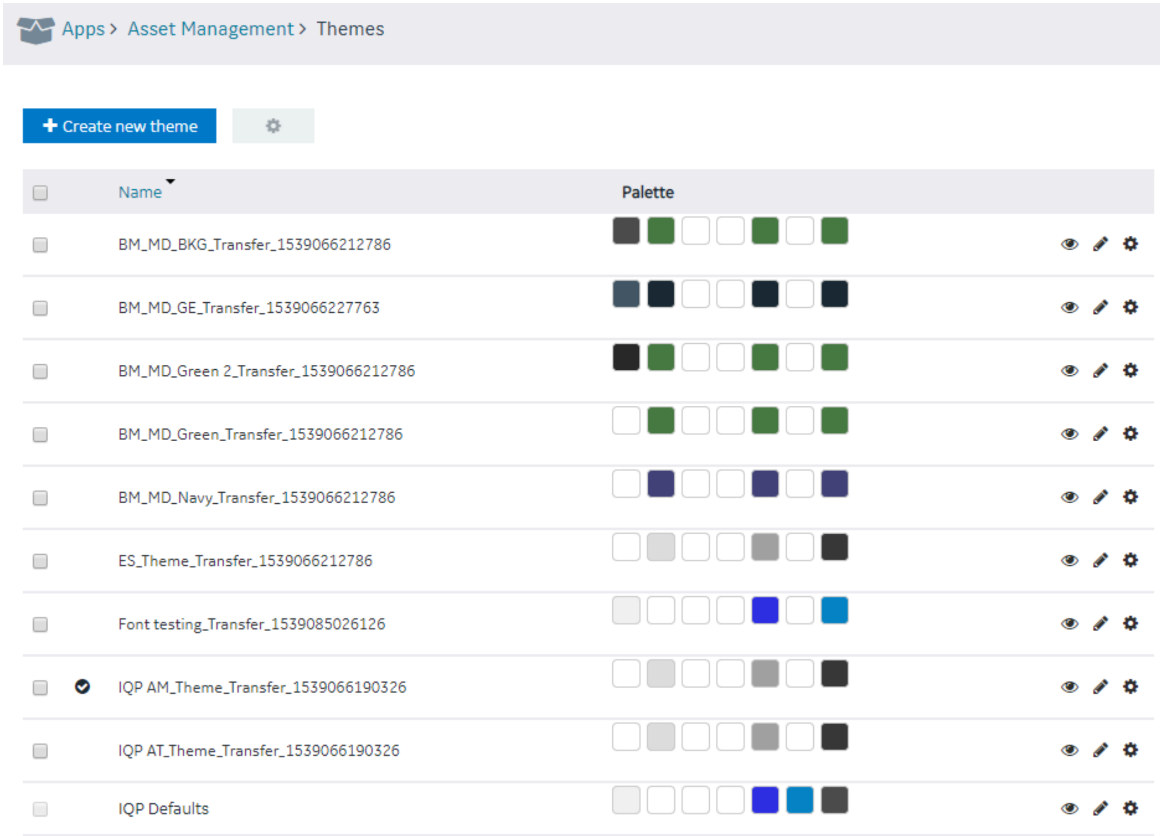
2. In the **Name** column, select an application.

   The **PAGES** workspace appears.



3. In the main navigation menu, select **THEME**.

   The **THEME** workspace appears.



4. In each row containing a theme that you want to delete, select the check box.
5. In the workspace heading, select , and then select **Delete themes**.
   A message appears, asking you to confirm that you want to delete the themes. If, however, a theme is used in an application, a list of applications that use the theme appears, and you cannot delete the theme.

> **Tip:**
>
> Alternatively, in each row containing a theme that you want to delete, select , and then select **Delete theme**.

6. Select **Delete**.
   The themes are deleted.

Settings

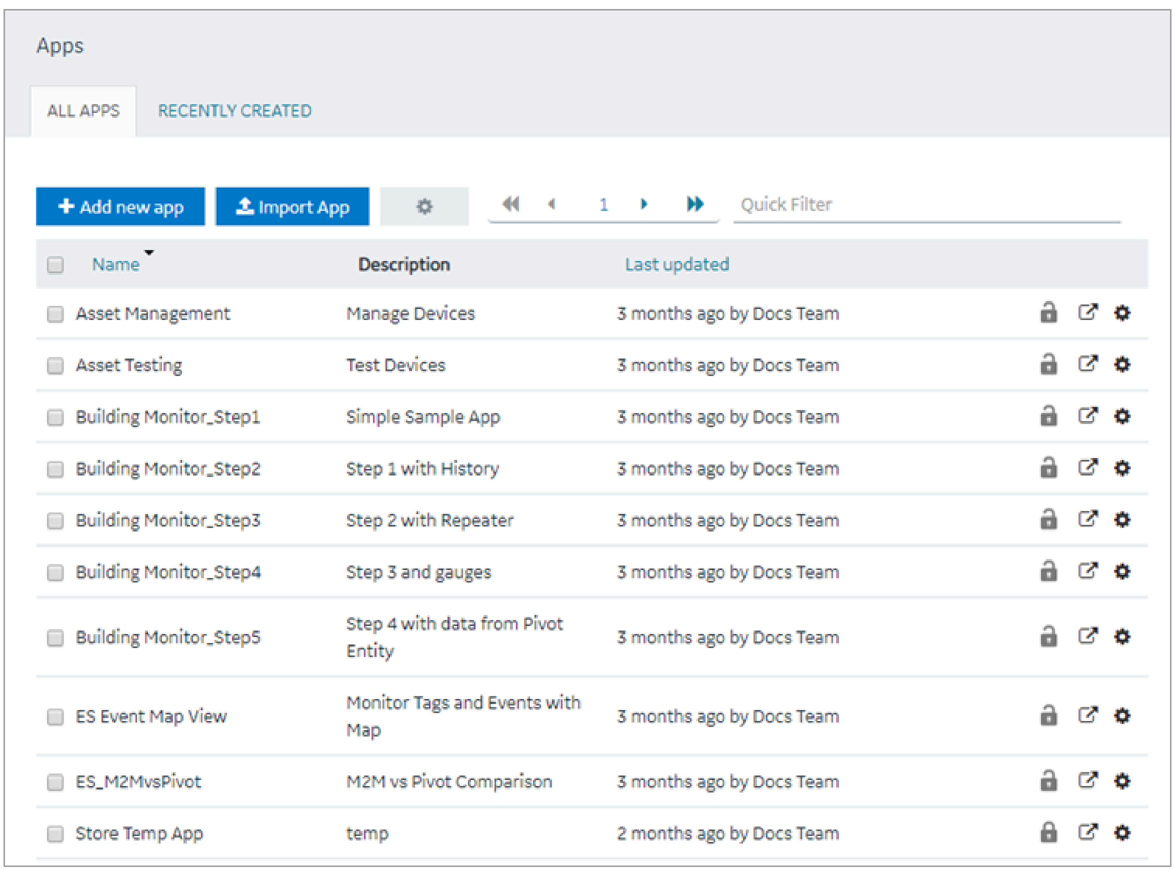
About Settings

You can configure the following settings for an application:

- Display brief or detailed error information in the error messages
- Display or hide a button for accessing trace information
- Display or hide a busy indicator to indicate that a page is loading data from a query
- Display or hide the title of the application
- Display or hide the user pages, which are used to change the password of the user and access user settings from the application
- Automatically close error pop ups without manual intervention

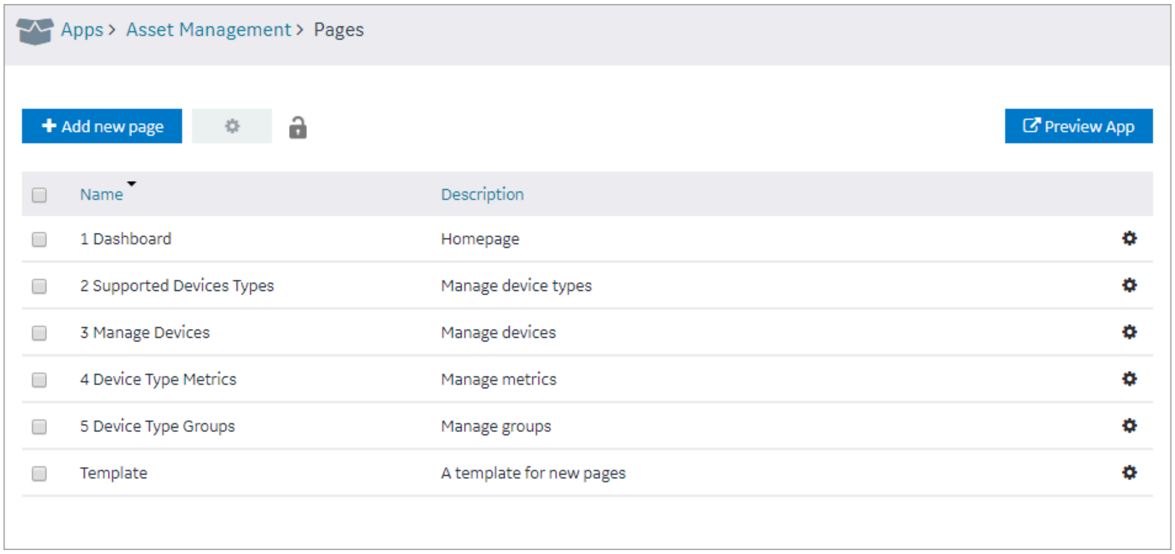
Modify Settings

1. In the main navigation menu, select **APPS**.
   The **APPS** workspace appears.



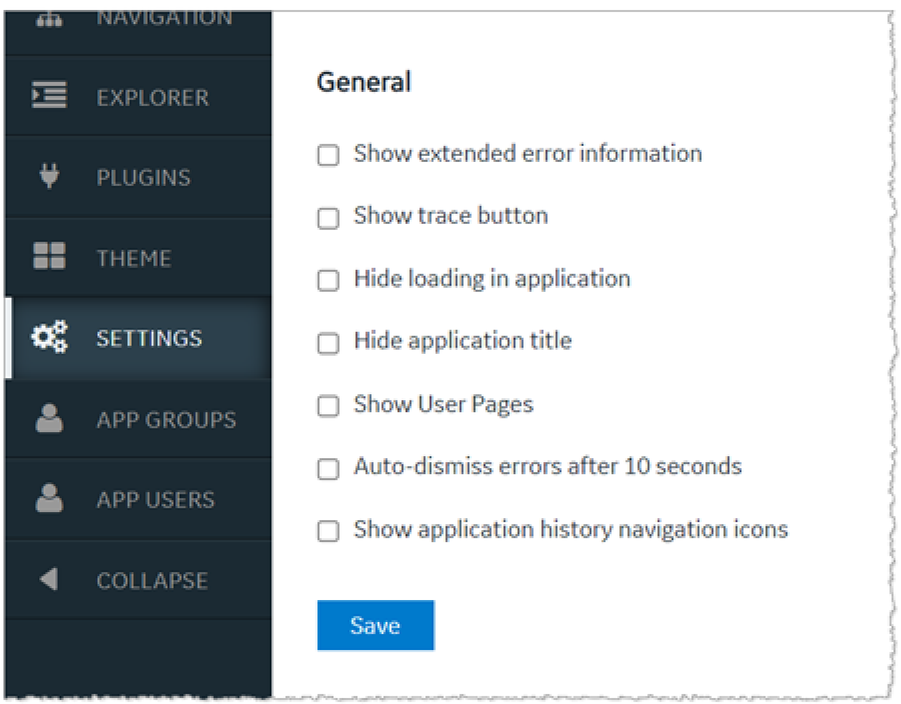
2. In the **Name** column, select the application whose settings you want to modify.

   The **PAGES** workspace appears.



3. In the main navigation menu, select **SETTINGS**.

   The **SETTINGS** workspace appears.



4. As needed, modify values as described in the following table.

Field	Description
Show extended error information	Select this check box if you want detailed error information to appear in error messages. You can use this information to troubleshoot issues in the application.
Show trace button	Select this check box if you want to display a button that allows you to access information on the data retrieved from queries, functions, and global variables that are used in the application. It also includes data that is inserted or updated using queries. When you select this check box (and save your changes), a **Trace** appears in the application. You can select this button to view the trace information.
Hide loading in application	Select this check box if you do not want to display a busy indicator to indicate that a page is loading data from a query.
Hide application title	Select this check box if you do not want the title of the application to appear when you access the application.
Show User Pages	Select this check box if you want to display user pages in the application navigation menu. These pages are used to change the password of the user and access user settings using the application. If you select this check box, the option to access the user pages appears in the application title. If, however, the **Hide application title** check box is selected, the option is moved to the navigation menu of the application.
Auto-dismiss errors after 10 seconds	Select this check box to automatically dismiss error messages after 10 seconds if they pop up in the end application. Recommended for hands-free environments.

Field	Description
Show navigation icons for application history	Select this check box to show  navigation icons on the banner of your application. The back/forward navigation icons work within the scope of an individual application. Use the navigation icons to `Go to previous page` or `Go to next page`. The icons are activated based on the entries for the current application session history.

5. Select **Save**.
   The settings are modified.

Widgets

About Widgets

When you design a page for an application, you can add widgets to the page to display the required information. This article provides information on using the following widgets available in Operations Hub.

Native Widgets

INPUTS	DISPLAY	LAYOUTS	TOOLS
• Check Box *(on page 336)* • Radio Button *(on page 337)* • Dropdown *(on page 339)* • Input *(on page 341)* • Slider *(on page 344)* • Toggle *(on page 345)* • Button *(on page 346)*	• Text *(on page 349)* • Header *(on page 350)* • Image *(on page 351)* • Graph *(on page 352)* • Visualization *(on page 356)* • Big Data *(on page 360)* • Grid *(on page 364)*	• New Line *(on page 397)* • Separator *(on page 397)* • Container *(on page 397)* • Repeater *(on page 398)*	• Event Settings *(on page 414)* • Upload Excel *(on page 415)* • Upload Devices *(on page 418)*

INPUTS	DISPLAY	LAYOUTS	TOOLS
• Camera *(on page 348)* • Text Area *(on page 349)*	• Map *(on page 367)* • Table *(on page 372)* • List *(on page 374)* • Gauge *(on page 375)* • Html *(on page 380)* • Interactive Map *(on page 393)*		

Integration Plugins

Category	Widgets
INPUTS	Button *(on page 421)*, Check Box *(on page 422)*, Radio Button *(on page 423)*, Slider *(on page 424)*, Text Area *(on page 424)*, Text Box *(on page 424)*, Toggle *(on page 425)*.
CHARTS	Chart Line *(on page 426)*, Chart Pie *(on page 427)*, Bullet Graph *(on page 428)*, Pareto Chart *(on page 432)*, Sparkline *(on page 434)*, Spider Chart *(on page 437)*, Timeline *(on page 440)*, Variwide Chart *(on page 446)*.
HMI	CIMPLICITY HMI Webspace *(on page 448)*, Alarm Card *(on page 458)*, Alarm Count *(on page 470)*, Mimic Card *(on page 470)*.
DISPLAY	DataGrid *(on page 488)*, Gauge Bar *(on page 496)*, Gauge Circular *(on page 497)*, Gauge Linear *(on page 498)*, Solid Gauge *(on page 507)*, Value Display *(on page 512)*, iFrame *(on page 500)*, Pivot Grid *(on page 502)*, Image *(on page 517)*, Simple Indicator *(on page 519)*, List *(on page 520)*, Text *(on page 520)*.
GENERAL	Date Picker *(on page 521)*, Breadcrumb *(on page 523)*, Trend Card *(on page 535)*, Task Client *(on page 551)*, Indicator *(on page 558)*, Drop-down *(on page 527)*, DateTime Range Picker *(on page 525)*, Favorite Organizer *(on page 530)*.

Category	Widgets
BATCH *(on page 562)*	Batch Menu, Batch List, Batch SFC, Batch Prompt, Batch Binding Prompts, Batch Alarms, Batch Phase Control, Batch Control, Batch Parameter, Batch Recipe Info, Batch Reports, Batch Step Control, Batch Step List.

Custom Plugins

Custom plugins can be added to Operations Hub through use of the Plug-in infrastructure. To learn more about plug-ins, refer to the About Plug-Ins *(on page 216)* section.

Native

Inputs

Check Box

A check box widget is used to allow application users to choose between two mutually exclusive options. For example, you can use a check box to allow the application user to specify whether the user has read the license agreement. You can also use a check box to display or hide other widgets on the page. To use the new version, refer to Check Box *(on page 422)*.

Check Box Settings

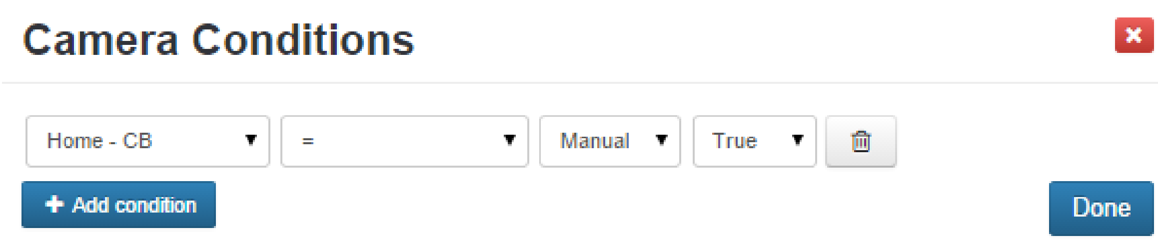
When you use a check box widget, in addition to providing values for the default fields for a widget, you must define the following settings:

Type of the Setting	Description
Target Data	If this check box only represents input to a single query, you can select the target input from the list of inputs to the queries that have been added in the **Page Data** section.
Source	Identifies the source of the check box value. You can specify one of the following types of sources: • **Data**: Select the source of data from the list of outputs from the queries that have been added in the **Page Data** section. • **Manual**: Select this option if you want to set true and false as the check box options.

Using a Check Box to Display or Hide a Camera Button

To use a check box widget to display or hide a **Camera** button, perform the following steps:

1. Add the check box and camera widgets to the page.
2. In the **CHECKBOX PROPERTIES** section, enter values in the **Label** and **Id** boxes, and then select the **Global Data** check box.
3. In the **CAMERA PROPERTIES** section, select **Add conditions**.
4. In the **Camera Conditions** window, select **Add condition**, and then enter or select values as shown in the following image.



> **Note:**
> In this case, CB was the ID specified for the check box widget.

5. Select **Done**, and then save the application.

   In the application, the **Camera** button appears only if you select the check box.

Radio Button

A radio button is a graphical user interface element that allows a user to select one option out of a set of predefined options. Unlike check boxes, which allow multiple selections, radio buttons require that only one option is selected. To use the new version, refer to Radio Button *(on page 423)*.

Table 5. Radio Button Properties

Property	Description
Target Data	The target data defines where the information will be sent.
Options	Radio buttons require multiple options that are mutually exclusive. Use these available options to create items for each radio button:

Table 5. Radio Button Properties (continued)

Property	Description
	• Select **Hard Coded** to manually create items for radio buttons. 1. Select **+ Add Option**. 2. Enter **Option text**. 3. Enter **Option value**. • Select **Dynamic** to create items using queries. 1. Select a **Value** from the database. 2. Select the **Display**text.
Data	Select this option if you want to provide data by means of a query output or a global parameter.
Manual	Select this option if you want to manually provide data.
Submit on change	Select the check box if you want to submit the query whenever the input value is updated.

Possible Uses

Radio buttons require only one selection out of multiple options. If there are only two options, a radio button is unlikely to be the best widget choice. One example could be selecting an answer on a questionnaire where the choices are: Agree, Neutral, and Disagree. Only one of these answers can be selected, because they are mutually exclusive.

Example

1. Add a radio button and a header on a page.
2. Specify the name in the **Id** box.
3. Select the **Global Data** check box to set the selected value to global.
4. In the **Options** box, select **Hard Coded**.
5. Select **+ Add Option** three times, and enter Agree, Neutral, and Disagree, and the corresponding values of 1, 2, 3.
6. For the header, in the **Data** box, select the global value of **RB** that was set in step 3.
7. Save the application, and preview it.

   The corresponding values appear in the header.

Dropdown

Allows to use standard features of a dropdown.

A dropdown is a graphical user interface element that allows a user to select one option out of a set of predefined options. Dropdowns are characterized by a wider set of options than that of a radio button. Radio buttons rarely have more than three options, while dropdowns can contain many more options. For advanced features, use the multi-feature Dropdown *(on page 527)*.

Table 6. Dropdown Properties

Property	Description
Required	Select the check box to send the input to the query.
Target Data	The target data defines where the information will be sent.
Options	Dropdowns require multiple options that are mutually exclusive. Use these available options to populate dropdown list items: • Select **Hard Coded** to manually enter and fill items for the dropdown. 1. Select **+ Add Option**. 2. Enter **Option text**. 3. Enter **Option value**. • Select **Dynamic** to populate dropdown list items using queries. 1. Select a **Value** from the database. 2. Select the **Display** text.
Data	Select this option if you want to provide data by means of a query output or a global parameter.
Manual	Select this option if you want to manually provide data.
Submit on change	Select the check box if you want to submit the query whenever the input value is updated.
First Option	By default, the first option in a dropdown is blank. It is recommended to manually enter option text

Table 6. Dropdown Properties (continued)

Property	Description
	such as `please select`, instead of a dropdown that appears empty. Enter its option value to be `none`.

Possible Uses

Dropdowns are similar in nature to radio buttons in that they require a mutually exclusive selection. However, while radio buttons are generally used for options between only a few choices, dropdowns can include hundreds of choices. One example of a drop-down list box could be selecting a country of residence. Every country in the world will take up too much space if displayed as radio buttons, while in a drop-down list box, the information can be more elegantly contained. The information selected could be converted to other information depending on the target data. For example, the country could be changed to a telephone prefix by setting the value to be telephone prefix and the display as the country name.

Example: An entity named Wiki has been already defined to store the prefecture names in Japan. The direct option value entering of 47 prefecture names is not productive. This entity value usage is productive. The necessary steps are just to specify this entity in the property after allocating dropdown on a page. In this sample, an entity field called PREF is specified both for Display and Value, where the prefecture names are stored.

1. Drag-and-drop the dropdown widget to a container.
2. Select the dropdown widget in the container to access the **DROPDOWN PROPERTIES** tab
3. Under the **GENERAL** section, provide the details as specified in the table:

Field	Description
Label	Enter `Select an option`.

4. Under the **DATA** section, provide the details as specified in the table:

Field	Description
Target Data	Select a query.
Options	Select `Dynamic`.
Value	Select `PREF`.
Display	Select `PREF`.
Submit on change	Select the check box.

In the practical application, a query can be executed based on the option selection in dropdown and the facility or company status in the prefecture can be displayed on a map as markers.

Input

The input widget is a graphical user interface element that contains a text box.

The input widget differs from a standard text box in that its purpose is to allow the end user to insert information into a database.

Properties

- **Type**: There are several options for the type of data that can be added via an input widget. Depending on the data type set, the system will automatically validate and confirm specific data sets. For example, while a Text type can be anything written in the input, an email address may have specific requirements such as the use of an at sign character (@). If the data type is set for email, the user must include an at sign character (@). If not, an error message appears. The following options are available:
    - Text
    - Password
    - Number
    - Hidden
    - Date
    - Time
    - DateTime
    - URL
    - E-mail

    Note:
    This DateTime output is not compatible with Historian queries. Use Date Picker *(on page 521)* instead.

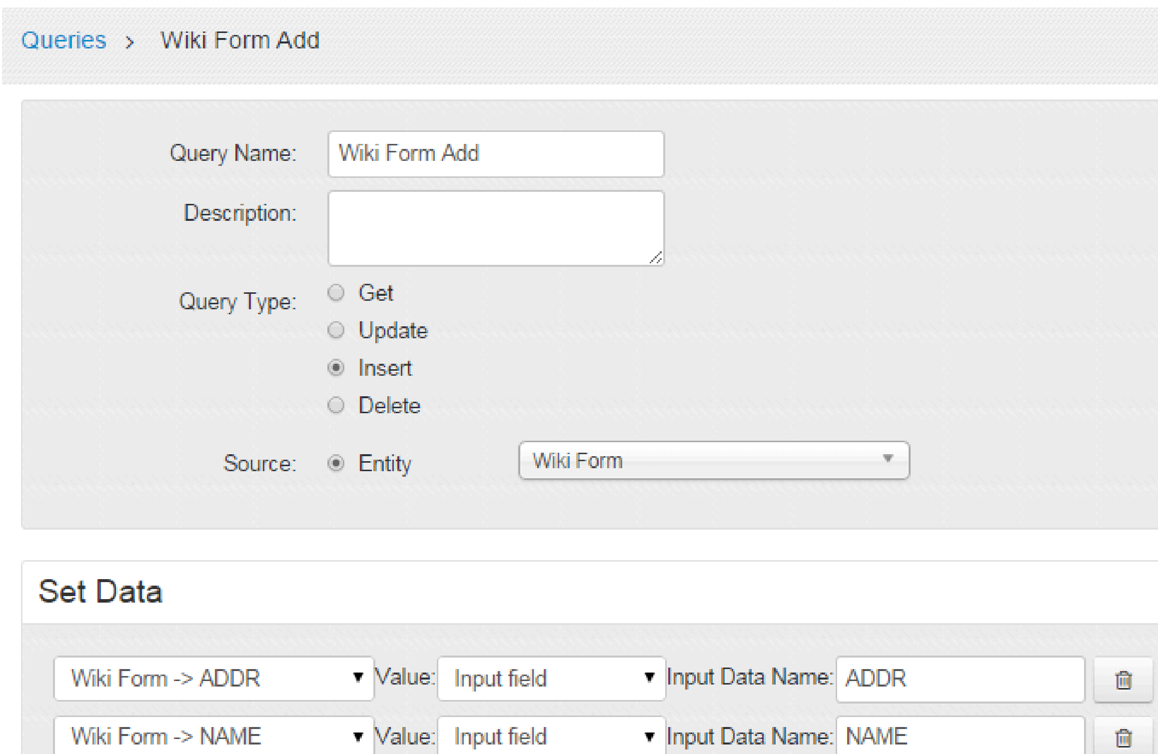
- **Target Data**: Check boxes can alter information in an entity via a query. Target Data indicates where this information will change and how depending on which query inputs are attached.
- **Source**: The data source can be selected based on which queries have been added in the Page Data section. It is also possible to manually insert the data source or to use a formula.
- **Required**: Specify if an input must be sent to the query.
- **Disabled**: If selected, the data input is not allowed.

Possible Uses

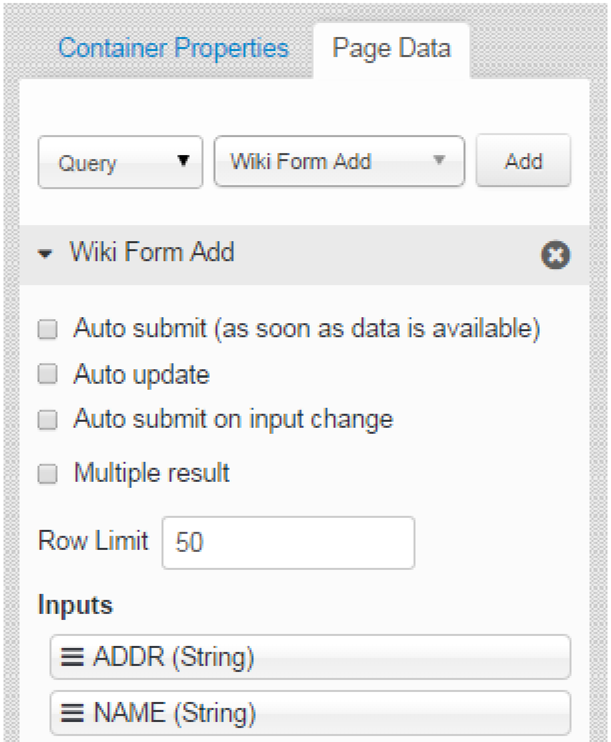
The input has a wide variety of uses. One basic example is that of a login or registration form. Such a form requires specific information to be stored in a database including data such as an email address, name, birthday, password, and other information. The input allows an end user to enter information in various forms in to a database.

In this example, we will create a simple input form using an entity and a query.

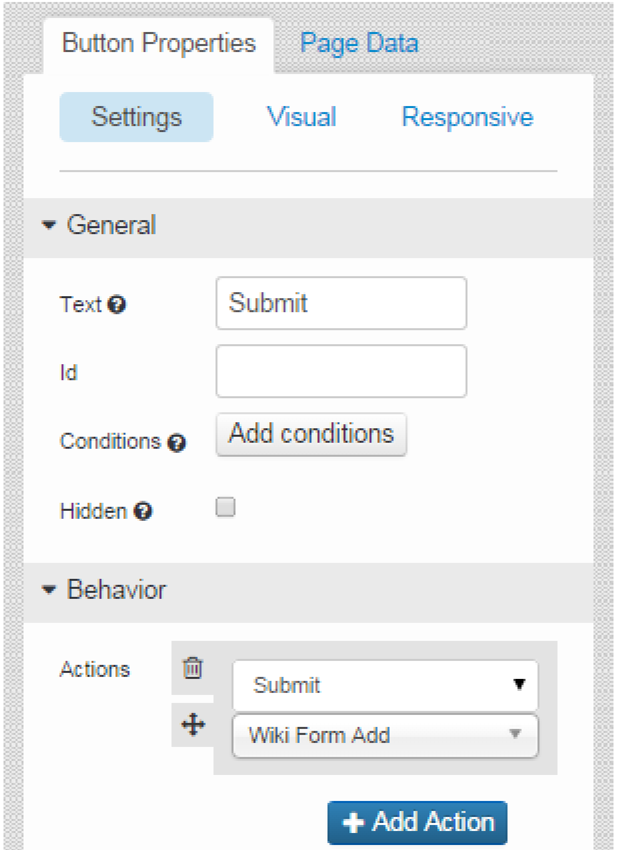
1. Add two input widgets to a page for address and name.
2. Add a button to indicate to add the information entered by the input widgets.
3. Create an entity named Wiki Form, and add the following entity fields: ADDR and NAME (data type: string).
4. Create an Insert query named Wiki Form Add to insert data into the entity, as shown in the following image.



5. Add the query to the application in the **Data Page** section, as shown in the following image.



6. Drag and drop the query input fields to the connect them to the input widgets.
7. In the Button Properties section for the button widget, specify the action to execute the insert query, as shown in the following image.



8. Save the application, and preview it.

   In the application, when you enter values and submit, the information is stored in the entity.

Slider

A slider is a graphical user interface element that is used to indicate an amount or value by means of an indication hash marker that can move on a horizontal plane that has a value indication. To use the new version, refer to Slider *(on page 424)*.

Slider Settings

- **Source**: The data source can be based on which queries have been added in the **Page Data** section. It is also possible to manually insert the data source or to use a formula.
- **Required**: Specify if an input must be sent to the query.
- **Submit on Charge**: If selected, changing the value of the input submits the query to which this input is assigned.
- **Step**: The spacing between variables on the horizontal plane of the slider.

- **Minimum**: Sets the minimum variable on the horizontal plane of the slider. This number appears on the left side of the plane.
- **Maximum**: Sets the maximum variable on the horizontal plane of the slider. This number appears on the right side of the plane.

Possible Uses

A slider can be used for any of the following purposes:

- To provide a number selector.
- To indicate the volume on an audio recorder or a maximum/minimum price.
- To allow a user to select a price they would be willing to pay as part of a filter system for search results.

Toggle

A toggle button contains two opposing, binary states based on Boolean logic. On/Off is the default for the button, because this is the most common use. To use the new version, refer to Toggle *(on page 425)*.

Toggle Settings

When you use a check box widget, in addition to providing values for the default fields for a widget, you must define the following settings.

Setting	Description
Source	The data source can be based on which queries have been added in the **Page Data** section. It is also possible to manually insert the data.
Required	Specify if an input must be sent to the query.
Submit on Change	If selected, changing the value of the input submits the query to which this input is assigned.
True Label	There are two states on a toggle button. The **True Label** setting refers to the label of the active state.
False Label	There are two states on a toggle button. The **False Label** setting refers to the label of the inactive state.
Width	The width of the toggle button.

Possible Uses

Toggle buttons are generally used for on/off actions. For example, if a setting or feature is active/inactive, this can be controlled with a toggle button.

This example describes the device on/off switching using a Toggle button.

> **Note:**
> Without an actual device or a simulator, the real action result cannot be seen.

1. In the page designer, add a toggle widget and two input widgets.
2. In **Page Data** section, add a function to the page, such as IQAW Set Immobilizer State.
3. Drag the function parameters to connect to the input widgets and the toggle widget. Note that function (command) itself (IQAW Set Immobilizer State) should be connected to the toggle widget.

Button

Buttons are used to start any action. By default, the text Submit appears on a button. It indicates that it is used to submit information that an application user provides using other widgets. To use the new version, refer to Button *(on page 421)*.

Button Settings

Buttons can perform a variety of actions, and can even perform multiple actions. Each specific action has its own choices. For example, if the action of selecting a button is to go to a specific page, that page can be selected after the action is selected in the same grey box.

In addition, you can arrange actions in a sequence. For example, if the selecting a button will both hide a component and submit data entered by a user, the action can first hide the component, and then submit the data, or vice versa.

You can configure the following actions for a button widget.

Action	Description
Submit	Sends information to an entity.
Go to page	Redirects to a different page in the application (for example, from the home page to a different page in the navigation).

Action	Description
Go to previous page	Redirects to one page back in history based on the entries created for the current application session. In the absence of previous session entries, the button does not redirect to any page.
Go to next page	Redirects to one page forward in history based on the entries created for the current application session. In the absence of forward (next) session entries, the button does not redirect to any page.
URL	Redirects a user to a URL outside the application.
Set global value	If selected, the data here will be available globally. Global data means that an entity changed in one part of the application will change across the application.
Show Component	Displays a hidden component.
Hide Component	Hides a component.
Toggle Show/Hide	Some widgets are marked as shown or hidden and the **Toggle Show/Hide** action will switch between hidden and shown views of a component.

Visual

Button types are design presets that can help create a better hierarchy and a better look and feel for an application. It is recommended to use button types to fit a button to its use. For example, a delete button might be a Negative type. The following button types are available:

- Primary
- Secondary
- Positive
- Negative
- Link

Possible Uses

Buttons can be used for a variety of purposes. In general, buttons are used in conjunction with other widgets. For example, if a user makes a series of selections with drop-down list boxes, check boxes, and radio buttons, they can then select a **Submit** button that will record the user's choices in an entity. Buttons can also be used to refresh a page, send a user to another page, set a global value, or show/hide content depending on how the button is configured.

This example shows how to create a window.

1. Add a button widget in the page designer.
2. Add a container below the button widget, and provide an ID for the container.
3. In the container, add several input widgets, and set the display condition of the container to Hidden.
4. In the **Button Properties** section of the button, set the action of Show Component, and specify the container ID.
5. Save the application, and preview it.

   In the application, if you select the button, the container appears.

Camera

The camera widget is a button that will open a default camera based on the device used by the application user. If a camera does not exist, you can select an image. For example, if you use an iPhone to access the application, and they select the camera button, the default iPhone camera options page appears. After you capture an image with the default camera, the image is held in the local memory of the application until you perform an action (such as linking the image display so the image appears in the application).

Camera Settings

When you use a camera widget, in addition to the default settings, the following settings are available.

Setting	Description
Max Width	The maximum width of the uploaded image in pixels. This setting is optional.
Max Height	The maximum height of the uploaded image in pixels. This setting is optional.

Possible Uses

You can use the camera widget to allow an application user to add images to an application or database. Example:

- If an application deals with selling goods, a user can upload an image of the goods that they want to sell.
- If an application deals with car rentals, a user can capture a photo to report a car accident, and then save it to the database. The rental agency can then view the image.

Text Area

The text area widget allows a user to provide large amount of text using an application. This widget contains a scroll bar. To use the new version, refer to Text Area *(on page 424)*.

Text Area Settings

To use a text area widget, in addition to the default settings, the following settings are available.

Setting	Description
Source	The source of data based on which queries have been added in the **Page Data** section. You can also enter the data source manually or use a formula.
Required	Identifies if an input must be sent to the query.
Submit on Charge	If selected, changing the value of the input submits the query to which this input is assigned.

Possible Uses

A standard text box can handle large amounts of text, but it may not be user-friendly because not all of the text can be seen or edited at once. If a user wants to submit a comment, for example, a text area allows them to write several sentences and view the text as a paragraph (for example, license agreement or privacy policy, which usually contains a large amount of text).

Display

Text

The text widget allows you to display text in an application. An application user can read the text, but cannot modify it. To use the new version, refer to Text *(on page 520)*.

Text Settings

To use a text area widget, in addition to the default settings, the following settings are available.

Setting	Description
Source	The source of data based on which queries have been added in the **Page Data** section. You can also enter the data source manually or use a formula.
Format	You can select one of the following values: • **Text** • **DateTime** • **Date** • **Time** The default value is **Text**.

Possible Uses

Since this widget can be connected to a query in the **Page Data** section, updated information can be displayed in the application. For example, if the application is used to display sports scores, the text box can be connected to an entity via a query that will display the score in a sport. The user can read the text, but cannot modify it.

Using a Text Widget to Display the Current Date and Time

1. In the **Page Data** section, select **Global**.
2. In the **System Globals** section, select **Date time (Local)**, and then select **Add**. System globals are provided as standard functions.
3. Add a text widget, and enter an label.
4. Drag the system global that you have added to connect to the text widget. Or, select the system global in the **Data** box.
5. Save the application, and preview it.

   The application displays the current date and time.

Header

Headers are generally larger amounts of text that are used to create titles to divide an application in to different areas depending on their content.

Header Settings

To use a header widget, in addition to the default settings, the following settings are available.

Setting	Description
Type	You can create three different sizes of headers: Header 1 (largest) to Header 3 (smallest) so that a hierarchy can be created based on text size.
Format	You can select one of the following values: • **Text** • **DateTime** • **Date** • **Time** The default value is **Text**.

Possible Uses

If an application has several different areas, you can use a header to create order and hierarchy.

For example, a food application for a grocery store may divide food in to several categories such as dairy, meat, and produce. These larger topics (Header 1) can then be divided in to smaller parts. For example, the produce header can contain two smaller headers (Header 2) underneath for fruits and vegetables. Within the category of vegetables, there may be an additional category of root vegetables that may have a smaller sized header (Header 3) with a list of different root vegetables underneath.

Image

Using the image widget, you can insert an image in to an application. Application users can see the image, but cannot manipulate it, since it is display-only. Images can be attached to the entities via queries and then shown to application users. To use the new version, refer to Image *(on page 517)*.

Image Settings

When you use an image widget, in addition to the default settings, the following setting is available:

- **Source**: The data source can be based on which queries have been added in the **Page Data** section. It is also possible to provide a URL or select a file from the local machine.

Possible Uses

You can add an image gallery in an application by adding several image widgets. Additionally, if application users use the camera widget, they can take an image, and then upload the image in to their application with a button. The button can send the image to an entity, and a query of that entity can use the image widget to display the picture.

Suppose you want to insert an image in an application, and want to direct the user to the home page when the image is selected. In that case, perform the following steps:

1. In the page designer, add an image widget to a page other than the home page.
2. Select the **File** option, and select **Choose File**.
3. Select the image that you want to insert in the application.
4. In the **Image Properties** section, in the **Actions** box, select the action to go to the home page.
5. Save the application, and preview it.

   When you select the image, the home page appears.

Graph

Graphs are data visualizations that you can add to display data in an application.

> **Note:**
> You need external Internet access to use the graph widget.

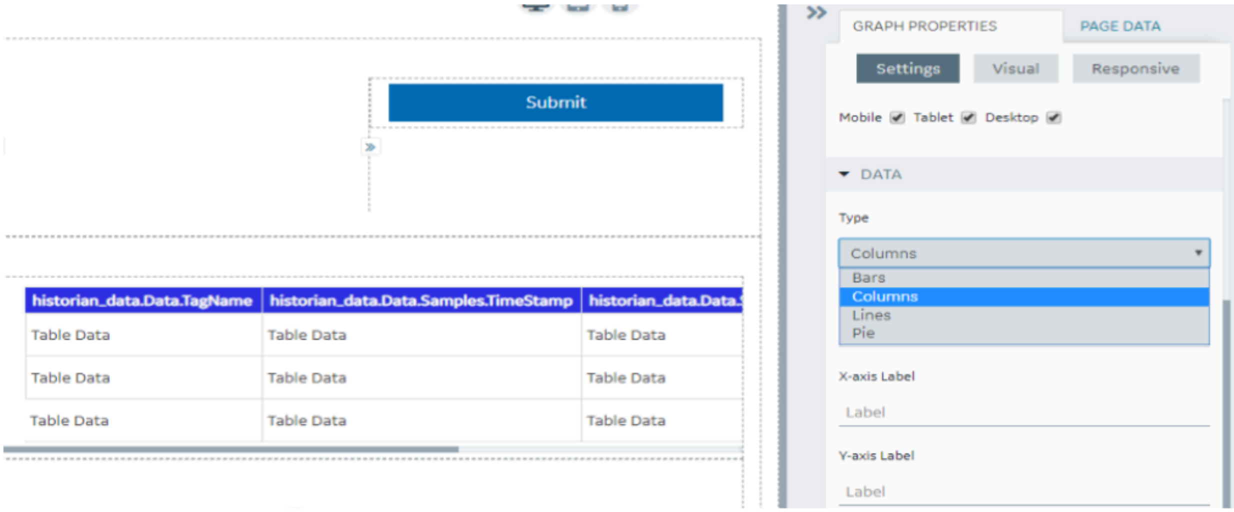
Graph Settings

To use a graph widget, in addition to the default settings, you must specify one of the following types of graphs.

Type of Graph	Description
Bars	Bar graphs show comparison among categories vertically. Specify the following settings for a bar graph: **Setting** — **Description** **X-axis Label** — Displayed below the graph horizontally.

<table>
<tr><th>Type of Graph</th><th>Description</th></tr>
<tr><td></td><td>
<table>
<tr><th>Setting</th><th>Description</th></tr>
<tr><td>Y-axis Data</td><td>The data source for the bars.</td></tr>
<tr><td>Y-axis Label</td><td>Displayed on the left side of the bar graph.</td></tr>
<tr><td>Add All Fields</td><td>This will add all the columns from the chosen entity. Each column can be labeled independently.</td></tr>
<tr><td>Sort By</td><td>Since an entity can contain several different types of data, it is possible to sort the data depending on the data in an entity.</td></tr>
</table>
</td></tr>
<tr><td>Columns</td><td>Column graphs are similar to bar graphs but are shown vertically instead of horizontally. Specify the following settings for a column graph:
<table>
<tr><th>Setting</th><th>Description</th></tr>
<tr><td>X-axis Label</td><td>Displayed below the graph horizontally.</td></tr>
<tr><td>X-axis Data</td><td>The data source for the columns.</td></tr>
<tr><td>Y-axis Label</td><td>Displayed on the left side of the graph.</td></tr>
<tr><td>Add All Fields</td><td>This will add all the columns from the chosen entity. Each column can be labeled independently.</td></tr>
<tr><td>Sort By</td><td>Since an entity can contain several different types of data, it is possible to sort the data depending on the data in an entity.</td></tr>
</table>
</td></tr>
<tr><td>Lines</td><td>Line graphs show how data changes over specific intervals of time. Specify the following settings for a line graph:
<table>
<tr><th>Setting</th><th>Description</th></tr>
<tr><td>X-axis Label</td><td>Displayed below the graph horizontally.</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Type of Graph</th><th>Description</th></tr>
<tr><td></td><td>
<table>
<tr><th>Setting</th><th>Description</th></tr>
<tr><td>X-axis Data</td><td>The data source for the lines.</td></tr>
<tr><td>Y-axis Label</td><td>Displayed on the left side of the graph.</td></tr>
<tr><td>Add All Fields</td><td>This will add all the columns from the chosen entity. Each column can be labeled independently.</td></tr>
<tr><td>Sort By</td><td>Since an entity can contain several different types of data, it is possible to sort the data depending on the data in an entity.</td></tr>
</table>
</td></tr>
<tr><td>Pie</td><td>In a pie graph, rather than axis points, there is a value that can be set to a query to post data on the pie graph. Specify the following settings for a pie graph:
<table>
<tr><th>Setting</th><th>Description</th></tr>
<tr><td>Value</td><td>The data source for the pie graph.</td></tr>
<tr><td>Title</td><td>The title of the graph.</td></tr>
<tr><td>Y-axis Label</td><td>Displayed on the left side of the bar graph.</td></tr>
<tr><td>Sort By</td><td>Depending on the data, sorting may be necessary in order to highlight certain information. Once the sort feature has been selected, it is possible to select ascending or descending order.</td></tr>
</table>
</td></tr>
</table>



Possible Uses

Graphs are a way to show data visually. For example, if 50 students enrolled for a course, you can use a graph widget to show how their grades have changed over time or it may be beneficial to show what grades the students received by percent.

When you plot the data stored in the M2M Entities using a graph widget, timestamp values are displayed in the following format: hh:mm

Downloading Data from a Graph

You can download data from an entity in a Microsoft Excel worksheet using a graph widget. To do so, in the **Graph Properties** section, select the **Allow Download** check box. The download button appears in the upper-right corner of the widget in the application.

Note:

- Downloading occurs based on the query last executed as shown in the graph.
- If the query is executed for the specific date range using Input boxes, for example, data is downloaded based on the condition specified.
- The entity data connected to the graph is downloaded, not the graph itself.

- If multiple queries are connected to the graph, a separate Microsoft Excel worksheet is generated for each query, and it is downloaded in a single worksheet.
- In the time_stamp related fields of the M2M_data Entity, the values of milliseconds are also stored. However, only hour, minute, and second values can be displayed when you use the graph widget.

Visualization

A visualization widget is a graph with additional features. The following features are available in a visualization widget:

- Line chart
- Area chart
- Bar chart
- Stacked bar chart
- Donut chart
- Multiple charts
- Additional y-axis
- Zooming in or out
- Grid lines
- Rotation
- Support of negative values
- Improved look and feel of tooltips
- Ability to focus on a specific field on the chart
- Grouping using a query field

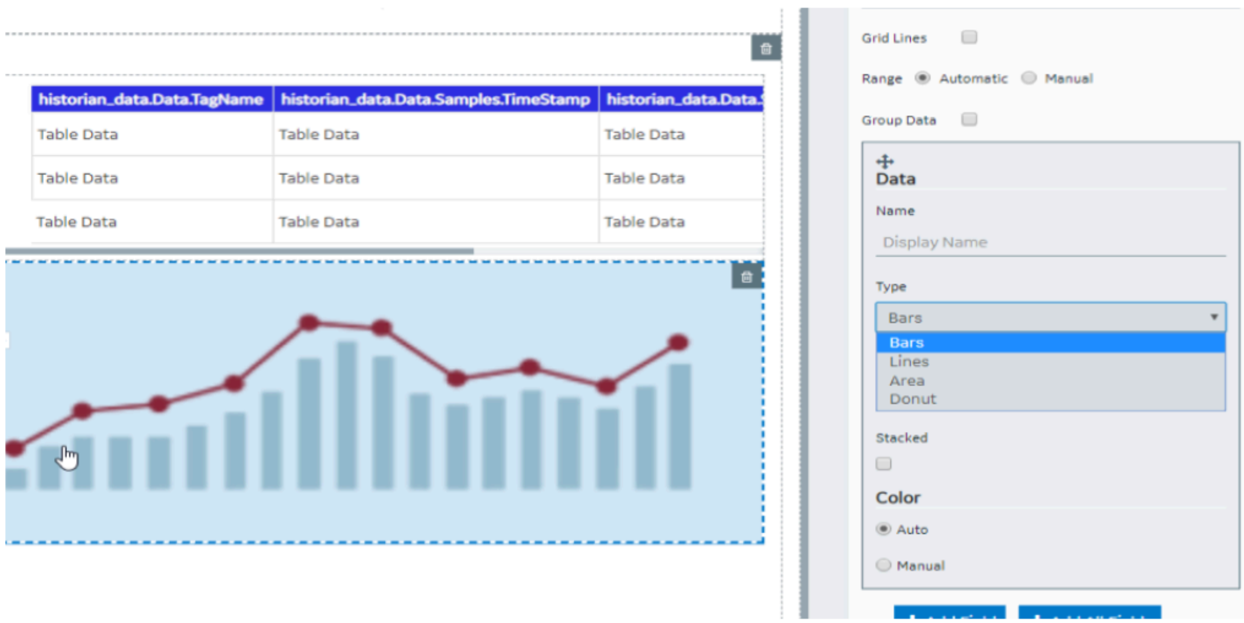
Important:
Due to the format of the data returned by Historian REST calls, the Visualization widget cannot display data from Historian sources.

Visualization Settings

When you use a visualization widget, in addition to the default settings of a widget, the following settings are available.

Setting	Description
Flow	Select the query (from the ones added in the **PAGE DATA** section) that should be used to retrieve information in the graph.
Switch Row/Column	Select this check box if you want to switch the x-axis and y-axis data.
X-axis	Provide values in the following boxes for x-axis settings: • **Data**: Select the query field whose data should be plotted on the x-axis. • **Label**: Enter a label for the x-axis. • **Rotate Ticks**: Select this check box to rotate ticks and avoid overlapping of data. The x-axis ticks might overlap if the data is large. • **Grid lines**: Select this check box if you want to show grid lines.
Y-axis	Provides values in the following boxes for y-axis settings: • **Label**: Enter a label for the y-axis. • **Grid Lines**: Select this check box if you want to show grid lines. • **Range**: Select whether the range of the y-axis should be set automatically or manually. If you select **Manual**, the **Min** and **Max** boxes appear, in which you must enter values.
Data	Provide values in the following boxes for the data settings: • **Name**: Enter the name of the graph. • **Type**: Select the type of the graph: Bars, Lines, Area, or Donut. • **Data**: Select the data source of the graph.

Setting	Description
	• **Stacked**: Select this check box if the graph should be plotted as a stacked bar chart. This option is available only for a bar chart. • **Color**: Select whether the color of the graph should be selected automatically or manually.
Add Field	Select this button if you want to plot another field on the graph.
Add All Fields	Select this button if you want to plot all the entity fields.



Using a Visualization Widget

Suppose you want to plot the following information on a graph:

- Sales amount for two branches - Tokyo and Tel Aviv, plotted as a line chart and an area chart, respectively.
- Sales amount for two products - V26 and V27, plotted as a stacked bar chart.
- Breakdown of sales amount per branch - plotted as a donut chart.

To do so, perform the following steps:

1. Create an entity to store the sales amount for the two branches and the two products.
2. Create a Get query to retrieve the sales amount.
3. In the page designer, in the **PAGE DATA** section of the container, add the query.
4. Add two visualization widgets to the container.
5. Add the following headers for the visualization widgets:
    - Lines/Area and Stacked
    - Donut
6. For the Lines/Area and Stacked chart, provide values as described in the following table for the x-axis.

Setting	Description
Flow	Select the query that you have created.
Data	Select the daily field of the query.
Rotate Ticks	Select the check box.
Grid Lines	Select the check box.

7. Select **Add Field**.

    An additional **Data** section appears for the other y-axis.

8. Provide values as specified in the following table for the two y-axes.

Setting	Description for the First Y-Axis	Description for the Second Y-Axis
Label	Enter Amount.	Enter Product.
Grid Lines	Select the check box.	Not applicable
Type	Select **Lines**.	Select **Area**.
Data	Select the field that stores the sales amount for the Tokyo branch.	Select the field that stores the sales amount for the Tel Aviv branch.
Y-axis side	Select **Left**.	Select **Left**.

9. Select **Add Field** twice. Two additional **Data** sections appear for the two y-axes.
10. Provide values as specified in the following table for the two y-axes.

Setting	Description for the First Y-Axis	Description for the Second Y-Axis
Type	Select **Bars**.	Select **Bars**.
Data	Select the field that stores the sales amount for the product V27.	Select the field that stores the sales amount for the product V26.
Stacked	Select the check box.	Select the check box.
Y-axis side	Select **Right**.	Select **Right**.

11. For the Donut chart, select Add Field twice, and provide values as specified in the following table.

Setting	Description
Flow	Select the query that you have created.
Donut Title	Enter Breakdown Per Branch.
Type	Select **Donut** for both the boxes.
Data	Select the field that stores the sales amount for V26 and V27, respectively.

12. Save the application, and preview it. The first graph displays a line chart and an area chart for the sales amount of Tokyo and Tel Aviv, respectively. It also displays a stacked bar chart for the sales amount of the two products, V26 and V27. The second graph displays a donut chart for the sales amount of V26 and V27.

Big Data

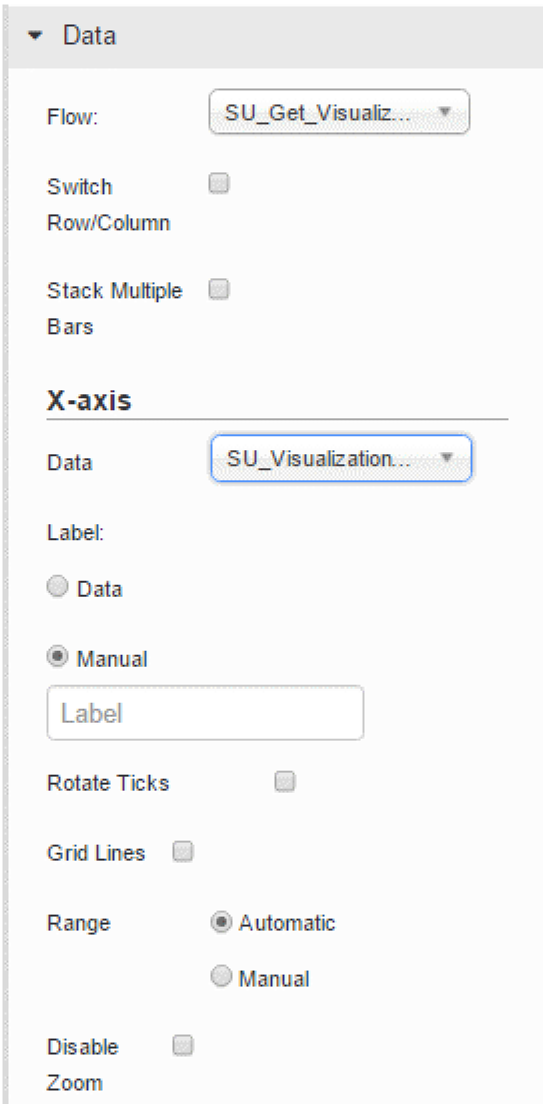
The bid data widget is a visualization widget that supports big data. Compared to the visualization widget, the big data widget allows you to specify the range more accurately.

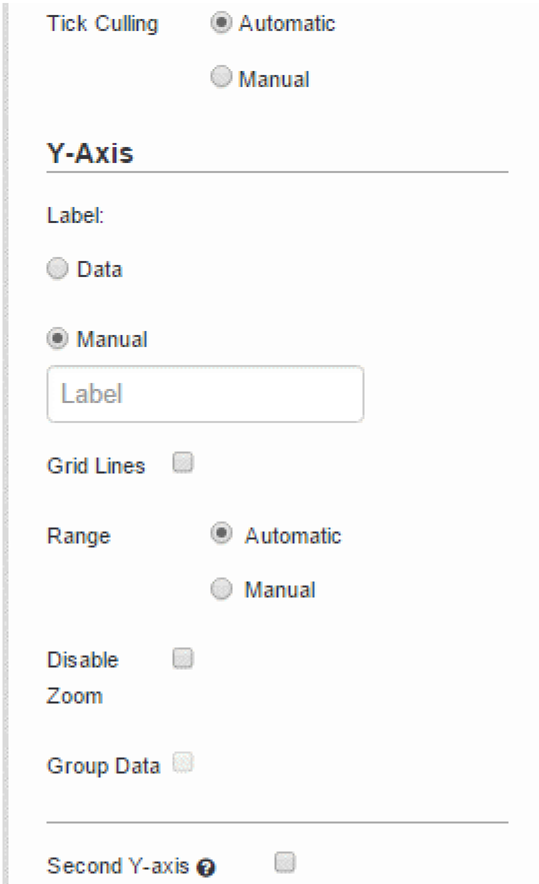
> **Note:**
> You cannot plot a donut chart or change the format of a date-time variable on x-axis for a big data widget.

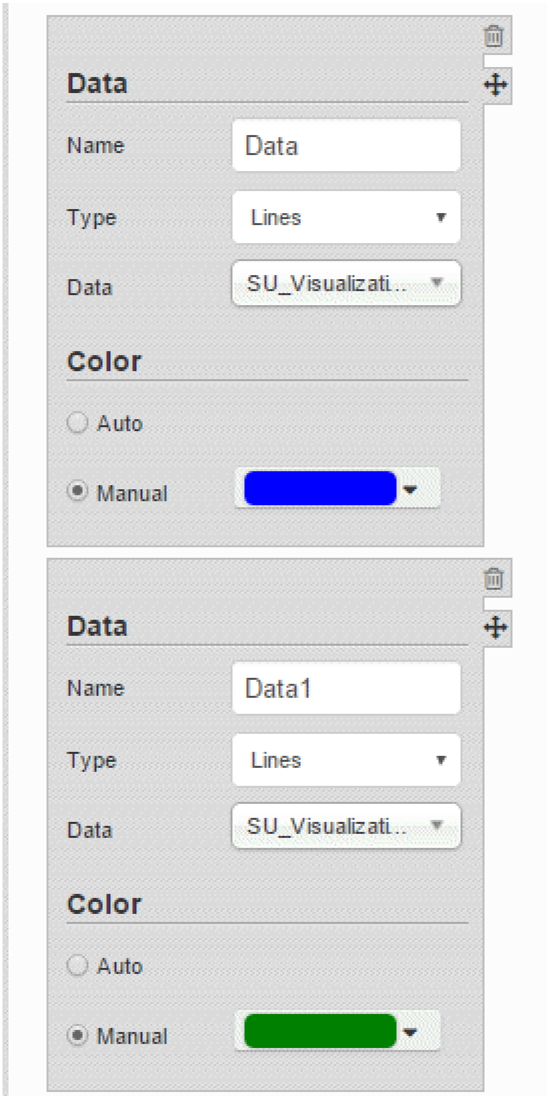
> **Important:**
> Due to the format of the data returned by Historian REST calls, the Big Data widget cannot display data from Historian sources.

Big Data Settings

When you use a big data widget, in addition to the default settings of a widget, the following settings are available.




Tick Culling
Automatic
Manual
Y-Axis
Label:
Data
Manual
Label
Grid Lines
Range
Automatic
Manual
Disable Zoom
Group Data
Second Y-axis



For instructions on configuring these settings, refer to Visualization *(on page 356)*.

About Zooming In and Zooming Out

Since the data displayed using a big data widget is huge, you can zoom in a selected area on the graph. To do so, you must specify the area precisely by dragging the mouse pointer on the area.

You can drag the mouse pointer in horizontal, vertical, or diagonal directions.

- If you drag the mouse pointer in a horizontal direction, the zoom-in area is set for only the x-axis.
- If you drag the mouse pointer in a vertical direction, the zoom-in area is set for only the y-axis.
- If you drag the mouse pointer in a diagonal direction, the zoom-in area is set for both x-axis and y-axis.

You can perform the following actions to zoom in or zoom out the widget:

- Zoom in a selected area by selecting .
- Pan across the widget by selecting .
- Zoom in from the center of the widget by selecting .
- Zoom out from the center of the widget by selecting .
- View the complete range of the graph by selecting .
- Reset the zoom level by selecting .

Grid

A grid widget functions similar to a table widget. In addition, you can perform the following tasks:

- Change the width of a grid dynamically.
- Rearrange or remove the columns of a grid from an application.
- Export the data displayed in a grid to a .csv file. In addition, you can export data from selected columns.
- Sort the data displayed in a grid.
- View the data in a tree structure.
- Scroll till the end of the grid regardless of the number of rows the grid contains.

Grid Settings

When you use a grid widget, in addition to the default settings of a widget, the following settings are available.

Setting	Description
Allow Export	Select this check box if you want to provide an option to application users to export the data in the grid to a .csv file. **Note:** This option is not available on iOS.

Setting	Description
Tooltips	Select this check box if you want tooltips to appear in the application.
Flow	Select the query that should be used to retrieve information in the grid.
Tree View	Select this check box if you want to display data in a hierarchical view. When you select this check box, the **Nested flow** box appears, allowing you to select the query that fetches the data for the child level in the hierarchy.
Name	Enter the name of the grid column.
Data	Select this option if you want data in the column to be retrieved from an entity field using a column, and then select the field in the drop-down list box.
Formula	Select this option if you want data in the column to be displayed based on a formula. For example, if an entity stores the marks scored by students for individual courses, you can create a formula to display the aggregate marks scored by each student.
Show <number> rows at a time	Identifies the number of rows that should appear by default in the grid. By default, the value in this box is 10. After you enter a value, the following options are available: • **Load all**: If you select this option, the grid will contain all the rows on the same page. However, if you access the application on a mobile device, each page in the grid will contain the number of rows that you specify. You can navigate to the other pages to access the rest of the rows. • **Infinite scroll**: If you select this option, the grid will contain all the rows on the same page.

Setting	Description
	• **Paging**: If you select this option, each page in the grid will contain the number of rows that you specify. You can navigate to the other pages to access the rest of the rows.

Using a Grid

Suppose you want to use a grid to display a list of managers in an organization and the employees reporting to each manager. To do so, perform the following steps:

1. Create an entity named Wiki Manager, add the fields Manager ID and Manager Name, and add the IDs and names of managers.
2. Create a Get query named Wiki Get All Managers to get all the records from the Wiki Manager entity.
3. Create an entity named Wiki Employee, add the fields Manager ID, Employee ID, and Employee Name, and add the respective details.
4. Create a Get query named Wiki Get Employee by Manager ID with settings as specified in the following image:
5. Create an application, and add a grid using the page designer.
6. In the **PAGE DATA** section, add the Wiki Get All Managers query, and connect all the fields to the grid.
7. Select the **Auto submit (as soon as data is available)** check box.
8. In the **GRID PROPERTIES** section, select the **Tree View** check box.
9. In the **Nested flow** box, select the Wiki Get All Employee by Manager ID query. Two boxes named **Row Limit** and **Manager ID** appear.
10. In the **Manager ID** box, select **Wiki Get All Manager.Manager ID**.
11. In the **Flow** box, select **Wiki Get All Managers**.
12. In the **Name** box, enter **Manager Name**.
13. In the **Data** box, select the field that stores the names of managers.
14. Select **Add Field**, and then provide values as specified in the following table.

Box	Description
Name	Enter Manager ID.
Data	Select this option, and then select **Wiki Manager** in the drop-down list box that appears.

Box	Description
Mapping	Select **Wiki Employee**.

15. Save the application, and preview it. A grid appears, displaying two sections. The first section contains a list of IDs and names of managers. The second section contains a list of employees that report to each manager.

Map

A map widget is used to display a map in an application. It uses the Google Maps feature. You can use the map widget to display the location of a place on a map (for example, the location of each site of a company).

To display asset locations on the map, you must access the API key generated by Google *(on page 56)*.

Map Settings

When you use a map widget, in addition to providing values for the default fields for a widget, you must define the following settings.

Setting	Description
Label	Identifies the title of the map.
Display	Identifies the type of the map. You can select one of the following values: • **Roadmap**: Displays the streets of an area. By default, this value is selected. • **Satellite**: Displays a satellite view of the Earth. • **Terrain**: Displays the geographical features of an area.
Layers	Identifies the layer that you want to display on the map. You can select one of the following values: • **Transit**: Displays the public transit network of an area. • **Traffic**: Displays real-time traffic information on the map.

Setting	Description
	• **Bicycling**: Displays the bicycling paths of an area. • **None**: Does not display any layer.
CENTER	Identifies the center point of the map. You can specify the center point using one of the following sources: • **Data**: Select a query output or a global parameter whose value is the center point of the map. • **Manual**: Enter the address or the latitude and longitude details of the center point manually, separated by a comma (for example, 35.681168, 139.767059). • **User Location**: Select this option to specify that the location of the device used by the application user is the center point of the map. If you select this option, the **Update Center** check box appears. If you select this check box, the map center is automatically updated when the user moves. **Note:** If you select the **User Location** option, when you access the map for the first time in the application, a message appears, asking you to allow the application to access your location. • **Automatic by Markers**: Select this option to specify that the center point of the map is positioned such that all the markers are visible on the map. This option is enabled only after you add a marker.

<table>
<tr><th>Setting</th><th>Description</th></tr>
<tr><td></td><td>Note:
The Zoom box contains a value that determines the zoom level of the map. This box is disabled when you select the Automatic by Markers option.</td></tr>
<tr><td>MARKERS</td><td>Identifies the markers that should appear on the map. Select Add Marker, and then enter or select values in the following sections or boxes that appear.
<table>
<tr><th>Section</th><th>Description</th></tr>
<tr><td>Position</td><td>Select one of the following options:
Data: Select this option if you want to specify the position of the marker by means of a query or a global parameter.
Manual: Select this option if you want to specify the position of the marker manually, and then enter the address or the latitude and longitude details.</td></tr>
<tr><td>Label</td><td>Select one of the following options:
Data: Select this option if you want to specify the label of the marker by means of a query or a global parameter. This option is enabled only if you select Data in the Position section.</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Setting</th><th>Description</th></tr>
<tr><td></td><td>
<table>
<tr><th>Section</th><th>Description</th></tr>
<tr><td></td><td>

- **Manual**: Select this option if you want to specify the label of the marker manually, and then enter the label.

</td></tr>
<tr><td>Marker Icon</td><td>Select the icon and color of the marker.</td></tr>
<tr><td>Condition</td><td>Select Add conditions, and then specify the conditions for displaying the marker.

Tip:
You can add multiple markers. For example, if you want one marker to represent sites whose overall plant efficiency is above 95 percent and another marker to represent sites below 95 percent, you can add the two markers with the same position data, and specify the conditions appropriately on each one.</td></tr>
<tr><td>Actions</td><td>Select Add Action, and then specify the action that should be triggered when the marker is selected (for example, display more details about the location).</td></tr>
</table>
</td></tr>
<tr><td>SHAPES</td><td>Identifies the circle that covers the area of a location. For example, if the map displays the locations of sensors that capture the radio signals within a radius of 1 km, you can add a shape to each marker to indicate the area covered by each sensor.

Select Add Shape, and then enter or select values in the following sections or boxes that appear.</td></tr>
</table>

<table>
<tr><th>Setting</th><th>Description</th></tr>
<tr><td></td><td>
<table>
<tr><th>Section</th><th>Description</th></tr>
<tr><td>Position</td><td>Select one of the following options:
Data: Select this option if you want to specify the position of the shape by means of a query or a global parameter.
Manual: Select this option if you want to specify the position of the shape manually, and then enter the address or the latitude and longitude details.</td></tr>
<tr><td>Radius</td><td>Select one of the following options:
Data: Select this option if you want to specify the radius of the shape by means of a query or a global parameter.
Manual: Select this option if you want to specify the radius of the shape manually, and then enter the radius in km.
Note:
The radius can also be used as a visual indicator of other parameters, such as signal strength.</td></tr>
<tr><td>Color</td><td>Select the color of the shape. You can also specify the opacity.</td></tr>
<tr><td>Condition</td><td>Select Add conditions, and then specify the conditions. For example, if you want the marker to represent the signal strength received by a sensor, you can add multiple</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Setting</th><th>Description</th></tr>
<tr><td></td><td><table><tr><th>Section</th><th>Description</th></tr><tr><td></td><td>shapes with different colors and the same position data, and then specify different signal strength conditions on each shape.</td></tr></table></td></tr>
</table>

Table

A table displays information, which can include text, links, and/or images. Each column in the table represents an entity field. The information that appears in a table cell is defined by selecting a query output or by using a formula.

Table Settings

When you use a table widget, in addition to the default settings for a widget, the following settings are available.

Setting	Description
Allow Download	Select this check box if you want to provide an option to application users to download the data displayed in the table. **Note:** The download feature is available only for entity data.
Flow	Select the query or function that should be used to retrieve information for the table. Without a flow, a table will not display any data.
Name	Enter the name of the table column.
Data	Select this option if you want data in the column to be displayed from an output field of the selected flow, and then select the field in the drop-down list box.

Setting	Description
Formula	Select this option if you want data in the column to be displayed based on a formula. For example, if the data retrieved by a query represents a test score, you can use a formula to display the score as a percentage of the total score.
Output data type	Select the data type of the data displayed in the column.
Add Action	Select this button if you want an action to be performed when a user selects a cell in this column.
Add Field	Select this button if you want to add another column to the table.
Add All Fields	Select this button if you want to add columns for all the output fields from the selected flow.
Load <number> rows at a time	Identifies the number of rows that should appear in the table. By default, the table displays all the rows retrieved by the query. If you select this check box, the **Paging** and **"Load more" button** options appear to allow the user to view more data. • **Paging**: If you select this option, each page in the table will contain the number of rows that you specify. You can navigate to the other pages to access the rest of the rows. • **"Load more" button**: If you select this option, the table will initially contain the number of rows that you specify. A **Load more** button appears in the application, which allows the application user to retrieve additional rows in the same page.

Possible Uses

Tables are a way to display information in an organized way. For example, if application users fill in their name and phone number in an application, a table can display the information in an easily understandable format. A more advanced example may be that employees in a company with a hundred employees enter the time they arrive and the time they leave each day. Each employee has a name, entry time, exit time, and ID in an entity. Using a table, you can display each employee's attendance record.

List

A list is a representation of data in bulleted points. To use the new version, refer to List *(on page 520)*.

List Settings

When you use a list widget, in addition to the default settings of a widget, the following setting is available.

Setting	Description
Source	Identifies the source of the list values. You can specify one of the following types of sources: • **Hard Coded**: Select this option to enter the list items manually. • **Dynamic**: Select this option to generate the list items dynamically from a query output field.

Possible Uses

You can use a hard-coded list to display prerequisites to perform a task. You can use a dynamic list to display a list of asset IDs returned by a query.

Using a List

Suppose you want to display a list of features available in an application by dynamically fetching the list from an entity. To do so, perform the following steps:

1. Create an entity named Features to store the list of features.
2. Create a query to get the list of features from the entity.
3. In the page designer, add a List widget.
4. In the **PAGE DATA** section, add the query that you have created.
5. In the **LIST PROPERTIES** section, in the **Source** box, select **Dynamic**.
6. In the **Value** box that appears, select the query output that fetches the list of features.
7. Save the application, and preview it.

   The list of features stored in the entity appear in the application.

Gauge

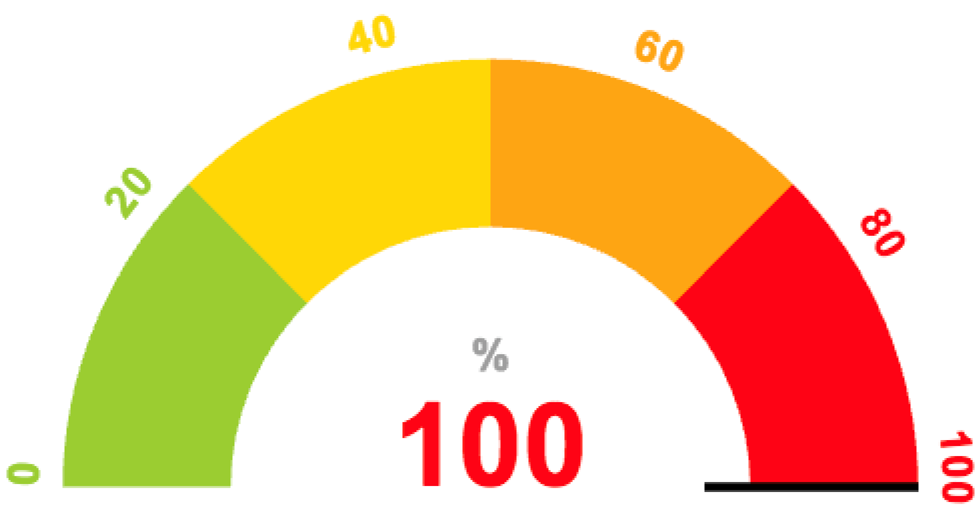
Using a gauge widget, you can plot data on a visual display. Some of the gauge widgets use a color-coded scale. The color of the reading indicates the risk level associated with the value.

Types of Gauge Widgets

The following types of gauge widgets are available:

- Battery: In this gauge type, the value is plotted on a horizontal scale. This is the default gauge type. For example, the following image can represent a gauge that plots the speed of a vehicle in kph. The color-coded scale highlights whether the speed of the vehicle is safe or risky.

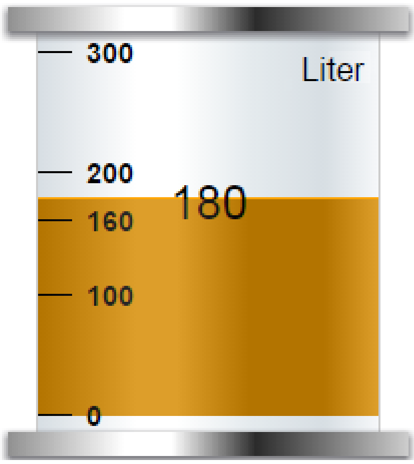
- Meter - Arc: In this gauge type, the value is plotted on a curved scale. For example, the following image can represent the percentage of unplanned power outage events out of the total number of power outage events. The color in which the plotted value appears indicates whether the percentage is acceptable.



- Meter - Radial: In this gauge type, the value is plotted on a circular scale. The gauge can be an internal radial or an external radial depending on whether the scale appears inside the radial or outside. For example, the following image represents an external radial meter gauge that plots the temperature inside an engine combustion chamber.

The following image represents an internal radial meter gauge that plots the pressure inside an engine combustion chamber.

- Tank: In this gauge type, the value is plotted on a vertical scale. For example, the following image can represent the amount of remaining lubricant in a tank with a capacity 300 liters. The color in which the plotted value appears indicates whether the lubricant level is safe or risky.



Also refer to Gauge Bar *(on page 496)*, Gauge Circular *(on page 497)*, and Gauge Linear *(on page 498)*.

Gauge Settings

When you use a gauge widget, in addition to providing values for the default fields for a widget, you must define the following settings:

Type of the Setting	Applicable Gauge Types	Description
Type	All gauges	Identifies the type of the gauge. You can select Battery, Meter, or Tank.
Style	Meter	Identifies the meter style. You can select one of the following values: • **Internal radial**: This is the default option. If you select this style, the markings appear on the dial. • **External radial**: If you select this style, the markings appear outside the dial. • **Arc Meter**: If you select this style, the meter appears as a color-coded semi-circle (instead of a dial). In addition, the **Scale** and **Needle** settings appear.

<table>
<tr><th>Type of the Setting</th><th>Applicable Gauge Types</th><th>Description</th></tr>
<tr><td>Source</td><td>All gauges</td><td>Identifies the source of the values plotted on the gauge. You can specify one of the following types of sources:
Data: Select a query or a global parameter whose output you want to plot on the gauge.
Manual: Enter a value manually that you want to plot on the gauge.
Formula: Enter a formula to calculate the value that you want to plot on the gauge.</td></tr>
<tr><td>Sector</td><td>Battery, Tank, Meter - Arc</td><td>Identifies the start position, color, and range for each sector in the gauge. For example, suppose you want to plot the speed of a vehicle. You want to categorize the speed range as follows:
<table><tr><th>Speed Range (in kph)</th><th>Category</th></tr><tr><td>0 - 100</td><td>Acceptable</td></tr><tr><td>101 - 160</td><td>Slightly risky</td></tr><tr><td>161 - 200</td><td>Risky</td></tr><tr><td>200 - 260</td><td>Highly risky</td></tr></table>
In this case, you will create four sectors and define the following settings:
<table><tr><th>Sector number</th><th>Start position</th><th>Color</th><th>Label</th></tr><tr><td>1</td><td>0</td><td>Green</td><td>Acceptable</td></tr><tr><td>2</td><td>101</td><td>Yellow</td><td>Slightly risky</td></tr><tr><td>3</td><td>161</td><td>Orange</td><td>Risky</td></tr><tr><td>4</td><td>200</td><td>Red</td><td>Highly risky</td></tr></table></td></tr>
</table>

Type of the Setting	Applicable Gauge Types	Description
		Tip: In the **Color** box, you can enter a color name or the hexadecimal code of the color.
Range	All gauges	Identifies the minimum and maximum values of the widget range, and units of measure of the gauge. You can also specify the color for the first sector of the gauge. In the previous example, you will enter the values 0, 200, kph, and green in the **Minimum**, **Maximum**, **Units**, and **Default Color** boxes, respectively.
Scale	Meter - Arc	Indicates whether you want to show the marking for each sector or just the minimum and maximum markings of the gauge. In the Scale settings, select one of the following options: • **Full**: Select this option if you want to show the markings for each sector of the gauge. By default, this option is selected. In the previous example, if you select **Full**, the following markings appears: 0, 101, 161, 200 • **Min/Max**: Select this option if you want to show only the minimum and maximum markings of the gauge. In the previous example, if you select **Min/Max**, the following markings appear: 0, 200
Needle	Meter - Arc	Indicates whether you want to show or hide the needle for the reading. By default, this check box is selected.
Visual	All gauges	Identifies the color for the markings and the background of the widget. The following settings are available: • **Custom Colors**: Select this check box if you want to use custom colors for the markings and the background. If you select this check box, the **Color** and **Background Color** boxes appear. • **Color**: Select the color for the markings. • **Background color**: Select the background color of the widget. • **Palette**: Select the background color of the dial of the radial meter gauge. This box appears only if you want to use a meter gauge.

Html

The html widget is used to provide html code to create an application. For example, to add a drop-down list box to an application, instead of using the dropdown *(on page 339)* widget, you can use html code, along with css code, to create the drop-down list box with a customized look and feel.

> **Note:**
> The interaction of the html code can change based on how the responsive design works for some elements.

When you use the html widget, in addition to the default properties of a widget, the following properties are available.

Table 7. Html Properties

<table>
<tr><th>Property</th><th>Description</th></tr>
<tr><td>Flow</td><td>Select the query (on page 180) that should be used to retrieve information for the widget. Without a flow, the widget will not display any data.

To populate values here, bind the html widget to a query on its PAGE DATA tab.</td></tr>
<tr><td>Select Data</td><td>Select an entity field (on page 168). Values in this drop-down list are populated based on the entities (on page 159) available in the selected query. Using these fields, you can connect data to components that you create using the html widget.

Next, select + Add Field to add the selected entity field to the application for which you can add the html code.

Tip:
You can select + Add All Fields to add all the entity fields at once.</td></tr>
<tr><td>Name</td><td>Provide a name for the added entity field.</td></tr>
</table>

Table 7. Html Properties (continued)

Property	Description
Data	Select this option if you want to retrieve information from an output field. Next, select the output field from **Output data type**. This drop-down list contains the output fields available in your selected query. **Note:** **Select Data** value must be set to `single` to update the output fields.
Manual	Select this option if you want to provide manual values to retrieve information. Enter the value.
Formula	Select this option if you want to retrieve information based on a formula. Build a formula.
Edit Code	Select this button to access a code editor for html, css, and javascript. You can enter the custom code in the code editor. **Tip:** The javascript code editor contains instructions on how to use the javascript API.
Scoped css?	Indicates whether the css code must be applied only to the html widget or globally. • If you want the css code to be applied only to the elements in the html widget, select this check box. • If you want the css code to be applied globally, clear this check box.

Using the Html Widget

Example 1: Suppose you want to stream videos from YouTube based on values selected in a drop-down list box. To do so, perform the following steps:

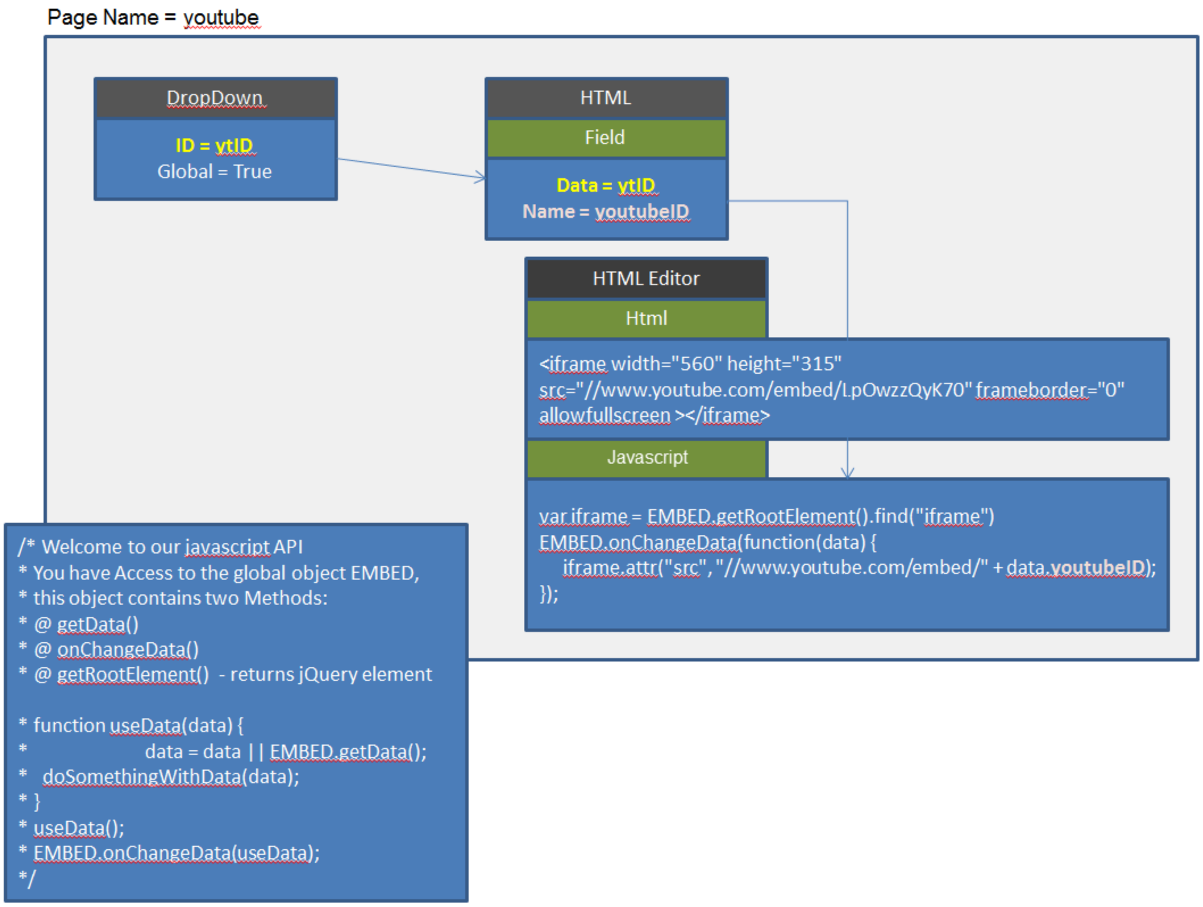
1. When designing application pages *(on page 308)*, drag-and-drop the html and dropdown widgets to a container.
2. Select the dropdown *(on page 339)* widget in the container to access the **DROPDOWN PROPERTIES** tab.
    a. Under the **GENERAL** section, provide the details as specified in the table:

Field	Description
Label	Enter `Select an option`.
Id	Enter `ytID`.
Global Data	Select the check box.

3. Select the html widget in the container to access the **HTML PROPERTIES** tab.
    a. Under the **DATA** section, provide the details as specified in the table:

Field	Description
Flow	Select a query.
Select Data	Select an entity field from the query, and do the following: ▪ **Name**: Enter `ytID`. ▪ Select **Data**. ▪ **Output data type**: Select the global variable (`ytID`) that stores the drop-down list box values.

A relationship is created between the dropdown and html widgets as shown in the following image.



Example 2: Suppose you want to create an application with the following pages:

- **Compass**: Displays a compass with the needle indicating the angle that an application user enters.
- **Stylish Header**: Displays text in a header with special effects.
- **Tiles**: Displays tiles of various colors.
- **Marquee**: Displays text that moves from one end to the other of the page.

To do so create the application pages *(on page 308)* for compass, stylish header, tiles, and marquee. Design the page layout for each as follows:

For Compass:

1. Add an input *(on page 341)* widget to a container, and provide **INPUT PROPERTIES** as specified in the table:

Field	Description
General > Label	Enter `Enter Angle:`
General > Id	Enter `direction`
General > Global Data	Select the check box.

2. Add a html widget below the input widget, add a field, and provide values as shown in the image.

Field	Description
General > Id	Enter `compass`
Data > Name	Enter `angle`
Data > Select Data	Select `compass - direction` from the list.
Data > Output data type	Select `Text field` from the list.

3. Select **Edit Code** to access the code editor, and save these lines of code:

Html	Enter these lines of code as shown in the following image: `<div class="compass">` `  <div class="compass-inner">` `    <div class="north">N</div>` `    <div class="east">E</div>` `    <div class="west">W</div>` `    <div class="south">S</div>` `    <div class="main-arrow">` `      <div class="arrow-up"></div>` `      <div class="arrow-down"></div>` `    </div>` `   </div>` `  </div>`

Css

Enter the following lines of code:

```
compass {


 width: 150px;

 height: 150px;

 font-size: 10px;

 background-color: transparent;

 border-radius: 100%;

 position: relative;

 margin: 0 auto;

 font-family: 'Lobster Two', Comic Sans MS;

 color: #2d2d2d;

} .compass-inner {


 width: 85%;

 height: 85%;
```

	`` background-color: transparent; border-radius: 100%; position: relative; left: 6.9%; top: 6.9%; border: 2px solid #2d2d2d; } .main-arrow { height: 100%; width: 7.5%; left: 46%; position: relative; padding-top: 3%; box-sizing:border-box; -webkit-transform: rotate(50deg); -moz-transform : rotate(50deg); -o-transform: rotate(50deg); -ms-transform: rotate(50deg); transform: rotate(50deg); } .arrow-up, .arrow-down { width: 0; height: 0; border-bottom: 57px solid red; border-left: 4px solid transparent; border-right: 4px solid transparent; position: relative; } .arrow-down { border-bottom-color: #2d2d2d; -webkit-transform: rotate(180deg); -moz-transform : rotate(180deg); -o-transform: rotate(180deg); -ms-transform: rotate(180deg); } .north { position: absolute; ```

```
 left: 45%;
 top: 2.5%;
} .east { position: absolute;

 left: 88%;
 top: 44%;
} .west {

 position: absolute;
 left: 7%;
 top: 44%;
} .south {

 position: absolute;
 left: 45%;
 top: 82%;
} @media (max-width: 600px) {

 .compass {
   width: 150px;
   height: 150px;
   font-size: 11px;
 }
.arrow-up, .arrow-down {

 border-bottom: 57px solid red;
 border-left: 4px solid transparent;
 border-right: 4px solid transparent;
} .arrow-down {

 border-bottom-color: #2d2d2d;
} } @media (max-width: 769px) {

 .compass {
   width: 150px;
   height: 150px;
   font-size: 11px;
```

	`` } .arrow-up, .arrow-down { border-bottom: 57px solid red; border-left: 4px solid transparent; border-right: 4px solid transparent; } .arrow-down { border-bottom-color: #2d2d2d; } } @media (max-width: 400px) { .compass { width: 100px; height: 100px; font-size: 11px; } .arrow-up, .arrow-down { border-bottom: 38px solid red; border-left: 3px solid transparent; border-right: 3px solid transparent; } .arrow-down { border-bottom-color: #2d2d2d; } } ```
Javascript	Enter the lines of code as shown in the following image:

4. Save the compass page.

For Stylish Header:

1. Add a html widget, select **Edit Code**, and save these lines of code:

Html	Enter the following lines of code: `<h1>3d text effect</h1>`
Css	Enter the following lines of code: `body{` `  text-align:center;` `  background:#dfdfdf;` `}` `h1{` `  text-transform:uppercase;`

<table>
<tr><td></td><td><pre>
  font-size:72px;

  font-family:'Verdana';

  padding:30px;

}
</pre></td></tr>
<tr><td>Javascript</td><td>Enter the following lines of code:<pre>
jQuery(document).ready(function(){

   $('h1').mousemove(function(e){

     var rXP = (e.pageX - this.offsetLeft-$(this).width()/2);

     var rYP = (e.pageY - this.offsetTop-$(this).height()/2);

     $('h1').css('text-shadow', +rYP/10+'px '+rXP/80+'px rgba(227,6,19,.8),
 '+rYP/8+'px '+rXP/60+'px rgba(255,237,0,1), '+rXP/70+'px '+rYP/12+'px
 rgba(0,159,227,.7)');

   });

});
</pre></td></tr>
</table>

2. Save the stylish header page.

For Tiles:

1. Add a html widget, select **Edit Code**, and save these lines of code:

<table>
<tr><td>Html</td><td>Enter the following lines of code:<pre>
 <div class="tile"></div>
</pre></td></tr>
<tr><td>Css</td><td>Enter the lines of code as shown in the following image:</td></tr>
</table>

Html Css Javascript

```css
.tile{

    height:300px;
    width:200px;

          -moz-box-shadow:    3px 3px 5px 6px #888888;
  -webkit-box-shadow: 3px 3px 5px 6px #888888;
  box-shadow: 10px 10px 5px black;
  text-align: center;


  background: #f0b7a1; /* Old browsers */
background: -moz-linear-gradient(top,  #f0b7a1 0%, #8c3310 50%, #752201 51%, #bf6e4e 100%); /* FF3.6+ */
background: -webkit-gradient(linear, left top, left bottom, color-stop(0%,#f0b7a1), color-stop(50%,#8c3310), color-stop(51%,#752201), color-stop(100%,#bf6e4e)); /* Chrome,Safari4+ */
background: -webkit-linear-gradient(top,  #f0b7a1 0%,#8c3310 50%,#752201 51%,#bf6e4e 100%); /* Chrome10+,Safari5.1+ */
background: -o-linear-gradient(top,  #f0b7a1 0%,#8c3310 50%,#752201 51%,#bf6e4e 100%); /* Opera 11.10+ */
background: -ms-linear-gradient(top,  #f0b7a1 0%,#8c3310 50%,#752201 51%,#bf6e4e 100%); /* IE10+ */
background: linear-gradient(to bottom,  #f0b7a1 0%,#8c3310 50%,#752201 51%,#bf6e4e 100%); /* W3C */
filter: progid:DXImageTransform.Microsoft.gradient( startColorstr='#f0b7a1', endColorstr='#bf6e4e',GradientType=0 ); /* IE6-9 */
}
```

2. Save the tiles page.

For Marquee:

1. Add a html widget, select **Edit Code**, and save these lines of code:

Html	Enter the lines of code as shown in the following image:

<table>
<tr><td></td><td>
</td></tr>
<tr><td>Css</td><td>Enter the lines of code as shown in the following image:</td></tr>
</table>

2. Save the marquee page.

Save and preview the application. The application has four pages built using a html widget.

Interactive Map

An interactive map widget is used to display interactive markers or icons on a static background (for example, an image representing an asset or a static map). The position of a marker on the image is defined by the offset from the top and left borders.

> **Note:**
> You need external Internet access to use the map widget.

In addition, using an interactive map, you can create an application that will:

- Provide an overview of the current state of an asset.
- Allow you to access a page to view more information.
- Send a command to control the asset.

Interactive Map Settings

To configure settings for an interactive map, you must add an image, and then configure the settings for each marker. To do so:

1. In the page designer, add the interactive map widget to the page.
2. Select **Upload Image**, and then select the background image file.

> **Note:**
> - If you want to change the background image, you can upload a new image without affecting any markers that you have added.
> - Background image filename must not exceed 40 characters.

3. Double-click the image where you want to add a marker.

   A marker is created at the position at which you clicked.
4. Select the marker.

   The settings for the marker appear in the **INTERACTIVE MAP PROPERTIES** section. The coordinates are populated automatically; they identify the position of the marker.

> **Tip:**
> To fine-tune the position of the marker, you can drag the marker to the required position or modify the coordinates manually.

5. Select **Add Marker**, and then enter values as specified in the following table.

Setting	Description
Marker Type	Identifies the type of the marker. You can select one of the following options:

Setting	Description
	◦ **Shape**: If you select this option, you can select one of the predefined shapes available in Operations Hub. By default, this option is selected. ◦ **Image**: If you select this option, you can upload an image for the marker.
Color	Identifies the color of the marker. This setting appears only if you have selected **Shape** in the **Marker Type** setting.
Shape	Identifies the shape of the marker. This setting appears only if you have selected **Shape** in the **Marker Type** setting. You can select one of the following options: ◦ **Round** ◦ **Square**
Image	Identifies the image for the marker. This setting appears only if you have selected **Image** in the **Marker Type** setting. For example, if the marker identifies the position of a radiator fan, you can upload the image of a fan instead of using a predefined round or square shape for the marker.
Size	Identifies the multiplier for the marker shape or image size. For example, if you enter 2, the marker size is double the default size. By default, the value in this box is 1.
Label	Identifies the text for the marker label if you want to display the label.
Label Color	Identifies the color of the label as it appears in the application.
Data Label	Identifies the data that is associated with the marker.

Setting	Description
	For example, suppose the interactive map plots the temperature of various components of a car. For a marker that identifies the position of a radiator fan in a car, you can map the data label with the output of the query that retrieves the temperature of the fan. When you access the application, the temperature value retrieved from the query is displayed for the radiator fan. You can select one of the following types of data labels: ◦ **Data**: Select this option if you want to display the data retrieved by a query, and then select the query output that want to display. ◦ **Manual**: Select this option if you want to enter the data manually, and then enter the value.
Data Label Color	Identifies the color and opacity of the data label.
Conditions	Identifies the condition to show or hide the marker. For example, you can add a condition to show the marker only if the temperature of the component reaches 50 degrees Celsius.
Actions	Identifies the actions to be performed when the marker is selected.

Note:
You can add multiple markers to a single position. Each marker can have a different shape, icon, or color to indicate different conditions. For example, if the temperature of a radiator fan in a car exceeds a certain limit, the green marker can be replaced with a red marker to indicate that the temperature is high. You can also configure a set of actions for each marker when selected.

Layouts

New Line

A new line widget is used to add a line to separate the components of a page.

Possible Uses

If widgets are placed too close to one another, adding a new line creates a blank space between the widgets to enhance readability.

Separator

A separator widget is used to add a line between widgets, thus creating a better or clearer order between the widgets.

Possible Uses

If an application displays a questionnaire, you can use a separator to divide the individual questions. This will arrange and group the questions together.

Container

A container widget is a layout element that creates a specific area for widgets within an application. A container is similar to the div element used in html. It is used as a box (invisible in the application) that helps organize the widgets in the application.

Container Settings

When you use a container widget, in addition to the default settings of a widget, the following settings are available.

Setting	Description
Show/Hide	You can show or hide a container from the application for each of the following device types: • Mobile • Tablet • Desktop
Conditions	When you specify conditions to a container, they are applied to all the widgets added to that contain-

Setting	Description
	er. For example, you can add a check box to the application to allow application users to show or hide the container.
Performance	By default, this check box is cleared, indicating that data within the container is loaded only when the container is shown in the application. If you select the check box, the data within the container is loaded, regardless of whether the container is shown or hidden. Selecting this check box can reduce the performance of the application.

Possible Uses

Container are used for the following purposes:

- Organization of content: You can use containers to organize widgets in rows and columns. You can then set information on varying planes to indicate the importance or sequence of information provided by the individual widgets in the container.

  For example, suppose you want to create an application to allow application users to enter their user account details. In that case, add a container with two columns. The first column can contain fields for the user's first name, last name, and phone number, whereas, the second column can contain fields for the user's email address and personal website address, along with a **Submit** button.
- Conditional content: You can use container to apply conditions to all the widgets in the container.

Repeater

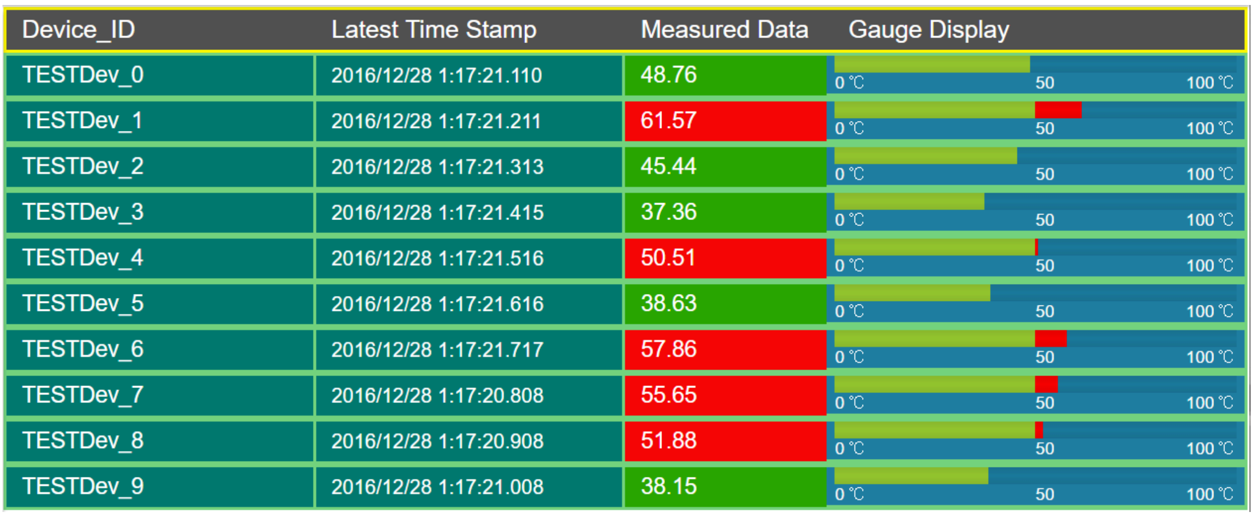
A repeater is a widget that is used to repeat the content layout for each item in a list returned by a query. For example, if a query returns a list of assets, the repeater can display the state of multiple parameters associated with each asset type using a combination of different widgets.

Using a repeater has the following advantages.

- You can create a dashboard-type application that monitors multiple assets at the same time.
- You can use different layouts and styles for each widget in the repeater to match the data type of an asset parameters and to enhance visibility.

- The layout of the content only needs to be defined once in the designer and it will be repeated for each item in the list that you want to monitor.
- The content that is repeated is automatically updated when the underlying query is updated (for example, new assets are added or the list of assets is updated by means of conditions in the query).

For example, if an entity stores the temperature recorded by assets, you can use a repeater to display not only the temperature recorded by each device, but also a gauge to indicate whether each value is in the acceptable range, as shown in the following image.



Device_ID	Latest Time Stamp	Measured Data	Gauge Display
TESTDev_0	2016/12/28 1:17:21.110	48.76	0 ℃ 50 100 ℃
TESTDev_1	2016/12/28 1:17:21.211	61.57	0 ℃ 50 100 ℃
TESTDev_2	2016/12/28 1:17:21.313	45.44	0 ℃ 50 100 ℃
TESTDev_3	2016/12/28 1:17:21.415	37.36	0 ℃ 50 100 ℃
TESTDev_4	2016/12/28 1:17:21.516	50.51	0 ℃ 50 100 ℃
TESTDev_5	2016/12/28 1:17:21.616	38.63	0 ℃ 50 100 ℃
TESTDev_6	2016/12/28 1:17:21.717	57.86	0 ℃ 50 100 ℃
TESTDev_7	2016/12/28 1:17:20.808	55.65	0 ℃ 50 100 ℃
TESTDev_8	2016/12/28 1:17:20.908	51.88	0 ℃ 50 100 ℃
TESTDev_9	2016/12/28 1:17:21.008	38.15	0 ℃ 50 100 ℃

Repeater Settings

When you use a repeater, in addition to providing values to the default fields for a widget, you must define the following settings.

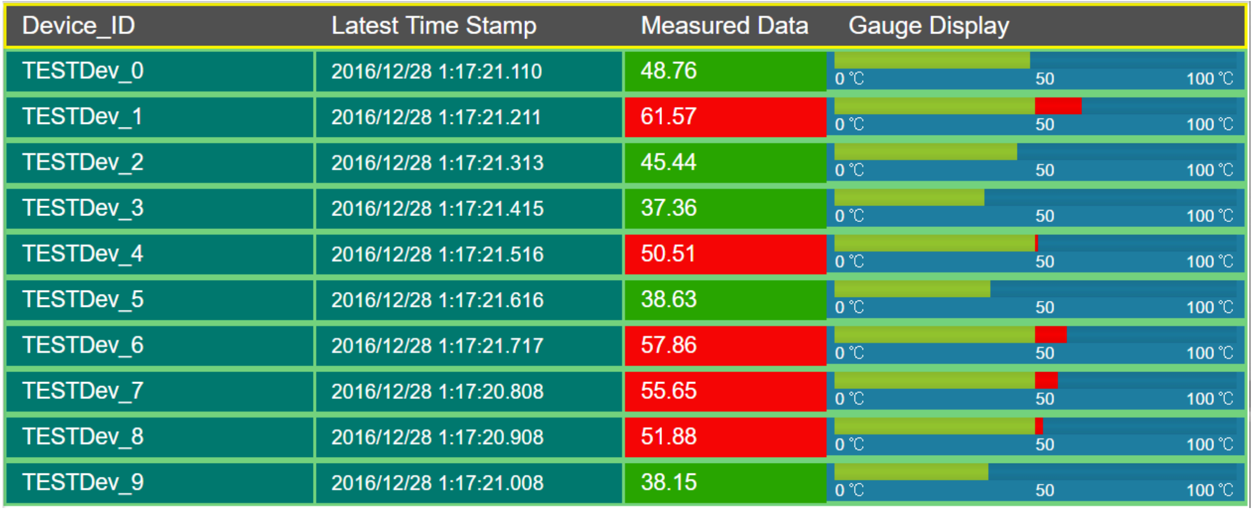
Setting	Description
Flow	Identifies the query to use to fetch data displayed in the repeater.
Multi-select	This setting is used in combination with a map or a graph widget. If you select this check box, a check box appears in each row of the repeater in the application, allowing the user to select which items should appear on the map or the graph. By default, this check box is cleared.

Setting	Description
Checked	If you have configured the Multi-select setting, this setting indicates the initial state of the check box in each row of the repeater in the application. By default, this check box is cleared. If you select this check box, all the check boxes in the application are selected.
Action	Identifies the action that should be performed when the repeater is selected. For example, suppose you want to allow the application users to select an asset, and then retrieve more information about the asset. In that case, select **Set global value**, and then select the global variable that stores the asset ID. The value set in this global variable is then used as an input to another query to retrieve data about the asset. You can add multiple actions.
Load <number> rows at a time	Identifies the number of rows that should appear by default in the repeater. By default, the value in this box is 10. If you select this check box, the **Paging** and **"Load more" button** options appear. • **Paging**: If you select this option, each page in the repeater will contain the number of rows that you specify. You can navigate to the other pages to access the rest of the rows. • **"Load more" button**: If you select this option, the repeater will initially contain the number of rows that you specify. A **Load more** button appears in the application, which allows the application user to retrieve additional rows in the same page.

<table>
<tr><th>Setting</th><th>Description</th></tr>
<tr><td>Item Horizontal Alignment</td><td>
Identifies the number of repeater instances that will appear horizontally next to one another before moving to the next row.
For example, suppose you want to display the following information in the repeater.
<table>
<tr><th>Device ID</th><th>Latest Time Stamp</th></tr>
<tr><td>Device 1</td><td>2019/12/22 8:04:37:037</td></tr>
<tr><td>Device 2</td><td>2019/12/22 22:14:31:545</td></tr>
<tr><td>Device 3</td><td>2019/12/22 8:04:40:040</td></tr>
<tr><td>Device 4</td><td>2019/12/21 5:28:59:059</td></tr>
</table>
If you enter 2 in this box, the table is split as follows in the repeater.
<table>
<tr><th>Device ID</th><th>Latest Time Stamp</th><th>Device ID</th><th>Latest Time Stamp</th></tr>
<tr><td>Device 1</td><td>2019/12/22 8:04:37:037</td><td>Device 2</td><td>2019/12/22 22:14:31.545</td></tr>
<tr><td>Device 3</td><td>2019/12/22 8:04:40:040</td><td>Device 4</td><td>2019/12/21 5:28:59:059</td></tr>
</table>
</td></tr>
</table>

Using a Repeater for a Basic Operation

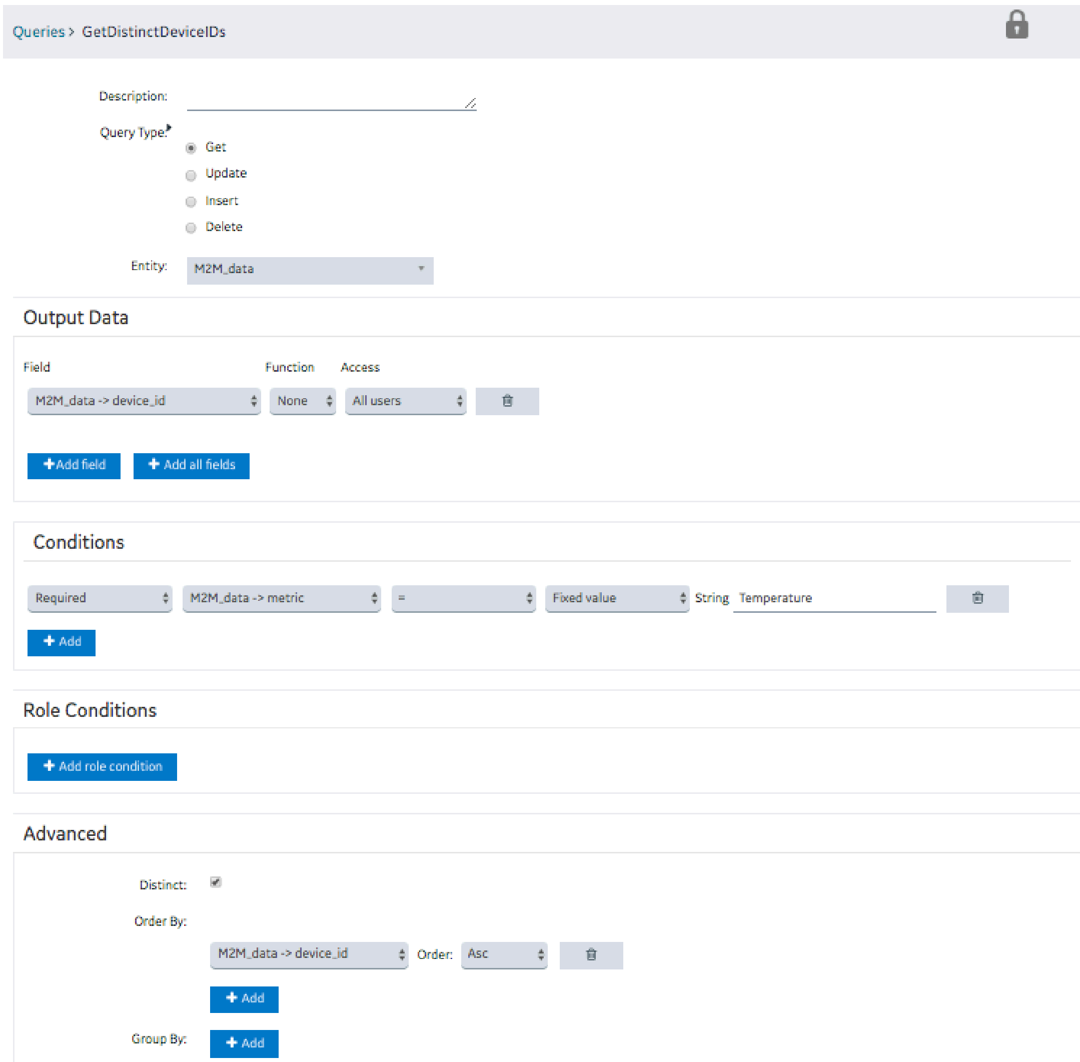
Suppose you want to use a repeater to display temperature recorded by multiple sensors, which is stored in the M2M_data entity. In addition to displaying the temperature, you can use a gauge widget in the repeater to highlight whether the temperature is in the acceptable range, as shown in the following image.



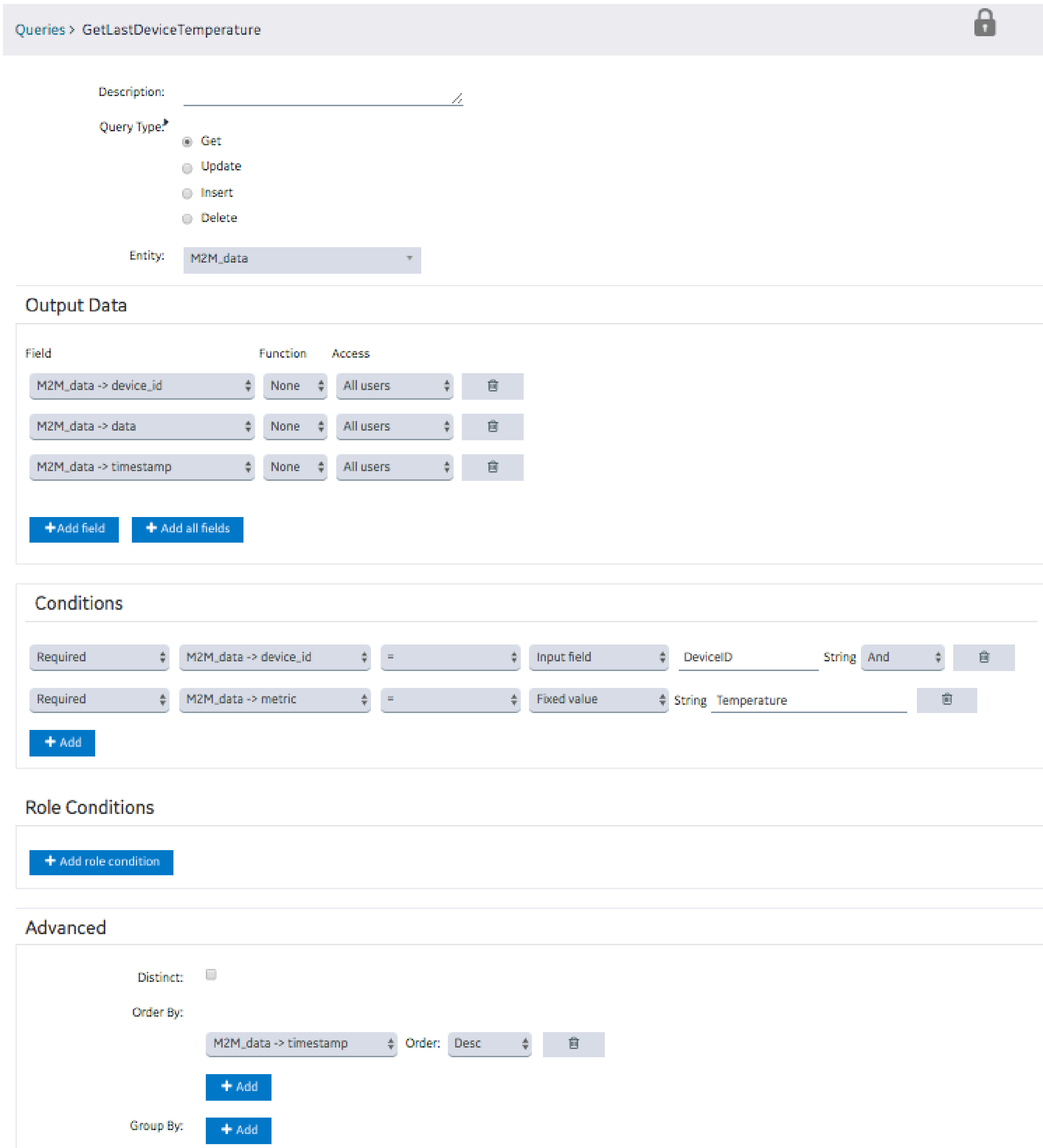
Device_ID	Latest Time Stamp	Measured Data	Gauge Display
TESTDev_0	2016/12/28 1:17:21.110	48.76	0 ℃ 50 100 ℃
TESTDev_1	2016/12/28 1:17:21.211	61.57	0 ℃ 50 100 ℃
TESTDev_2	2016/12/28 1:17:21.313	45.44	0 ℃ 50 100 ℃
TESTDev_3	2016/12/28 1:17:21.415	37.36	0 ℃ 50 100 ℃
TESTDev_4	2016/12/28 1:17:21.516	50.51	0 ℃ 50 100 ℃
TESTDev_5	2016/12/28 1:17:21.616	38.63	0 ℃ 50 100 ℃
TESTDev_6	2016/12/28 1:17:21.717	57.86	0 ℃ 50 100 ℃
TESTDev_7	2016/12/28 1:17:20.808	55.65	0 ℃ 50 100 ℃
TESTDev_8	2016/12/28 1:17:20.908	51.88	0 ℃ 50 100 ℃
TESTDev_9	2016/12/28 1:17:21.008	38.15	0 ℃ 50 100 ℃

To do so, perform the following steps:

1. Create the following queries:
   - GetDistinctDeviceIDs: To fetch a distinct list of device IDs from the M2M_data entity. Enter or select values as shown in the following image.



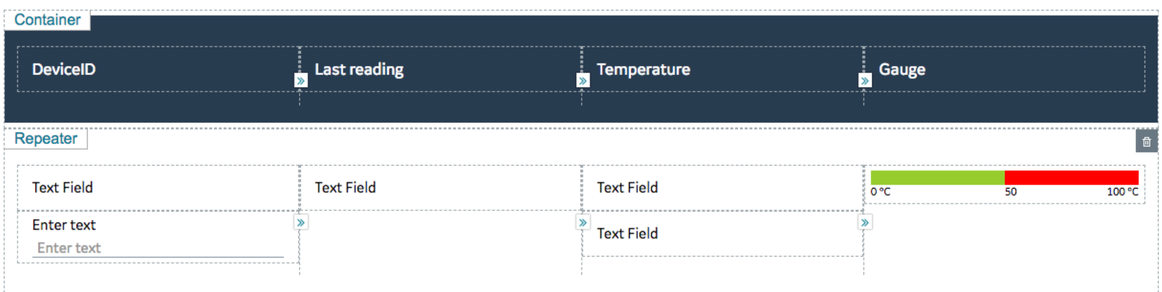
◦ GetLastDeviceTemperature: To fetch the measurement time (that is, time stamp) and the measured value of the temperature for each device. Enter or select values as shown in the following image.



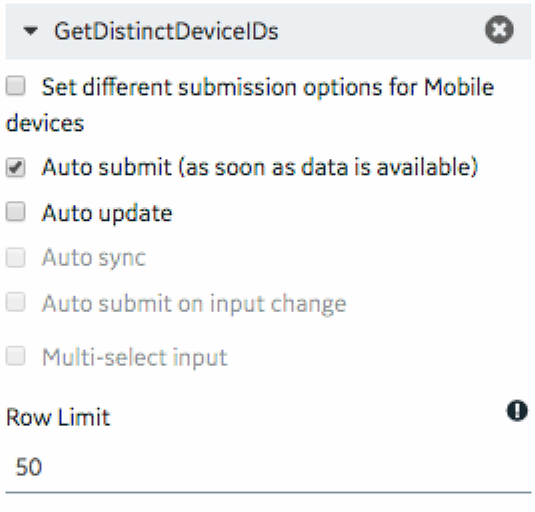
2. Create an application, and then add a page.
3. Add a container to the page for the heading row, and perform the following steps:
    a. Split the container into four columns.
    b. In each column, add a header widget to contain the column headings.
    c. Specify the following column headings:

        - Device ID
        - Last Reading
        - Temperature
        - Gauge
    d. In the **Visual** section for each heading, select the **Custom Colors** check box, and in the **Color** box, select the white color.
4. In the **Visual** section, select the **Custom Colors** check box, and in the **Background Color** box, select the dark blue color.
5. Add a repeater for the data rows, and perform the following tasks:
    a. Split the repeater into four columns.
    b. In the first column, add a text widget and an input widget.
    c. In the second column, add a text widget.
    d. In the third column, add two text widgets.
    e. In the fourth column, add a gauge widget.

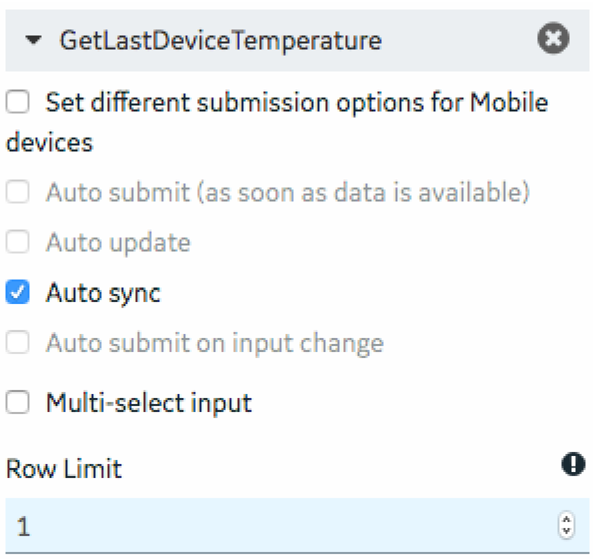
    The widget appears as shown in the following image.



6. Select **PAGE DATA**, and then perform the following steps:
    a. Add the two queries that you have created.
    b. For the GetDistinctDeviceIDs query, configure the settings as shown in the following image.

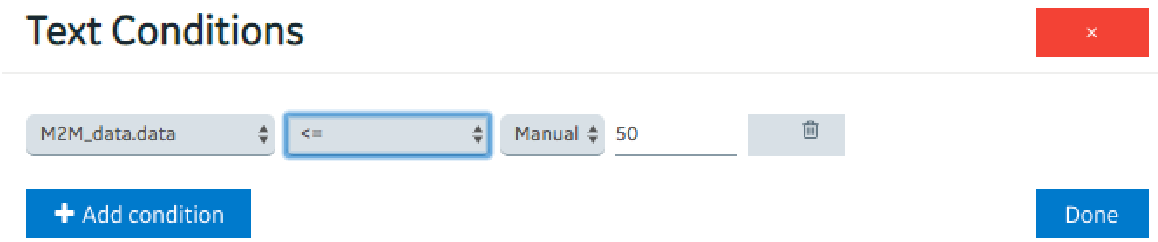


c. For the GetLatestDeviceTemperature query, configure the settings as shown in the following image.



7. In the **REPEATER PROPERTIES** section, in the **Flow** box, select the query GetDistinctDeviceIDs.
8. In the **PAGE DATA** section, from the the GetDIstinctDeviceIDs query, drag M2M_data.device_id to the text widget and the input widget in the first column of the repeater.
9. In the **INPUT WIDGET PROPERTIES** section, select the **Disabled** and **Hidden** check boxes.
10. In the **PAGE DATA** section, from the GetLastDeviceTemperature query:
    - Drag DeviceID to the input widget in the first column of the repeater.
    - Drag M2M_data.timestamp to the text widget in the second column of the repeater.
    - Drag M2M_data.data to the two text widgets in the third column and the gauge widget in the fourth column of the repeater.

11. Select the text widget in the second column, and in the **TEXT PROPERTIES** section, in the **Format** box, select **DateTime**.
12. Select the first text widget in the third column, and in the **TEXT PROPERTIES** section, select **Add Conditions**, and then specify values as shown in the following image.

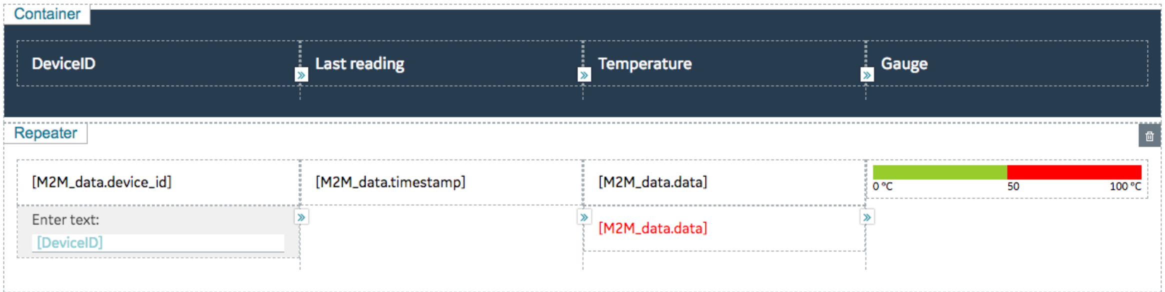


13. Select the second text widget in the third column of the repeater, and in the **TEXT PROPERTIES** section, perform the following steps:
    a. In the **Visual** section, select the **Custom Colors** check box, and then in the **Color** box, select red.
    b. Select **Add Conditions**, and then specify values as shown in the following image.

14. Select the gauge widget in the repeater, and in the **GAUGE PROPERTIES** section, perform the following steps:
    a. Delete two of the color sections.
    b. In the **Start Position** and **Label** boxes for the remaining color section, enter 50.
    c. In the **Maximum** box, enter 100.
    d. In the **Units** box, enter degrees Celsius.

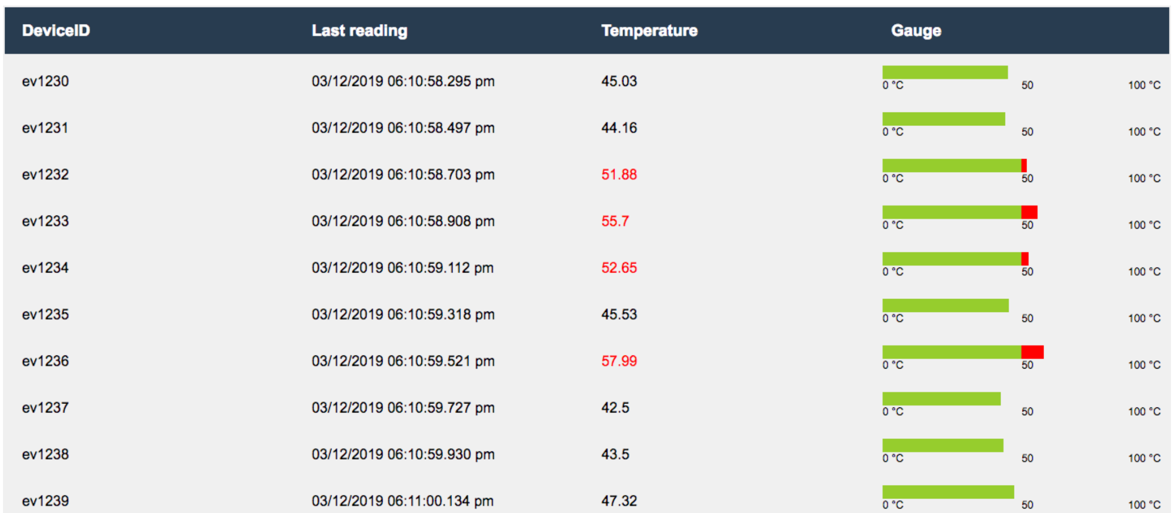
> **Tip:**
> If you want to enter °C, you can copy it from a Microsoft Word document.

The repeater widget appears as shown in the following image.



15. Save the application, and preview it.

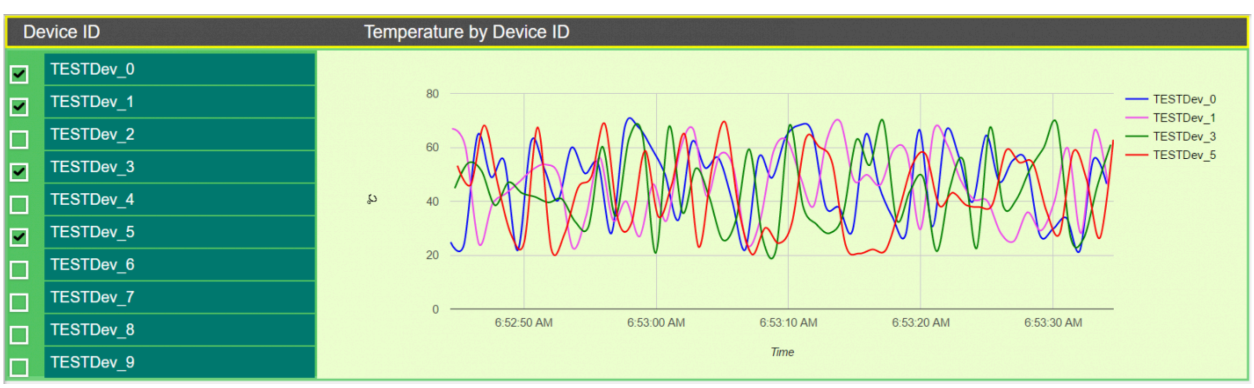
    The application appears as shown in the following image.



DeviceID	Last reading	Temperature	Gauge
ev1230	03/12/2019 06:10:58.295 pm	45.03	0 °C 50 100 °C
ev1231	03/12/2019 06:10:58.497 pm	44.16	0 °C 50 100 °C
ev1232	03/12/2019 06:10:58.703 pm	51.88	0 °C 50 100 °C
ev1233	03/12/2019 06:10:58.908 pm	55.7	0 °C 50 100 °C
ev1234	03/12/2019 06:10:59.112 pm	52.65	0 °C 50 100 °C
ev1235	03/12/2019 06:10:59.318 pm	45.53	0 °C 50 100 °C
ev1236	03/12/2019 06:10:59.521 pm	57.99	0 °C 50 100 °C
ev1237	03/12/2019 06:10:59.727 pm	42.5	0 °C 50 100 °C
ev1238	03/12/2019 06:10:59.930 pm	43.5	0 °C 50 100 °C
ev1239	03/12/2019 06:11:00.134 pm	47.32	0 °C 50 100 °C

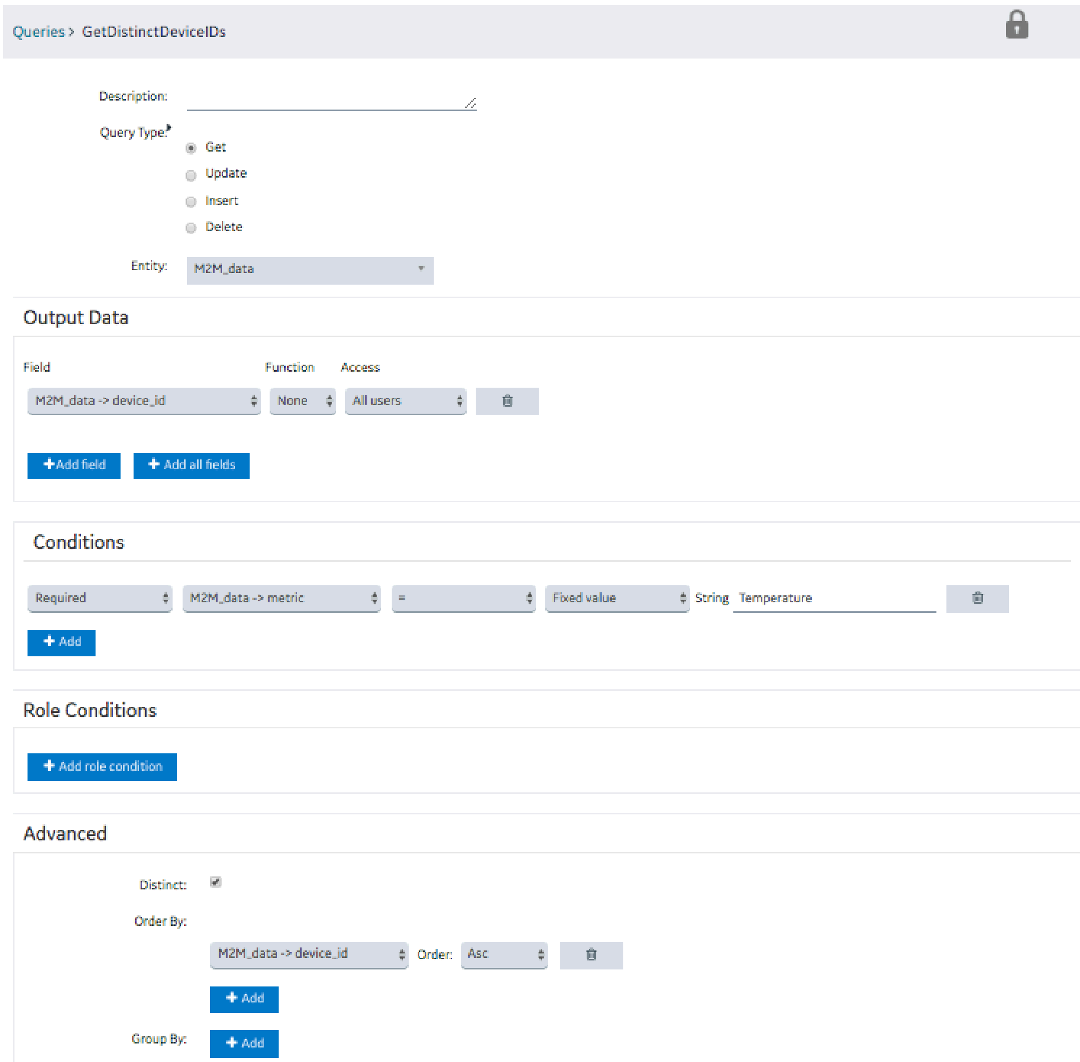
Using a Repeater for a Multi-Select Operation

Suppose you want to use a repeater to plot a trend graph of temperature recorded by selected devices. You want to allow application users to select the devices whose temperature you want to plot in real time, as shown in the following image.

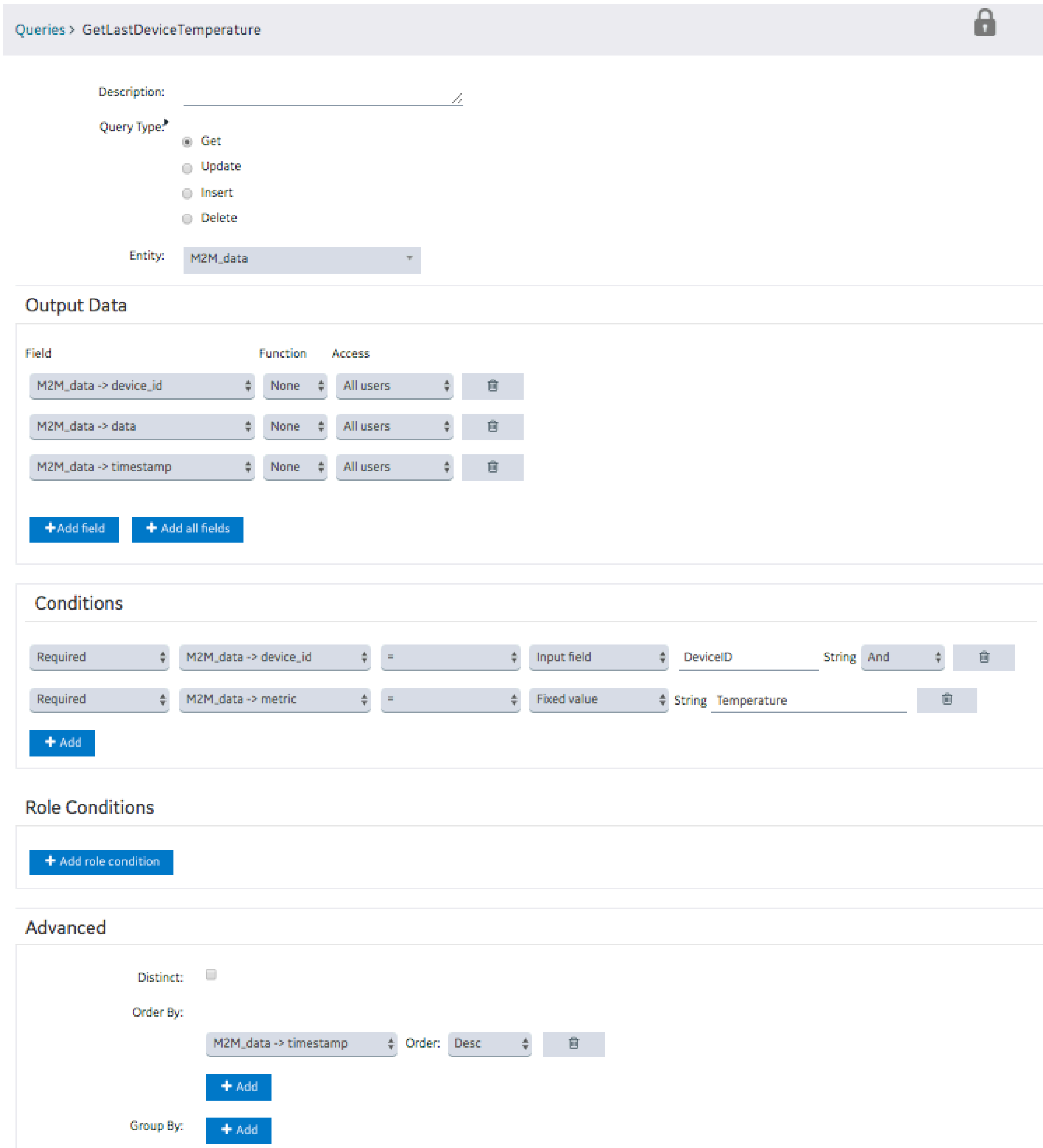


To do so, perform the following steps:

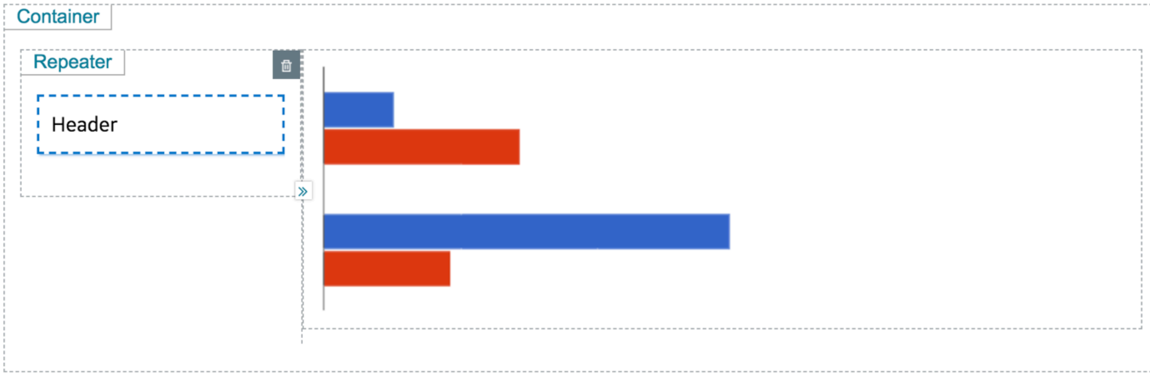
1. Create the following queries:
   - GetDistinctDeviceIDs: To fetch a distinct list of device IDs from the M2M_data entity. Enter or select values as shown in the following image.



◦ GetLatestDeviceTemperature: To fetch the measurement time (that is, time stamp) and the measured value of the temperature for each device. Enter or select values as shown in the following image.

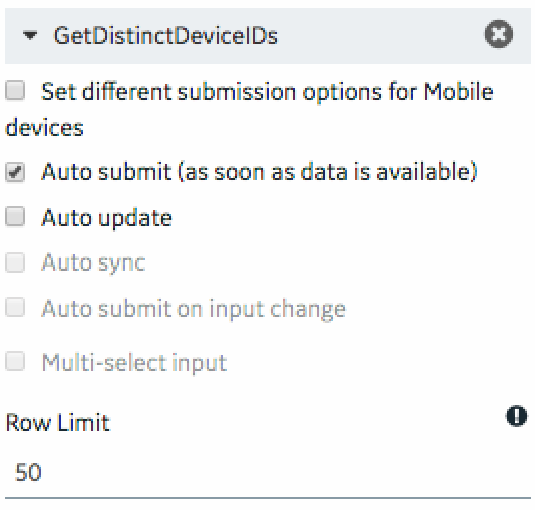


2. Create an application, and then add a page.
3. Add a container with six columns.
4. Except for the first column, merge the other five columns.
5. Add a repeater and a graph widget to the container, and add a header widget to the repeater, as shown in the following image.

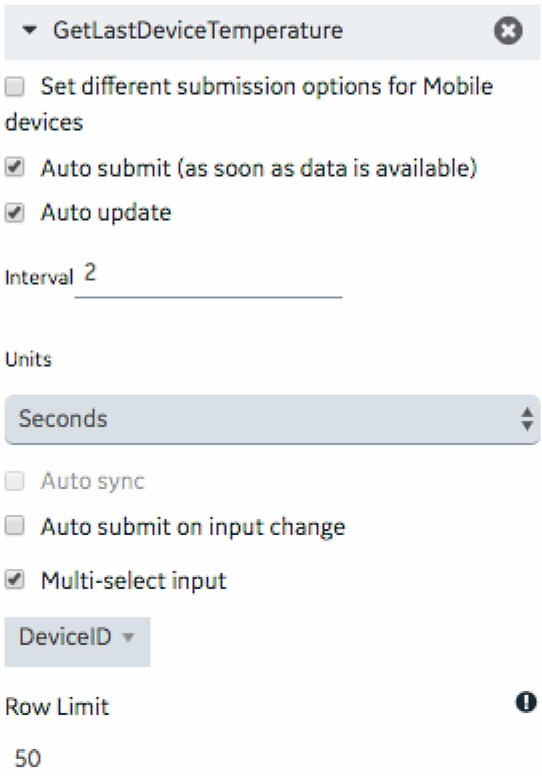


- The repeater provides a list of devices that the application users can select.
- The graph plots the temperature recorded by the selected devices.

6. Select **PAGE DATA**, and perform the following steps:
   a. Add the two queries that you have created.
   b. For the GetDistinctDeviceIDs query, configure the settings as shown in the following image.

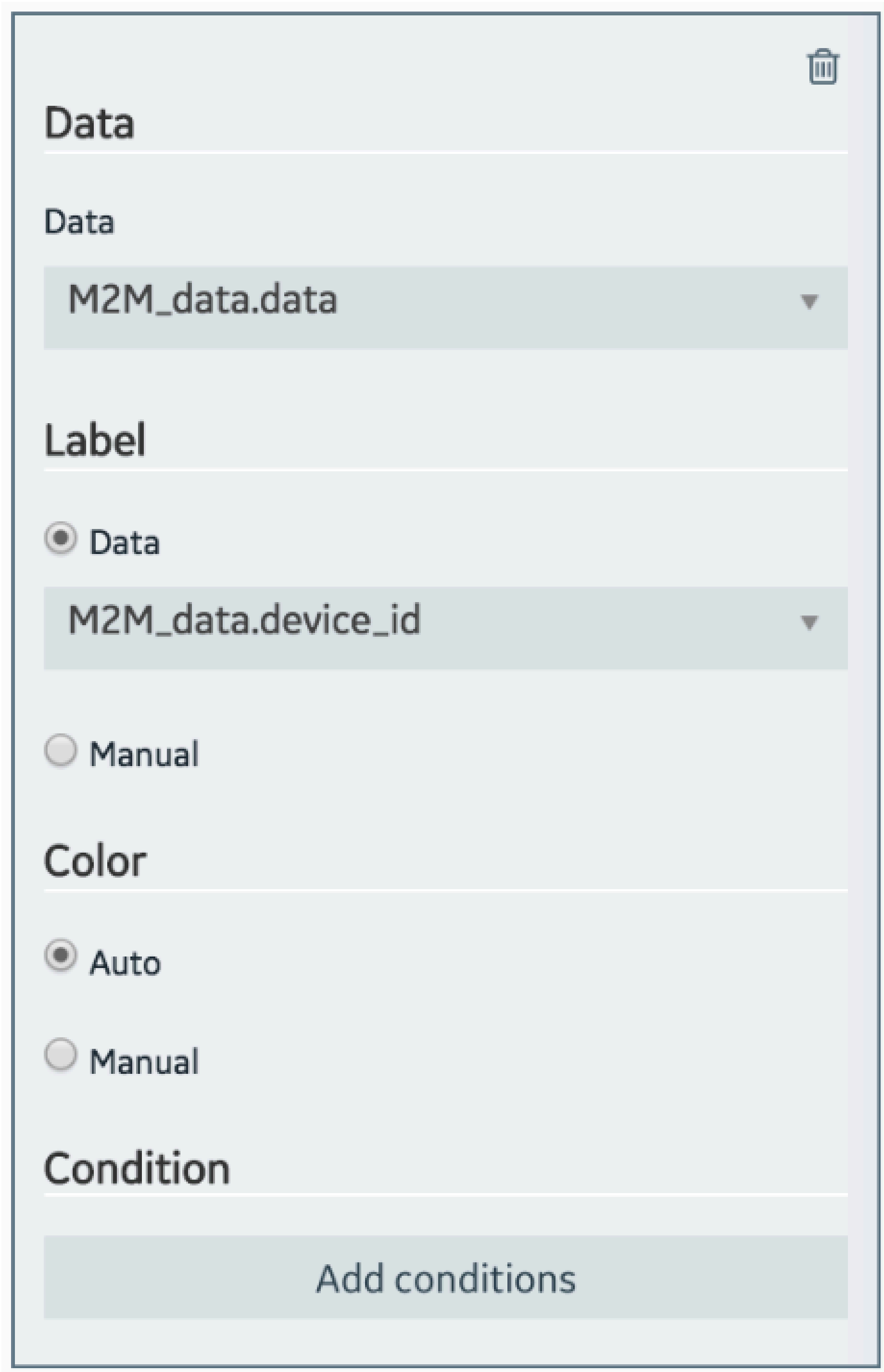


c. For the GetLatestDeviceTemperature query, configure the settings as shown in the following image.



7. In the **REPEATER PROPERTIES** section, in the **Flow** box, select the query GetDistinctDeviceIDs, and then select the **Multi-select** and **Checked** check boxes.
8. In the **GRAPH PROPERTIES** section:
    - In the **Type** box, select **Lines**.
    - In the **X-axis Data** box, select M2M_data.timestamp from the GetLatestDeviceTemperature query.
    - In the **X-axis Label** box, enter Time.
    - In the **Y-axis Label** box, enter Temperature.
    - In the **Data** box, select M2M_data.data from the GetLatestDeviceTemperature query.

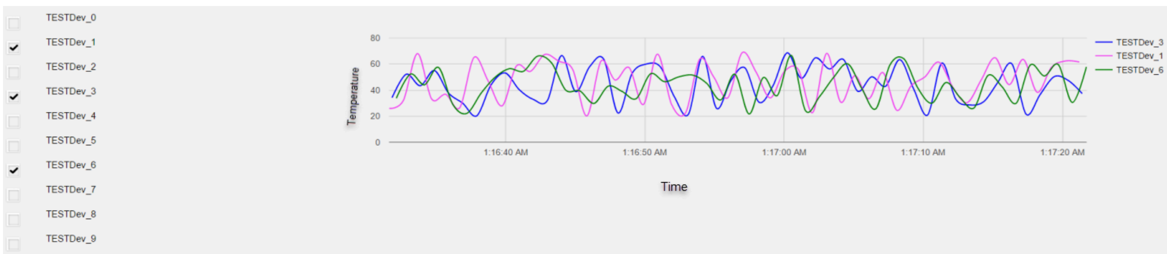
◦ In the **Label** box, select M2M_data.device_id from the GetLatestDeviceTemperature query.



9. In the **GRAPH PROPERTIES** section, in the **Responsive** subsection, set the height to 50 percent.
10. Select the header widget, and then in the **HEADER PROPERTIES** section, select **Data**, and then select M2M_data.device_id from the GetDistinctDeviceIDs query.

11. Select **PAGE DATA**, and then perform the following steps:
    a. For the GetDistinctDeviceIDs query, point to the row containing M2M_data.device_id, and then select . This will create a global variable for the ID.
    b. For the GetLatestDeviceTemperature query, drag the input DeviceID to the global variable that you have created.
12. Save the application, and preview it.

    The application appears as shown in the following image. You can use the check boxes to display or hide the temperature curve for each device.



Tools

Event Settings

An event settings widget is used to allow users to turn on or off event notifications using the application.

Using the Event Settings Widget to Control an Event

Suppose you want to trigger an event to send email notifications when the temperature recorded by a device reaches a certain limit, and you want users to specify the limit using the application. To do so, perform the following steps:

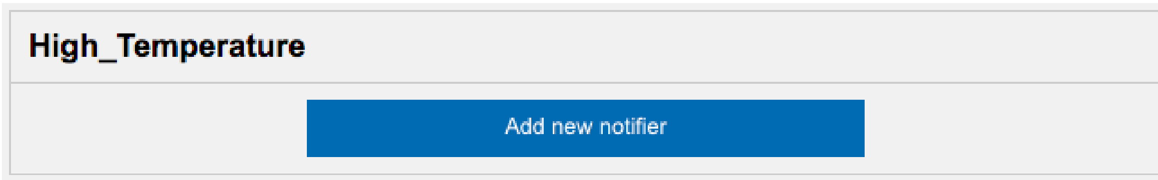
1. Create an email template named Temperature_Warning, which you will use to send email notifications.
2. Create an event named Temperature_Warning. In the event:
    - Create a trigger based on a device.
    - Create an action to send an email using the email template that you have created.

> **Tip:**
> For information on creating an event, refer to the Events *(on page 228)* section of the documentation.

3. Using the page designer, add the event settings widget to the relevant page of the application.

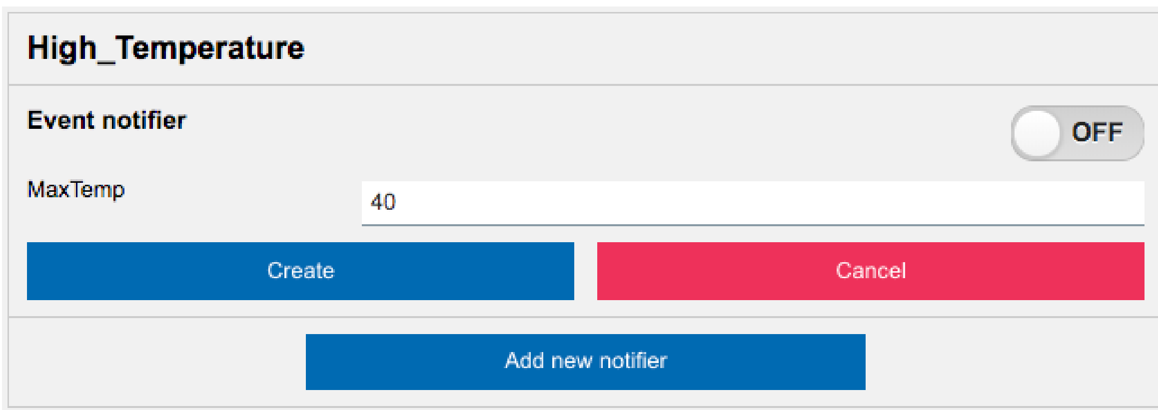
4. In the **EVENT SETTINGS PROPERTIES** section, in the **Event** box, select the event **High_Temperature**.
5. Save the application, and then access it.

   The event settings widget appears in the application.



6. Select **Add new notifier** to add an instance of the event.

   The **Event notifier** section appears, displaying the settings that you have configured.



7. Change the settings as needed, switch the **ON** toggle, and then select **Create**.

   The event is now active and will be triggered when the temperature reaches the specified limit.

Upload Excel

The upload excel widget is used to upload data from a Microsoft Excel workbook. This data is used to update an entity that has been created in Operations Hub.

Upload Excel Settings

When you use an upload excel widget, in addition to providing values for the default fields for a widget, you must define the following settings.

> **Important:**
> Only workbooks with a single worksheet are supported in the upload excel widget.

Setting	Description
Label	Identifies the name of the button that users will select in the application to upload data (for example, Upload Employee Data). By default, the value in this box is **Upload Excel**.
Entity	Identifies the entity to be updated with the data from the Microsoft Excel workbook. When you select the entity, the entity fields appear along with a check box next to each field. These check boxes are selected by default, indicating that the data for the corresponding fields will be included in the Microsoft Excel workbook. If you do not want to include data for a field, clear the corresponding check box.
Actions	Identifies the actions to be performed after the data is uploaded. For example, you can add a table to the application to display the data that has been uploaded, and then use a submit query action to update the table.

Updating Data of Sales Representatives

Suppose you want to update the data of sales representatives that is stored in the SalesRep entity. It contains the following fields:

- Rep_Code
- Rep_Name
- Department
- Car_No

To update the entity using the upload excel widget, perform the following steps:

1. Create a Microsoft Excel workbook with the data that you want to update. It is recommended that the column names match the field names in the entity.
2. Using page designer, add the upload excel widget to the application.
3. In the **Upload Excel Properties** section:

   a. In the **Label** box, enter Upload Sales Rep Data.
   b. In the **Entity** box, select **SalesRep**.
4. Save the application, and preview it.

   A button labeled **Upload Sales Rep Data** appears in the application.
5. Select **Upload Sales Rep Data**, and then select the workbook that you created.

   The **Select Column Mapping** window appears.
6. Enter or select values as specified in the following table.

Setting	Description
Use Header Row Names	Select this check box if you want to use the names specified in the heading row in the workbook. When you select this check box, the **Header Row Number** box appears.
Header Row Number	Enter the row number that contains the column names. Suppose the column names appear in the first row of the workbook. In that case, enter 1.
Import data from row <number> to row <number>	Enter the starting and ending rows in the workbook whose data you want to upload. Suppose the data for the four fields that you want to upload appears in the first four rows in the workbook. In that case, enter 1 and 4. **Tip:** If you want to import data in all the rows in the workbook, leave the **to row** box blank.
Append Data to existing data	Select this option if you want data from the workbook to be appended to the existing data in the entity. By default, this option is selected.
Overwrite existing data	Select this option if you want data from the workbook to overwrite the existing data in the entity.
Specify Column Mappings	For each field in the entity, select the column name in the workbook that you want to map. Suppose you want to map the Rep_Name field in the entity with the Representative Name column in the workbook. In that case, select **Representative Name** in the box that appears next to **Rep_Name**.

7. Select **Import**.

   The SalesRep entity is updated with the data from the workbook.

Upload Devices

Using the upload devices widget, you can upload a list of assets to Operations Hub. This data is stored in the baseline M2M entities.

Using the Upload Devices Widget

To use an upload devices widget, save the asset data in a CSV file with the following columns.

Column Heading	Purpose	Usage	Mapped to Entity	Mapped to Entity Field
device_unique_name	Identifies the unique ID of the device gateway or asset. This is the ID that the device will use when sending data using REST APIs or MQTT APIs.	This column is required.	device_gateway	device_id
			M2M_groups_device_thing	gateway_thing_id
device_type	Identifies the type of the device gateway or asset.	This column is required.	device_gateway	device_type
			supported_device_gateway	device_type
unique_address	Identifies the unique address of the device gateway (for example, imei number, mac address, unit ID).	If there is no unique address, enter None. This column is required if the url column is blank.	device_gateway	unique_address

Column Heading	Purpose	Usage	Mapped to Entity	Mapped to Entity Field
url	Identifies the URL for the device gateway.	If there is no URL, enter None. This column is required if the unique_address column is blank.	device_gateway	url
thing_unique_name	This parameter is obsolete.	This column is required and must be blank.		
thing_type	This parameter is obsolete.	This column is required and must be blank.		
group_name	Identifies the name of the device group. If the group does not exist in Operations Hub, it will be created.	This column is required. If devices are not grouped, we recommend that you enter the same value as in the device_type column.	M2M_groups M2M_groups_device_thing	group_name group_name
group_type	Identifies the group type. The supported group type is gateway.	This column is required.	M2M_groups	group_type

In addition, the CSV file can contain the following columns:

- Columns mapped to the device_gateway entity:
    - device_location
    - device_altitude
    - device_latitude
    - device_longitude
    - device_latlong
    - device_username
    - device_password
    - device_firmware_ver

- device_description
- device_generic_1
- device_generic_2

- Columns mapped to the supported_device_gateway entity:
  - supported_description
  - supported_manufactor
  - supported_product_code
  - supported_generic_1
  - supported_generic_2
- Columns mapped to the M2M_groups entity:
  - group_generic_1
  - group_generic_2
  - group_description

Integration

Integration Overview

The integration plugins are distributed under the following categories:

- Inputs *(on page 420)*
- Charts *(on page 426)*
- HMI *(on page 448)*
- Display *(on page 487)*
- General *(on page 521)*
- Batch *(on page 562)*

You can also use a list of native widgets *(on page 334)* available in Operations Hub.

Inputs

Inputs Overview

The following list of plugins are available under the inputs category:

- Button *(on page 421)*
- Check Box *(on page 422)*
- Radio Button *(on page 423)*
- Slider *(on page 424)*

Button

Use a button to trigger an action in your application.

The plugin is available under **INTEGRATION > INPUTS**. When designing application pages *(on page 308)*, drag-and-drop **button** to a container. To use the old version, refer to Button *(on page 346)*.

Table 8. Button Properties

Property	Description
BEHAVIOR > Click Event	Provide an action for the button plugin. For example, if you select `Go to next page`, the button will lead to the specified page in the end application. To add more actions, select **+Add Action**. You can choose from these available actions: • `Submit`: This action submits the data to the selected entity. • `Go to page`: This action leads to the specified page within the application. • `Go to previous page`: Use this action to navigate between historical entries created for the current application session. In the end app, selecting the button leads to a previously visited page from history. If there is no previous history, then the button remains idle. • `Go to next page`: Use this action to navigate between historical entries created for the current application session. In the end app, selecting the button leads to the next page. In the absence of next session entries, the button remains idle. • `URL`: This action leads to the specified (external) URL.

Table 8. Button Properties (continued)

Property	Description
	• `Set global value`: This action enables the data to be available globally. • `Show Component`: This action displays a hidden component in the end app. • `Hide Component`: This action hides a component. • `Toggle Show/Hide`: This action allows to switch between hidden and shown views of a component.
Label	The label name that appears on the button.
Icon	If you want to use an icon for your button, choose icons from DevExtreme or Font Awesome icon libraries.
Label Styling	Formats the label: **Font Family**, **Font Size**, and **Font Color** formats the label text. **Background Color** adds a color to the label background. **Background Hover Color** appears when you move your mouse over the label.

Check Box

The widget is available under **INTEGRATION > INPUTS**. When designing application pages *(on page 308)*, drag-and-drop **checkbox** to a container. To use the old version, refer to Check Box *(on page 336)*.

Table 9. Check Box Properties

Property	Description
Target > Output Value	Selecting the check box in the end app sends value to the target. Use a query or a global to specify the target data source.
Source > Input Value	Provides input for the check box from a data source.
Source > Label (unchecked)	This is the label that appears when the check box is not selected.

Table 9. Check Box Properties (continued)

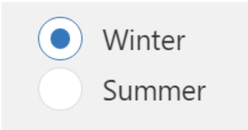
Property	Description
Source > Label (checked)	This is the label that appears when the check box is selected.
Label Styling	Formats the label: **Font Family**, **Font Size**, and **Font Color** formats the label text.
Check State Colors	Select colors that appear in the background of the check box. • **Unchecked Background Color**: This color appears when the check box is not selected. • **Checked Background Color**: This color appears when the check box is selected.

Radio Button

The widget is available under **INTEGRATION > INPUTS**. When designing application pages *(on page 308)*, drag-and-drop **radio** to a container. To use the old version, refer to Radio Button *(on page 337)*.

Table 10. Radio Button Properties

Property	Description
Label	A lable name that appears as a header for the radio button.
Target > Output Value	Provide the target data source to send information.
Source > Input Value	Provide the input data source to receive values for the radio button.
Items	Radio button requires multiple options. Select **+Add Item** to add multiple options. For each item, specify a display text and value.
Label Styling	Formats the label: **Font Family**, **Font Size**, and **Font Color** formats the label text. **Background Color** adds a color to the label background.



Slider

The widget is available under **INTEGRATION > INPUTS**. When designing application pages *(on page 308)*, drag-and-drop **slider** to a container. To use the old version, refer to Slider *(on page 344)*.

Table 11. Slider Properties

Property	Description
Label	A lable name that appears as a header for the slider.
Source > Input Value	Provide the input data source to receive values for the slider.
Target > Output Value	Provide the target data source to send information.
Label Styling	Formats the label: **Font Family**, **Font Size**, and **Font Color** formats the label text.

Text Area

The widget is available under **INTEGRATION > INPUTS**. When designing application pages *(on page 308)*, drag-and-drop **textarea** to a container. To use the old version, refer to Text Area *(on page 349)*.

Table 12. Text Area Properties

Property	Description
Target > Output Value	Provide the target data source to send information.
Source > Input Value	Provide the input data source to receive values for the text area.
Height (px, %, etc)	Enter the size of the text area in pixels.

Text Box

The widget is available under **INTEGRATION > INPUTS**. When designing application pages *(on page 308)*, drag-and-drop **textbox** to a container.

Table 13. Text Box Properties

Property	Description
Target > Output Value	Provide the target data source to send information.
Source > Input Value	Provide the input data source to receive values for the text box.
Display Mode	Specify the input type for the taxt box, whether password, email or URL.
Enable Clear Field Action	Select the check box to add a delete option in the end app to clear any data in the text box.
Label Styling	Formats the text: **Font Family**, **Font Size**, and **Font Color** formats the text entered in the text box.

Toggle

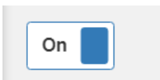
The widget is available under **INTEGRATION > INPUTS**. When designing application pages *(on page 308)*, drag-and-drop **toggle** to a container. To use the old version, refer to Toggle *(on page 345)*.

Table 14. Toggle Properties

Property	Description
Label	A lable name that appears as a header for the tog-gle.
True State	The text that appears when the toggle is in true state. For example, `On`.
False State	The text that appears when the toggle is in false state. For example, `Off`.
Target > Output Value	Provide the target data source to send information.
Source > Input Value	Provide the input data source to receive values for the toggle.

Table 14. Toggle Properties (continued)

Property	Description
Label Styling	Formats the toggle text: **Font Family**, **Font Size**, and **Font Color** formats the label text and true/ false state text.
Toggle Width	Enter a width for the toggle.



Charts

Charts Overview

The following list of plugins are available under the charts category:

- Chart Line *(on page 426)*
- Chart Pie *(on page 427)*
- Bullet Graph *(on page 428)*
- Pareto Chart *(on page 432)*
- Sparkline *(on page 434)*
- Spider Chart *(on page 437)*
- Timeline *(on page 440)*
- Variwide Chart *(on page 446)*

Chart Line

The widget is available under **INTEGRATION > CHARTS**. When designing application pages *(on page 308)*, drag-and-drop **chartLine** to a container.

Table 15. Chart Line Properties

Property	Description
Line Type	Select from the available list of chart line types.
Source > Data Source	Provide the input data source to receive values for the chart.
Title	Title name for the chart.

Table 15. Chart Line Properties (continued)

Property	Description
Subtitle	Subtitle name for the chart.
Y Axis Title	Title name for y-axis.
X Axis Title	Title name for x-axis.
Legend	Select the **Visible** check box if you want to show the chart legend. You can also use the options to position the legend in the chart.
Crosshair	Select the check box if you want to show the crosshairs in the chart.
Show Points	Select the check box if you want to show data points in the chart.
Point Symbol	Select from the available list of symbols to represent the points in the chart.
Stacking	• Stacked: Lines do not intersect in this chart. • Full Stacked: Lines reach a total of 100% of the axis range at each point. • None: No stacking.

Chart Pie

The widget is available under **INTEGRATION > CHARTS**. When designing application pages *(on page 308)*, drag-and-drop **chartPie** to a container.

Table 16. Chart Pie Properties

Property	Description
Pie Type	Select from the available list of pie charts.
Source > Data Source	Provide the input data source to receive values for the chart.
Title	Title name for the chart.
Subtitle	Subtitle name for the chart.

Table 16. Chart Pie Properties (continued)

Property	Description
Legend	Select the **Visible** check box if you want to show the chart legend. You can also use the options to position the legend in the chart.
Show Labels	Select the check box if you want to show labels in the chart.
Show Tooltips	Select the check box if you want to show tool tips in the chart.
Show Name	Select the check box if you want to show label name.
Show Value	Select the check box if you want to show values in the tooltip.
Show Percentage	Select the check box if you want to show percent-ages in the tooltip.

Bullet Graph

Use bullet graphs to compare the performance of any two values.

The horizontal bar in a bullet graph represents the actual value, while the vertical line represents the target value. You can add color-coded range limits to visualize the progression status of the actual value to the target value.

The bullet graph widget is available under **Integration > Charts**. When designing application pages *(on page 308)*, drag-and-drop **GEBulletGraph** to a container.

The following list of properties are specific to this widget. For common properties, refer to Page Components *(on page 575)*.

Table 17. Bullet Graph Properties

Property	Description
Title	Enter a title name for the bullet graph. This name appears at runtime.
Engineering Unit	Enter the unit of measurement for values.

Table 17. Bullet Graph Properties (continued)

Property	Description
Display Engineering Unit On Graph	If you select the check box, the specified unit appears next to the horizontal bar that represents the actual value in the graph. Clear the check box to hide the unit.
Target Value	Use any of these options to specify the target and actual values in the graph: • **Query**: Allows to select a query. • **Global**: Allows to select a global parameter. • **Manual**: Allows manual entry of values. • **Formula**: Allows to create data formulas. The bullet graph always compares only a single value against the target value. To compare multiple values, create multiple graphs. When you drag and drop a query on the bullet graph, only the source value field gets updated. By default, the source target is set to `500`.
Min	Enter the minimum axis value for the graph.
Max	Enter the maximum axis value for the graph.
Variant	You have an option to use a bar graph instead of the bullet graph. • **Bullet**: The default bullet graph displays a background progress bar. • **Bar**: Displays a single bar graph.
Number Of Decimals	Enter the number of decimal places to format actual and target values in the graph. The decimals do not apply to ticks. For example, enter `1` to round off value to the nearest tenths, `2` to round off value to the nearest hundredths, so on.

Table 17. Bullet Graph Properties (continued)

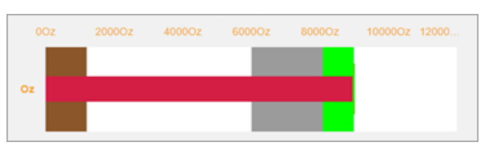
Property	Description
Width (px) - 0 equals dynamic	Enter the width of the graph in pixels. For example, `600`. If set to `0`, the bullet graph widget occupies 100% of its container.
Height	Enter the height of the graph in pixels. For example, `130`.
Orientation	• **Horizontal**: This is the default display orientation for the graph. • **Vertical**: If you select a vertical orientation, re-adjust the width and height of the graph.
Display EGU on Axis Ticks	Select the check box if you want the engineering unit to appear next to each tick mark value.
Display Axis Ticks On Opposite Side	Select the check box if you want the tick marks to appear above the graph. By default, ticks appear below the graph.
Ticks	Choose how to display the tick marks on the graph scale. • **Dynamic**: Dynamically selects the tick mark range to display. • **Min/Max**: Displays only min and max tick mark values. • **Hidden**: Hides the tick marks.
Font Color	Select a font color for the graph text.
Color	Select a color for the horizontal bar in the graph that represents the actual value.
Target Color	Select a color for the vertical line in the graph that represents the target value.
Color Background	Select a color to apply as a background for the graph.

Table 17. Bullet Graph Properties (continued)

<table>
<tr><th>Property</th><th>Description</th></tr>
<tr><td>Custom Limit(s)</td><td>
Select (+Add Item) to set up custom range limits and add plot bands to your bullet graph. The plot bands appear in the background providing a visual display of performance status.

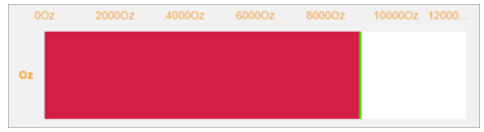
Choose a Plot Band Option.
<table>
<tr><td>Manual</td><td>Select this option if you want to enter from and to values to set up a range limit.</td></tr>
<tr><td>Percent- age of To- tal</td><td>To set up a range limit, calcu- lates the percentage of the total value (maximum axis value) provided in the bullet graph.</td></tr>
<tr><td>Percent- age of Tar- get</td><td>To set up a range limit, calcu- lates the percentage of the target value provided in the bullet graph.</td></tr>
</table>

Select a unique color to help identify the range in the graph.
Use ↑ and ↓ to re-arrange the order of the range limits.

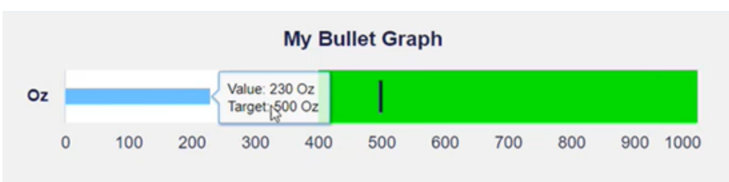
The order of the custom range limit impacts the graph. In the example figure, the green band repre- sents the first applied range limit (90 -100 % target) followed by the rest of the range limits as per the order.


</td></tr>
</table>

Table 17. Bullet Graph Properties (continued)

Property	Description
	If using the bar variant graph, the horizontal value bar may overlap the plot bands in your graph. 
Historian REST Options	Use this property to configure Historian REST queries. You can define which index of the result set to use as input data. The default **Result Set Index** is `0`, wherein the widget uses the first tag data from the query result set. Enter `1` to consider the second tag data, `2` for third, so on. Select the **Reverse Sorting Order** check box to reverse the query result set. The bottom record value is provided as input to the widget. Clear the check box to provide the top record value as input to the widget.

Bullet Graph at Runtime



Pareto Chart

Plot a pareto chart for qualitative analysis of your data.

You can use this widget to run a pareto analysis on your data. A pareto chart is a combination of colums/bars and a line graph. The colums/bars represent individual values, and are arranged in a descending order. The pareto line represents the cumulative total of the values. This visual arrangement helps to identify the most important factors in a given dataset in order to make critical decisions.

The pareto chart widget is available under **INTEGRATION > CHARTS**. When designing application pages *(on page 308)*, drag-and-drop **GEParetoChart** to a container.

The following list of properties are specific to this widget. For common properties, refer to Page Components *(on page 575)*.

Table 18. Pareto Chart Properties

Property	Description
Title Configuration	
Name	Enter a title name for the pareto chart. This name helps to identify the pareto chart at runtime.
Font Size (px)	Set the font size for the title text in pixels.
Font Color	Select a font color for the pareto chart text.
Width (px) - 0 equals dynamic	If set to 0, the pareto chart occupies 100% of its container.
Height (px)	Set a height for the pareto chart in pixels.
Label Configuration	
Y-Axis Label	Enter a label name for the Y-axis, which is displayed at runtime.
Axis Label Font Size (px)	Set the font size for the y-axis label name text in pixels.
Line Configuration	
Width (px)	Enter a value that defines the thickness of the pareto line in the chart.
Color	Select a color for the pareto line.
Series Configuration	
Variant	Both variants are used to compare two or more values, wherein the length of the column/bar is proportional to the data value. Select between:

Table 18. Pareto Chart Properties (continued)

Property	Description
	• Column: Inserts vertical columns to represent data in the chart. Use this variant for larger data sets. • Bar: Inserts horizontal bars to represent data in the chart. Use this variant if your chart titles are long.
Color	Select a color for the columns/bars in the chart.
Source - Data Source	To provide values for the pareto chart, select the **Query** tab to choose from queries that return output fields for the x-axis and y-axis data: 1. Reason (String) 2. Frequency/Occurrence (number) **Note:** Currently you can pass values to the widget using a query only.

Sparkline

Generate simple sparkline charts to visualize data trends.

Use the sparkline widget to create compact and easy to understand line charts. Configure sparkline properties to insert inline lightweight charts. The sparkline widget is available under **INTEGRATION > CHARTS**. When designing application pages *(on page 308)*, drag-and-drop **GESparkline** to a container.

The following list of properties are specific to this widget. For common properties, refer to Page Components *(on page 575)*.

Table 19. Sparkline Properties

Property	Description
Title	Enter a title name for the sparkline. This name helps to identify the sparkline chart at runtime.

Table 19. Sparkline Properties (continued)

Property	Description
Engineering Unit	Enter the engineering unit of measurement for values.
Height - 0 equals 100%	Set the height in pixels. If set to 0, the sparkline chart occupies 100% of its container.
Font Color	Select a font color for the title name, current value, and engineering unit.
Font Size (px) (0 equals Dynamic)	Set the font size in pixels. If set to 0, the font size becomes dynamic, which means the font is resized based on the height of the widget.
Line Color	Select a color for the line.
Line Width	Enter a value in pixels that defines the thickness of the line in the chart.
Number of decimals	Enter the number of decimal places to format values. For 1 decimal place, the value is rounded off to the nearest tenths; for 2 decimal places, the value is rounded off to the nearest hundredths, so on.
Source - Value	Use any of these options to provide values for sparkline. The only output field should be Value. • Select the **Query** tab to choose from queries that return Value as output. • Select the **Global** tab to choose from output fields available as global parameters. • Select the **Manual** tab, and enter the value in the text field. • Select the **Formula** tab to add a formula that returns an Value as output.
Result Set Index	This property is applicable for Historian REST queries only. It allows to define which index of the

Table 19. Sparkline Properties (continued)

Property	Description
	result set the widget should use as input data. Default is 0. For example, consider a Historian REST query that returns data for three tags. • If you want the widget to use the first tag data from the query result set, then set the index value as **0**. • To direct the widget to use the second tag data, enter the index value as **1**. • Similarly, you can set index values as 2, 3, 4, etc. based on the data to provide as input to the widget.
Reverse Sorting Order	This property is applicable for Historian REST queries only. It helps to reverse the query result set. Select the check box to provide the bottom record value as input to the widget. Clear the check box to provide the top record value as input to the widget. When you apply this property to REST queries that return more than one record for each input tag, the records of the selected tag (use **Result Set Index** to select the tag) are reversed. For example, consider a Historian REST query with two input tags (tag1 and tag2); each with 100 records as result. Set the **Result Set Index** as **0** and verify the following:

Table 19. Sparkline Properties (continued)

Property	Description
	• If you selected the **Reverse Order** check box, then the 100th record (last) value of tag1 is displayed on the sparkline. • If you cleared the **Reverse Order** check box, then the first record value of tag1 is displayed on the sparkline.

Spider Chart

Use spider charts to compare and analyze multiple data sets.

With the spider chart widget, you can:

- Create visually appealing spider graphs.
- Apply unique color coding for efficient comparison of data.
- Analyze values that change over a period of time.
- Use the resultant information for better decision-making.

The spider chart is available under **INTEGRATION > CHARTS**. When designing application pages *(on page 308)*, drag-and-drop **GESpiderChart** to a container.

The following list of properties are specific to this widget. For common properties, refer to Page Components *(on page 575)*.

Table 20. Spider Chart Properties

Property	Description
Title	Enter a title name for the spider chart. The title appears at runtime.
Font Color	Select a font color *(on page 585)* for the spider chart text.
Line Color	Select a line color *(on page 585)* for the spider chart axes.
Default Min	Enter the minimum axis value.

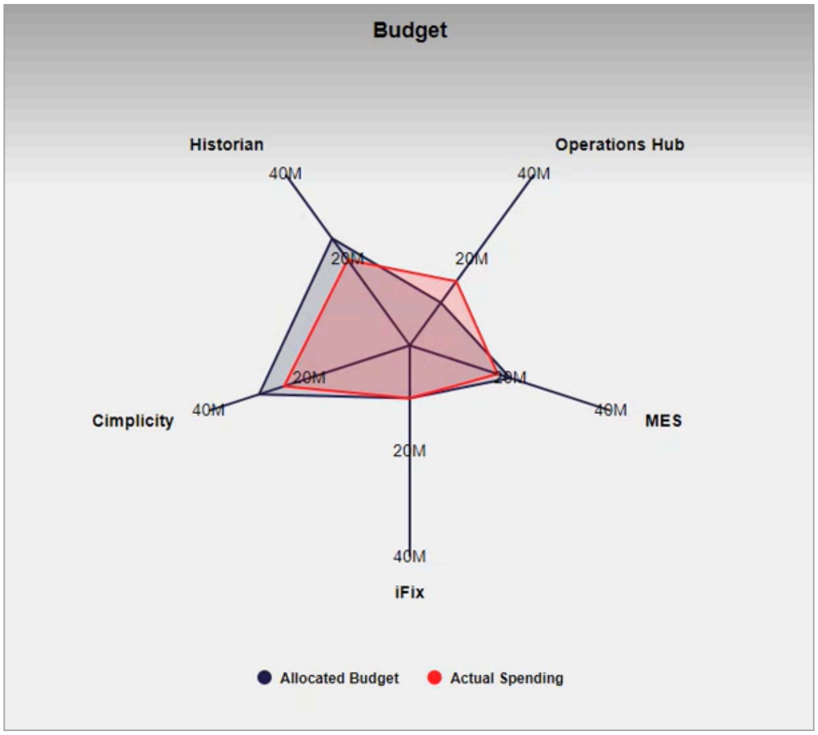
Table 20. Spider Chart Properties (continued)

Property	Description
	• This value is set as default. • Applies to all the available axes on the spider chart.
Default Max	Enter the maximum axis value. • This value is set as default. • Applies to all the available axes on the spider chart.
Legend	Select: • **Bottom**: Legend appears at the bottom of the chart. • **Right**: Legend appears on the right side of the chart. • **None**: Hides the legend.
Max-width	Enter the maximum width the spider chart can occupy in an application.
Axis Labels	Add items to create multiple axes in a spider chart. Enter the following information for each item (axis): • **Label**: A label name to identify the axis. • **Alt. Min**: Alternate minimum axis value if you want to override the default min *(on page 437)* value. • **Alt. Max**: Alternate maximum axis value if you want to override the default max *(on page 438)* value.
Series	Add items to set up a data series for the spider chart. • **Name**: Enter a name for the data set. • **Color**: Select a line color *(on page 585)* for the data set.

Table 20. Spider Chart Properties (continued)

Property	Description
	• **Fill**: If you select the check box, the data set area is filled with the series color. • **Source Value**: To get values for the data set, choose any of these options: ◦ **Query**: Select a query to get output values from a data source. ◦ **Global**: Select a global value that returns an array as output. ◦ **Manual**: Enter semicolon separated values. • **Reverse Sorting Order**: This property applies to Historian REST queries only. It helps to reverse the query result set. ◦ If you select the check box, the bottom record value is taken as input. ◦ If you clear the check box, the top record value is taken as input.

Spider Chart at Runtime



Timeline

Use the timeline widget to visually monitor the progress of your events.

Generally used for time-based events, the timeline widget can monitor the status of a machine and update the events that occurred over a time period. It can capture data on how long a machine was running, or remained in an idle state. To visualize multiple events against a single time period, add multiple timelines aligned to the same X-axis on a chart.

The timeline widget is available under **Integration > Charts**. When designing application pages *(on page 308)*, drag-and-drop **GETimeline** to a container.

The following list of properties are specific to this widget. For common properties, refer to Page Components *(on page 575)*.

Table 21. Timeline Properties

Property	Description
BEHAVIOR > Event Selected	Trigger actions on the timeline selected event.
Title	Enter a title to help identify the timeline at runtime.

Table 21. Timeline Properties (continued)

Property	Description
Font Color	Select a font color *(on page 585)* for the widget text.
Show Border	Select the check box to add a border to the timeline widget. A border frames the widget and provides a clean look.
Border Color	Select a color *(on page 585)* for the border.
Show X-axis Labels	Select the check box to show the X-axis ticks on the widget at runtime. Clear the check box to hide the ticks.
Width	Enter a width for the timeline widget.
Height	Enter a height for the timeline widget.
Event Table Datasource	The event table helps to match the colors and labels. It enables the widget to assign a specific color and label to an incoming event. When a value from the result set *(on page 442)* matches a value from the event table, then the configured color and label applies to that entry. You can configure an event table either manually *(on page 442)*, or get data from a data source. Select the output fields in this order: • Value • Label • Color Use any of these options to get data from a data source: • Select a query output. • Select a global parameter. • Enter source data manually. • Add a formula.

Table 21. Timeline Properties (continued)

Property	Description
	Note: Currently, we only support the option to use a query output to retrieve data.
Point Primary Color	Serves as the first color in the zebra striped color pattern. Select a primary color *(on page 585)* to apply to the timeline event table if not retrieving values from a datasource.
Point Secondary Color	Serves as the second color in the zebra striped color pattern. Select a secondary color *(on page 585)* to apply to the timeline event table if not retrieving values from a datasource.
Event Table Manual	You can create event table entries manually. In the absence of an **Event Table Datasource**, these entries are used for retrieving data for the timeline events. • Select **+Add Item** to create an event table entry. • For each event table entry, enter these details: ◦ **Value** ◦ **Label** ◦ **Color** Events that do not match an entry from the event table are assigned the **Point Primary Color** or **Point Secondary Color**.
Datasource Values	Configure one or more data sources to get values for the timeline widget. When you add multiple data sources, you get a single view for multiple timelines all aligned to the same X-axis. It allows you to compare data at different time intervals. To configure a data source:

Table 21. Timeline Properties (continued)

Property	Description
	1. Select **+Add Item**. **Note:** You must add an item even if you want to drag and drop the data to bind to the widget. 2. Enter a **Name** to identify the data source at runtime. The name is shown next to the timeline and on the tooltip. If you do not provide a name for the data source, the query name appears on the tooltip. 3. Use any of these options to get data from a data source: ◦ Select a query output. ◦ Select a global parameter. ◦ Enter source data manually. ◦ Add a formula. You must select timestamp as the first value followed by other values. Select the output fields in this order: ◦ Datetime ◦ Value **Note:** • Currently, we only support the option to use a query output to retrieve data. • If you drag-and-drop *(on page 121)* multiple tags on the timeline widget,

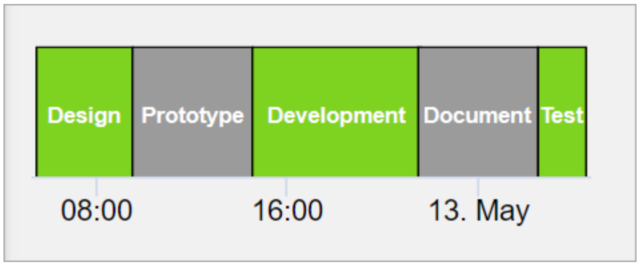
Table 21. Timeline Properties (continued)

Property	Description
	only the last selected tag is bound to the output. Only one data source value can be bound per query.
Input Datetime Format	Select from local or UTC.
Start Sample	Select the **Enable** check box to insert an event at the start of the timeline. Then, specify the start timestamp.
Datasource Start Timestamp	Use any of these options to provide start time-stamp values from a data source: • Select a query output. • Select a global parameter. • Enter source data manually. • Add a formula. **Note:** When using multiple REST query data sources, ensure that the start time for all the REST query data sources closely match with one another.
Datasource Start Value	Use any of these options to provide event value at the start (after timestamp) from a data source: • Select a query output. • Select a global parameter. • Enter source data manually. • Add a formula.
End Sample	Select the **Enable** check box to insert an end time for the last event on the timeline. Then specify the end timestamp.

Table 21. Timeline Properties (continued)

Property	Description
Datasource End Timestamp	This is the final timestamp for the last event in the query. It is required to specify an end timestamp to get all the values from last queried batch on display. Use any of these options to provide end timestamp values from a data source: • Select a query output. • Select a global parameter. • Enter source data manually. • Add a formula.
Output Targets	You can configure output targets for a selected event. At runtime, these targets trigger only on selecting the respective event. • Select **+Add Item** to configure an output target. • Select an **Output Value**. The available values are Start Local Time, Start Local Time ISO, Start UTC Time, Start UTC Time ISO, End Local Time, End Local Time ISO, End UTC Time, End UTC Time ISO, Value, and Label. • To specify a target source/tag, use a query or global. You can add one or more output targets for an event. • Use and to reorder output targets. The output targets are implemented in the specified order. • Select to delete an output target.

Timeline at Runtime



Variwide Chart

A variwide chart is a column chart where each column has a separate width to represent the third dimension.

The variwide chart is available under **INTEGRATION > CHARTS**. When designing application pages *(on page 308)*, drag-and-drop **GEVariwideChart** to a container.

The following list of properties are specific to this widget. For common properties, refer to Page Components *(on page 575)*.

Table 22. Variwide Chart Properties

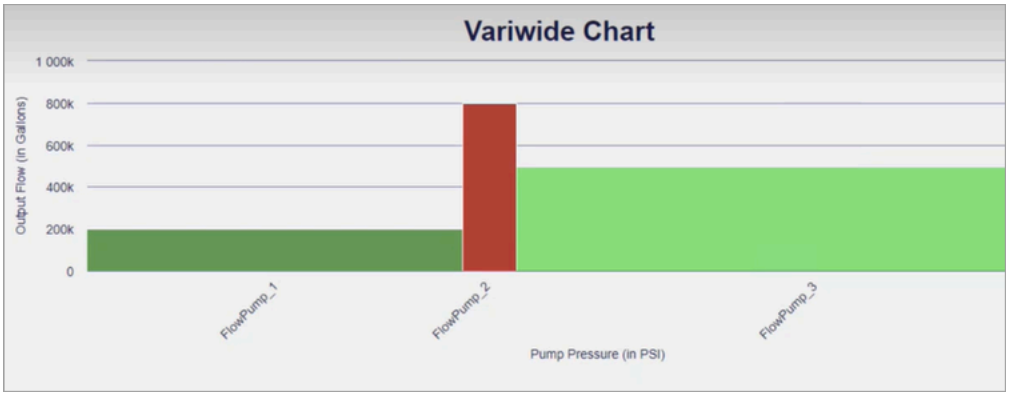
Property	Description
Title Configuration	Set a title for your variwide chart. • **Name**: Enter a title name. • **Font Size (px)**: For the title text, enter the font size in pixels. • **Font Color**: Select a font color for the title. • **Width (px) - 0 equals dynamic**: Enter a width for the variwide chart. If set to 0, the chart occupies 100% of its container, and fills the area in the application. • **Height (px)**: Enter the height of the chart in pixels.
Label Configuration	Configure the axes labels in your variwide chart.

Table 22. Variwide Chart Properties (continued)

Property	Description
	• **Y-Axis Label**: Enter a label name that appears on the chart's y-axis. • **X-Axis Label**: Enter a label name that appears on the chart's x-axis. • **Font Size (px)**: For the label text, enter the font size in pixels This value applies to both the x and y axis labels.
Series Configuration	Select query output values from a data source to define a data series for your chart. Only three inputs from the query are considered for mapping in the following order: • first output field maps to category (x-axis) • second output field maps to value (y-axis) • third output field value represents the width of the column chart (z-axis)
Series color configuration - manual	Add items to configure colors in your chart. Use this property to override the default chart series color. • **Label**: Enter the label name if you want to apply a specific color for the respective label. • **Color**: Choose a color to apply to a label (if label name is specified), or a column. If you ***configure both label and color***, the column with the label name always appears in the specified color. If you ***configure only color***, the color is applied to a column in a sequential order. Columns with no color configuration adopt the default highcharts configuration.

Variwide Chart at Runtime

In the illustrated example, pump pressure is represented by the width of each column for the respective category.



HMI

HMI Overview

The following list of plugins are available under the HMI category:

- CIMPLICITY HMI Webspace *(on page 448)*
- Alarm Card *(on page 458)*
- Alarm Count *(on page 470)*
- Mimic Card *(on page 470)*

CIMPLICITY HMI Webspace

Use the widget to access CIMPLICITY CimView screens.

Employ the Webspace widget with other Operations Hub widgets for better consolidation and visualization of data. This provides you with an end-to-end solution for better data analysis, visualization and monitoring. Refer to Integrating Webspace with Operations Hub *(on page 450)*.

The Webspace widget is available under **Integration > HMI**. When designing application pages *(on page 308)*, drag-and-drop the widget to a container, and configure its properties.

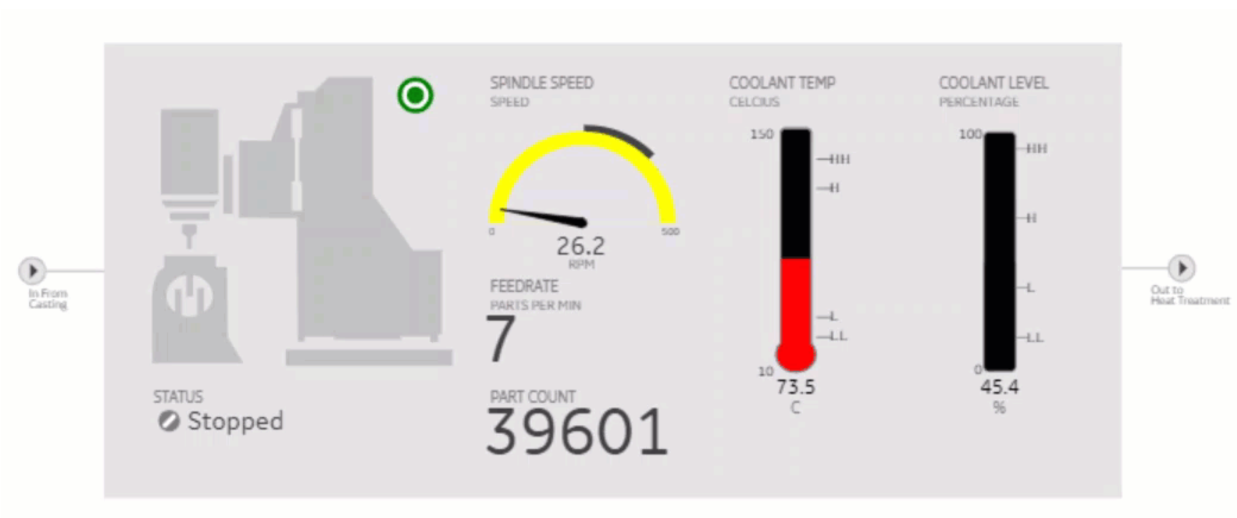
Note:
Only a single instance of the CIMPLICITY HMI Webspace widget per app is supported. If using multiple instances of webspace widgets across multiple pages, you may encounter access error

> messages when navigating between pages that contain webspace instances. After confirming the message, the widget loads as expected.

Table 23. Webspace Properties

Property	Description
Webspace server	Specify the machine that has CIMPLICITY Webspace running on it.
CIMPLICITY screen path	Specify the path to the CimView screen to load. This path is where the file resides on the Webspace system (`C:\ProjectsFolder\screens\ScreenName.cim`).
Port for the Webspace Session Manager	`9443` is the default port setting.

CIMPLICITY HMI Webspace at Runtime



The first time a strong encrypted session is loaded, a message appears stating that the Proficy Webspace Strong Encryption license has been updated and needs a restart. If this error occurs, then restart these services in the following order (on the Webspace node):

1. Proficy WebSpace License Manager
2. Proficy WebSpace Application Publishing Service
3. Webspace Session Manager Microservice

Integrating Webspace with Operations Hub

This topic describes the setup and configuration of Operations Hub with CIMPLICITY WebSpace.

Install the following applications:

- CIMPLICITY 11.1
- WebSpace 6.0 (with update 6.0.3, and Strong Encryption License)
- Operations Hub 2.0 (with SIM 4)
- Google Chrome (installed on each node)

You must have the following account information:

- Operations Hub secret (from installation)
- Operations Hub Administration Username/Password (default usually 'ophubadmin')

1. Add Operations Hub root certificate to the root certificate store on Operations Hub machine *(on page 44)*.
2. Enable the encrypted transport for communications via the Webspace server *(on page 450)*.
3. Set up the IIS to listen on port 443 *(on page 451)*.
4. Configure the Windows firewall *(on page 453)*.
5. Export the CIMPLICITY self-signed certificate *(on page 454)*.
6. Import the CIMPLICITY self-signed certificate to Operations Hub *(on page 454)*.
7. Set up CIMPLICITY project properties *(on page 455)*.
8. Set up CIMPLICITY project user security *(on page 456)*.
9. Configure CIMPLICITY options *(on page 456)*.

Webspace - Enable Encrypted Transport

You must enable the encrypted transport for communications via the WebSpace server.

1. Open the WebSpace Administrator on the server running WebSpace.
2. Go to **Tools > Host Options > Security**.

3. For **Transport**, select **Encrypted**.
4. Browse to the `CIMPLICITY installation\ScadaConfigPki` folder, then select the `server_cert.crt` file. For a default installation, the certificate location would be: `C:\Program Files (x86)\Proficy\Proficy CIMPLICITY\ScadaConfigPki\server_cert.crt`

5. Select **OK** to save and close **Host Options**.

IIS Configuration - Set up HTTPS Binding for port 443

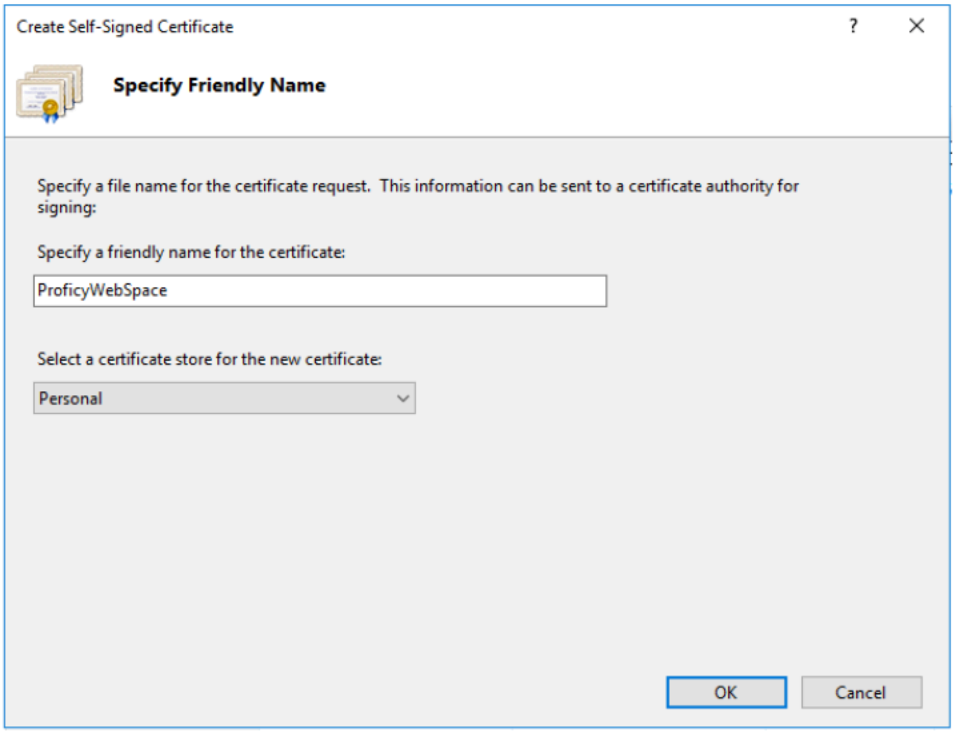
You must set up the Microsoft Internet Information Services to listen on port 443 so that it can be used for https requests, which are necessary for the Operations Hub integration.

1. Log in to the CIMPLICITY/Webspace machine.
2. Go to **Start > Control Panel > Administrative Tools**.
3. Open **Internet Information Services (IIS) Manager**.
4. On the left-hand pane, select the root of the IIS Server, usually listed as the computer name.

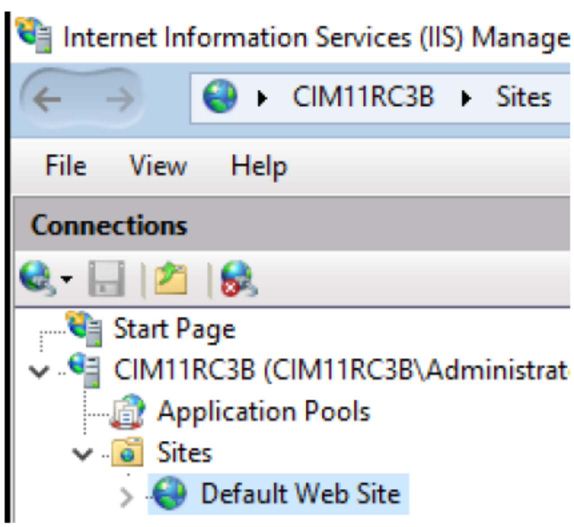
5. Select **Server Certificates**.

6. On the right-hand pane, select **Create Self-Signed Certificate**.

7. Enter name as `ProficyWebspace`, and select **Personal** as the certificate store.



8. Select **OK** to save.
9. On the left-hand pane, select the root of the IIS Server, usually listed as the computer name.
10. On the left-hand pane, select **Default Web Site**.



11. On the right-hand pane, go to **Edit Site > Bindings**.

12. Select **Add** to open **Edit Site Binding**.
13. Select **https** as type.

14. Select **All Unassigned** as the IP address.
15. Enter `443` for port.
16. Enter the computer name of the Webspace system as host name.
17. Select **ProficyWebspace** as the SSL Certificate.

18. Select **OK**.
19. On the **Site Bindings** dialog, select **Close**.

20. On the left-hand pane, select the root of the IIS Server, usually listed as the computer name.
21. On the right-hand pane, select **Restart** to restart the IIS Server.

Configure Windows Firewall

Open the Windows Firewall ports on each system so that the two nodes (WebSpace/Operations Hub) can communicate properly.

Open Windows Powershell as an administrator to run the commands.

1. On the Operations Hub system, run the following commands to open the firewall ports.

    a. Open Operations Hub port 443 (Operations Hub reverse proxy port):

    ```
    New-NetFirewallRule -DisplayName "my_port_443" -Direction Inbound
    -Action Allow -Protocol TCP -LocalPort 443
    ```

2. On the CIMPLICITY/WebSpace system, run the following commands to open the firewall ports.

    a. Open CIMPLICITY port 9443 (Public external REST port for NGINX):

    ```
    New-NetFirewallRule -DisplayName "my_port_9443" -Direction
    Inbound -Action Allow -Protocol TCP -LocalPort 9443
    ```

    b. Open CIMPLICITY port 443 (the WebSpace/IIS port):

    ```
    New-NetFirewallRule -DisplayName "my_port_443" -Direction Inbound
    -Action Allow -Protocol TCP -LocalPort 443
    ```

    c. Open CIMPLICITY port 491 (the WebSpace server port):

    ```
    New-NetFirewallRule -DisplayName "my_port_491" -Direction Inbound
    -Action Allow -Protocol TCP -LocalPort 491
    ```

Export CIMPLICITY Self-Signed Certificate

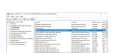
Export this certificate that was created when CIMPLICITY was installed on the system.

The certificate is exported and then imported into the Trusted Certificate store on the Operations Hub computer.

1. Open Windows Run, and enter `certmgr.msc`.

2. Go to **Trusted Root Certification Authorities > Certificates**.
3. Select the certificate named **CIMPLICITY<computer_name><datetime>@SelfsignedRootCA**.

4. Right-click CIMPLICITY self-signed certificate, then select **All Tasks > Export**.
   The **Certificate Export Wizard** appears.
5. Select **Next**.
6. When prompted for the **Export File Format**, select **DER encoded binary X.509 (.CER)**.
7. Select **Next**.

8. Select **Browse**, enter file name of CIMPLICITY_Self_Signed and choose to save on the Desktop.

9. Select **Next**.
10. Select **Finish**.

Import CIMPLICITY Self-Signed Certificate

Import the CIMPLICITY self-signed certificate to the Operations Hub computer.

Export CIMPLICITY Self-Signed Certificate *(on page 454)*.

1. Copy the exported certificate on the Operations Hub computer.
2. Right-click the certificate, and select **Install Certificate**.
   The **Certificate Import Wizard** appears.
3. Select **Local Machine**, then select **Next**.

4. Select **Place all certificates in the following store**.

5. Select **Browse** to access the **Select Certificate Store**.

6. Select **Trusted Root Certification Authorities** at the store, then select **OK**.
7. Select **Next** in the import wizard.
8. Select **Finish**.

The certificate is imported successfully.

Set up CIMPLICITY Project Properties

Configure CIMPLICITY to interact with the Webspace widget in Operations Hub.

1. Open the CIMPLICITY project that you have access via Operations Hub, in the CIMPLICITY workbench.
2. Go to **Project > Properties**
   The **Project Properties** dialog appears.

3. Select the **Operations Hub** tab, and provide these details:

Field	Description
Server name	Enter the computer name of the Operations Hub server.
Port	Enter `443`.
User name	Enter the administrator account for the Operations Hub Server, i.e. `OpHubAdmin`.
SSL Security	If **(Not Trusted)**, follow these steps: a. Select the check box for **Require trusted connection**. b. Select **View Certificate**. The certificate fields should be populated. **Note:** The certificate retrieved from the Operations Hub server is placed in the `<project>/da-`

Field	Description
	ta/WebHMIPki/server_certs folder. c. Go to `<project>/data/WebHMIPki/server_certs/` folder, and copy the certificate called `<opshub servername> Root CA <datetime>.cert` d. Paste the certificate in `<project>/data/WebHMIPki/trusted_issuers/` folder. e. Verify if SSL Security is updated to **(Trusted)**.
Test Connection	After updating all the details, test the connection.

Connected successfully to the Operations Hub server.

Set up CIMPLICITY Project User Security

To avoid having to login on the Webspace container to the project, for each user that is configured in Operations Hub, a matching user must be configured in the CIMPLICITY project.

1. Open the CIMPLICITY Project in the CIMPLICITY Workbench.
2. Go to **Security > Users**.
3. For each user in the Operations Hub configuration, create a CIMPLICITY user of the same name with a security type of `CIMPLICITY`.

> **Note:**
> The passwords for the user between Operations Hub and the CIMPLICITY project do not need to match.

Configure CIMPLICITY Options

Set up CIMPLICITY options to ensure that sessions are properly created.

1. On the CIMPLICITY/WebSpace node open **CIMPLICITY Options**.
2. Select the **Webspace** tab.
3. On the left pane, select **General**.

4. Select the check box for **Autostart Webspace Session Manager**.
5. Verify the port is 4957, then select **Apply**.

   A message appears to restart the Webspace Session Manager service.
6. Select **Yes** to restart the service.
7. On the left pane, select **Server**.

8. Provide these details:

Field	Description
Windows Server Credentials	a. Enter a valid **User name** and **Password** for the Webspace system. **Note:** The user must be authorized to launch CimView.exe, as well as access the screens directory for the screens that are accessed via the Webspace widget. b. Select **Test**. If successful, ▪ Trust UAA appears as **Untrusted** ▪ Generate UAA Client appears as **Not generated**
Operations Hub UAA/OAuth2 Setup	a. Enter the **Server URL** for the Operations Hub server. For example, https://opshub-system:443/uaa. b. Test for a successful connection. c. Select **Trust UAA** to change its status from untrusted to trusted. **Note:** When trusted, the UAA certificates are copied to the <CIMPLICITY installation>\web-

Field	Description
	`space-session-manager\pki\trusted` directory. d. Select **Generate UAA Client** to enter the credentials for UAA Administrator. i. Client Id: `admin` ii. Client Secret: Enter the Operations Hub secret, which was entered during installing Operations Hub. iii. Select **Generate**. The status changes to **Generated** on successful generation of the UAA Client.
Single/Relay Server	Provide the session manager credentials, and select **Apply**. ◦ WSM Admin User: Enter a user name (example: Administrator) ◦ Admin Password: Enter a password (example: pass1234) ◦ Confirm Password: Enter the same password to confirm. **Note:** This can be any user name/password and does not have to match any specific windows user name or password.

A message appears to restart the Webspace Session Manager service.

9. Select **Yes** to restart the service.

Alarm Card

Use the alarm card to monitor your industrial assets. Get information from the HMI/SCADA system on alarms generated by their severity levels.

The alarm card widget is available under **Integration > HMI**. When designing application pages *(on page 308)*, drag and drop 

to a container.

Table 24. Alarm Card Properties

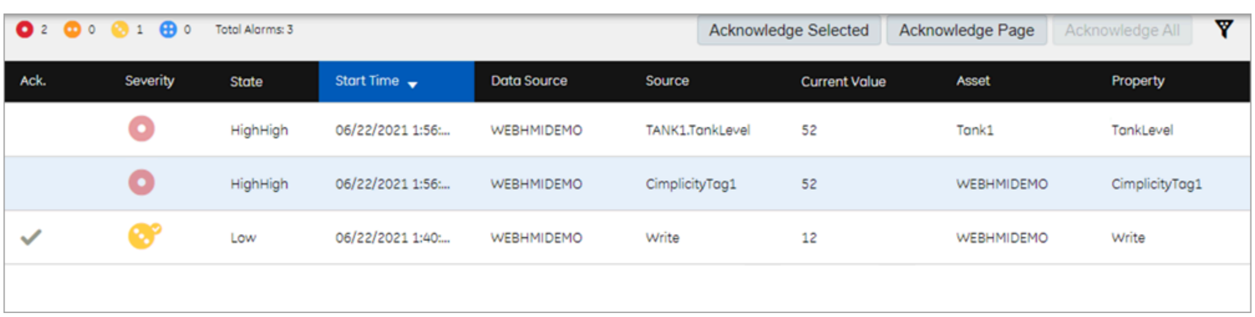
Property	Description
View All Alarms by default (Disabling this option will display context based alarms)	This is a default setting to show all alarms irrespective of context when the page loads at runtime. If using the bread crumb widget along with the alarm card, then alarms are displayed according to the context. If an alarm contains an OPC UA tag that is not associated with a model property, then the source server of the tag is displayed in the alarm grid.
Asset Name (Optional Override)	Select your own asset to display alarms. The selected asset overrides the default asset name at runtime.
Data Source (default data source used to filter alarms on page load)	Select a data source to set as default for filtering alarms on page load at runtime.
Page Size - Number of alarms to display per page	Enter a number to specify the number of alarms that appear on a page at runtime. The maximum number of alarms you can display per page is 100.
Auto Hide Columns	Select to automatically hide the table columns if screen space is a constraint. **Note:** This option is enabled by default. To hide any of the other columns at runtime, you must clear the check box for this option.
Hide Acknowledge Column	Select to hide the **Ack.** column at runtime. This column contains the status to indicate whether the alarm is acknowledged in the HMI/SCADA system

Table 24. Alarm Card Properties (continued)

Property	Description
	or not. A check mark in this column indicates that the alarm is acknowledged.
Hide Severity Column	Select to hide the **Severity** column at runtime. This column contains the icon that indicates the alarm severity status.
Hide Start Time Column	Select to hide the **Start Time** column at runtime. This column contains the start time and date for the alarm.
Hide Source Column	Select to hide the **Source** column at runtime. This column contains the tag associated to the alarm.
Hide Current Value Column	Select to hide the **Current Value** column at run-time. This column contains the query value such as whether the alarm is running or stopped.
Hide Asset Column	Select to hide the **Asset** column at runtime. This column contains the asset name associated to the alarm.
Hide Property Column	Select to hide the **Property** column at runtime.
Hide Description Column	Select to hide the **Description** column at runtime.
Hide State Column	Select to hide the **State** column at runtime. This column contains the alarm's current status.

Alarm Card at Runtime

To acknowledge alarms *(on page 469)*, you must have the permission to do so in the supporting HMI/SCADA system.



Select to filter alarms *(on page 467)* based on specific conditions.

Each icon has a corresponding number to indicate the number of alarms currently active for that severity level. The alarm count *(on page 470)* in the banner shows the number of alarms per severity level for all assets in the model, whereas the alarm card displays the number of alarms per severity level for the selected context.

The severity of an alarm is based on the priorities set in the HMI/SCADA system (iFIX or CIMPLICITY). Each alarm icon is color-coded and contains a specific number of dots to indicate its severity level, as shown in this table.

Note:
The alarm severity ranges are hard-coded in the application. Access the `application.properties` file to modify alarm severity ranges.

You can modify the property `rank.ranks` in `C:\Program Files\GE\Operations Hub\webhmi-tomcat\webapps\alarm-microservice\WEB-INF\classes\application.properties` and restart webHMI tomcat service.

Icon	Description
	Alarm is critical.
	Alarm is high priority.
	Alarm is medium priority.
	Alarm is low priority.

Alarm information is not displayed if data sources are disconnected. Select to get more information.

Note:
Currently, if a data source is deleted from Operations Hub, the alarms configured to the deleted data source are still displayed at runtime. To clear such alarms, restart the data distributor service.

Configure iFIX for Alarms

When using the iFIX HMI/SCADA system as your data source, follow this quick walkthrough to successfully get data and alarms flowing for the first time into Operations Hub.

First install iFIX, and then install Operations Hub on the same server.

1. Start the iFIX application.
2. Log in to iFIX with a default/guest account.
3. Go to **Applications > Security > Security Configuration Utility**.

   Security is available in the System & Security group.
4. On the **Security** toolbox, select **User Account**.
5. Select **Add** to create a user account.
   The **User Profile** dialog appears.
6. Provide iFIX security for the user account:

Field	Description
Full name	Enter a name for the new user account.
Login name	Enter a login name for the user account.
Password	Enter a password for the user account.
Group Membership	Select **Modify** to add any/all available groups to the user account, then select **OK**.
Security Areas	Select **Modify** to add any/all security areas to the user account, then select **OK**.
Application Features	Select **Modify** to add any/all application features to the user account, then select **OK**.

7. Select **OK** to save the user profile.
   The **Password Confirmation** dialog appears.
8. Enter the password again and select **OK**.
   The user account is saved with the credentials and added to the **Current Users** list.
9. On the Security toolbox, select Configuration and select **Enabled**.
10. Go to **Applications > OPC UA Configuration**.
    The iFIX OPC UA Server Configuration Tool screen appears.
11. On the **Server** tab, select the check box for **Server Enabled**.
12. On the **Alarms** tab, select the check box for **Alarms Enabled**.

13. Select **Save and Exit** to save the selections, and close the screen.
14. Go to **Applications > Database Manager**.

    The **iFIX Database Manager** spreadsheet appears.
15. Open an existing database, or select **Create New** on the spreadsheet toolbar to save a new database.
16. On the spreadsheet toolbar, select **Add** to add blocks to your database.

    The **Select a block type** screen appears.
17. Select any block type, then select **OK**.

    The selected block type screen appears.
18. On the **Basic** tab:
    a. Enter **Tag Name**.
    b. Enter **I/O Address**.
    c. Select **Save**.
19. On the **Alarm** tab:

    a. Select the check box for **Enable Alarming**.

    b. In the **Alarm Options** table, enter the alarm values.

    For example:

High High	60
High	40
Low	20
Low Low	10

    c. Select **Save**.

20. On the **Advanced** tab:
    a. Select the check box for **Enable Output**.
    b. Select **Save**.

    The tag name configured with an alarm is added to the spreadsheet.
21. Repeat steps 8-12 to add more blocks to your database.

- Create a data source with OPC UA configuration *(on page 293)* in Operations Hub.
- Use the alarm card *(on page 458)* and alarm count *(on page 470)* widgets in your application.
- Acknowledge Alarms *(on page 469)*.
- Apply Filters to View Alarms *(on page 467)*.
- Configure CIMPLICITY for Alarms *(on page 464)*.

Related information

Configure iFIX for Mimics *(on page 472)*

Configure CIMPLICITY for Alarms

When using the CIMPLICITY HMI/SCADA system as your data source, follow this quick walkthrough to successfully get data and alarms flowing for the first time into Operations Hub.

- Install the latest versions of CIMPLICITY and Operations Hub on different servers or on the same server.
- Create an administrative user that you can use for both CIMPLICITY and Operations Hub. The user IDs must match in order to connect and manage communications and operations between the two systems, but the passwords must be different.

1. Start the CIMPLICITY Workbench application.
2. From the Workbench toolbar, go to **File > New > Project**.
   The **Create User for New Project** dialog appears.
3. Provide these details for the new user account:

Field	Description
Username	Enter the user name for the new account.
Password	Enter a password.
Confirm password	Enter the password again to confirm.

   Note:
   You will use the credentials to establish a secure connection with authentication for the CIMPLICITY data source in Operations Hub.

4. Select **Next**.
   The **Create As** dialog appears.
5. Enter the name and location for the new project.

   Note:
   For write operations to work, the project name and the CIMPLICITY data source name in Operations Hub should be the same.

6. Select product options and protocols that will be included in the project.
7. Select **Create**.
8. After creating the project, go to **Project > Properties**.
   The **Project Properties** screen appears.
9. On the **OPC UA Server** tab, perform these steps.
   a. Select the check box for **Enable Server**.
   b. Select **Security Configuration**, then select the check box for all the security options you want to enable for the OPC UA server.
10. On the **Operations Hub** tab, perform these steps.

    a. Provide the following details:

Field	Description
Server name	Enter the name of the Operations Hub server to connect.
Port	Enter the port number for Operations Hub UAA. For example, 443.
User name	Enter the account username that is used to log in to the Operations Hub application.

    b. Select the check box for **Require trusted connection**.

    c. If `(Not Trusted)`, go to the CIMPLICITY project's `\data\WebHMIpki\server_certs` folder and copy the root certificates.

    d. Paste the copied certificates in the CIMPLICITY project's `\data\WebHMIpki\trusted_issuers` folder.

    e. On the **Operations Hub** tab, select **Test Connection**.
    A success message appears updating the connection status as `(Trusted)`.

11. From the CIMPLICITY Workbench project directory, right-click **Points > New**, to create a new device point.
12. Provide the following information for the new point and select **OK**.

Field	Description
Point ID	Provide a unique name that identifies the CIMPLICITY point.

Field	Description
Type	Select `Virtual`.
Class	Select `Analog`.

The **Point Properties** screen appears.

13. On the **Virtual** tab, provide these details:

Field	Description
Initialization	Select `Initialized`.
Initial value	Enter `0`.
Calculation	Select `Equation` and build an expression. For more information on calculation types, refer to the *Configure Virtual Calculations* topic in the CIMPLICITY help guide.

14. On the **Alarm** tab, provide these details:

Field	Description
Alarm message	Select `Point ID`. For more information on alarm message variables, refer to the *Enter an Alarm Definition* topic in the CIMPLICITY help guide.
Alarm limits	Enter the alarm limits. For example: ◦ HiHi: 60 ◦ Hi: 40 ◦ Lo: 20 ◦ LoLo: 10

15. Select **OK** to save and close the **Point Properties** screen.
16. Repeat steps 6-10 to create more device points.
17. Run the CIMPLICITY project.

- Create a data source with OPC UA configuration *(on page 293)* in Operations Hub.
- Use the alarm card *(on page 458)* and alarm count *(on page 470)* widgets in your application.
- Acknowledge Alarms *(on page 469)*.
- Apply Filters to View Alarms *(on page 467)*.
- Configure iFIX for Alarms *(on page 462)*.

Related information

Configure CIMPLICITY for Mimics *(on page 480)*

Apply Filters to View Alarms

Apply conditions to filter and display alarms.

You can use filters to narrow down your search for the exact alarm information you want to view.

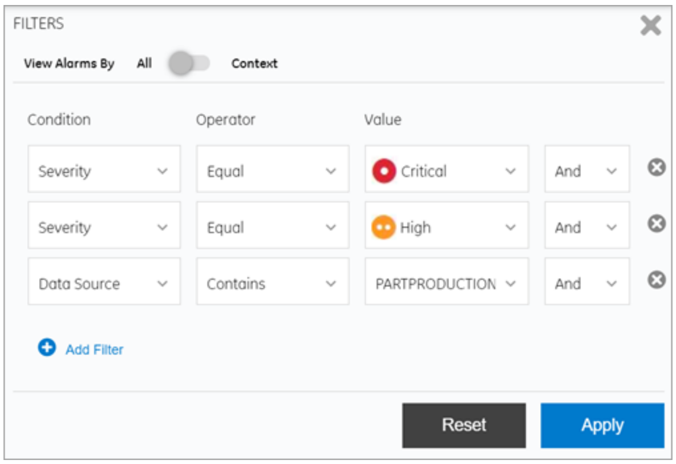


Table 25. Filter Criteria for Alarms

Field	Description
View Alarms By	Use the toggle to switch between these states: • Set to **All** if you do not have an asset model. You can filter alarms from all the available data sources. • Set to **Context** if you have an asset model. From the breadcrumb, navigate to your asset context to filter respective alarms.
Condition	Select any of these conditions to filter and display alarms:

Table 25. Filter Criteria for Alarms (continued)

Field	Description
	• Acknowledged: Displays only the list of acknowledged alarms. • Severity: Displays alarms based on a selected severity value - critical, high, medium, or low. • Start Time: Displays alarms based on a selected date and time. • Source: Displays only alarms from the selected tag/source. • Data Source: Displays only alarms from the selected data source.
Operator	Select an operator to describe the relationship between the condition and the value. Based on the selected condition, the following operators are available: Equal, NotEqual, GreaterThan, GreaterOrEqual, LessThan, LessOrEqual, Contains, NotContains, etc.
Value	Select the value you want to filter. Values for filtering alarms are populated based on the selected condition and operator. If condition is data source, it takes about 30 seconds to initially populate the list of available OPC UA data sources in your system. In case you deleted a data source from your system, the deleted data source still appears in the **Value** drop-down list. To clear deleted data sources, restart these services in the following order: 1. GE Operations Hub WebHMI Tomcat Web Server 2. GE OpHub Data Distributor

Table 25. Filter Criteria for Alarms (continued)

Field	Description
+ Add Filter	Select to insert a new filter criteria. Use the **And**, **Or** operators to describe the relationship between two or more filter criteria.
Reset	Select to clear all the filters. To clear individual filters, select next to the filter you want to delete.
Apply	Select to apply the filters and display only alarms that match the filter criteria.

Acknowledge Alarms

Alarms are acknowledged in the HMI/SCADA system.

Alarms are displayed based on the applied filter conditions *(on page 467)*. You have the option to acknowledge,

- all the alarms at once
- only the specific number of alarms listed per page
- only the selected alarms

Configure iFIX *(on page 462)* or CIMPLICITY *(on page 464)* to be able to acknowledge alarms.

1. To acknowledge only selected alarms:
    a. Select the rows for the alarms in the table.
    To unselect, select the row again.
    b. Select **Acknowledge Selected**.
    A confirm dialog appears.
    c. Select **Acknowledge** to confirm.
2. To acknowledge all the alarms listed on a page:
    a. Select **Acknowledge Page**.
    A confirm dialog appears.

    b. Select **Acknowledge** to confirm.
    Only alarms on the specific page are acknowledged.

3. To acknowledge all the alarms at once:
    a. Select **Acknowledge All**.
    A confirm dialog appears.
    b. Select **Acknowledge** to confirm.
    All the displayed alarms for the applied filter condition are acknowledged.

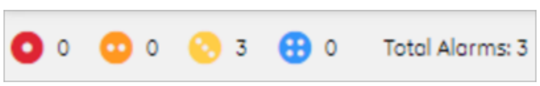
A check mark appears for the acknowledged alarm in its **Ack** column. The alarm severity icon also indicates a check mark if successfully acknowledged in the HMI/SCADA system.

Alarm Count

This widget provides only the count of alarms per severity level for all the assets in a model.

You can use the alarm count widget when you want to provide only a summary of alarms in your application.

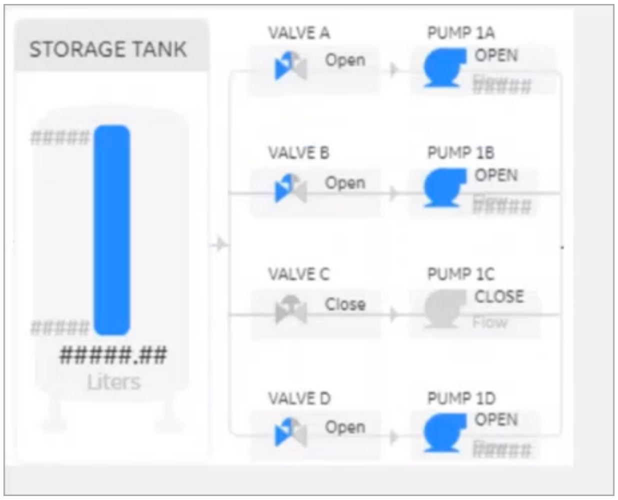
The alarm count widget is available under **Integration > HMI**. When designing application pages *(on page 308)*, drag and drop GEAlarmCount to a container. The alarm count is displayed as a banner at runtime with the number of alarms currently active for the severity level.



Mimic Card

A mimic card provides a specific view of a process diagram associated with an asset. This allows you to monitor and control production equipment and processes.

The mimic card widget is available under **Integration > HMI**. When designing application pages *(on page 308)*, drag and drop GEMimicCard to a container.



The mimic card also allows you to update values during runtime *(on page 486)*, and get results immediately.

You can use the mimic card with or without a model. When not using a model, create pages and assign direct tags.

Table 26. Mimic Card Properties

Property	Description
Asset Name (Optional Override)	Provide the asset name for which you want to replace its currently assigned mimic. **Note:** You can opt to override either an asset name or a mimic name. If you attempt to override both, only the asset name is considered.
Mimic Name (Optional Override)	Provide the mimic name to replace the currently assigned mimic. The new mimic must use only direct tags (not model-based) for its data sources. Also, the new mimic cannot use click-target navigation as the mimic has no context for navigation when loaded in this manner.

Table 26. Mimic Card Properties (continued)

Property	Description
	Note: If you do not specify an override for both the asset name or mimic name, then the mimic from the selected asset context in a breadcrumb is considered. When not using the breadcrumb in an application, it is mandatory to provide an override either for the asset name or the mimic name.
Height	Allows to set the height of the widget at runtime. You can set the values in percent or pixels. For example, 100%, 50%, 300, etc.

Configure iFIX for Mimics

When using the iFIX HMI/SCADA system as your data source, follow this quick walkthrough to successfully get mimics into Operations Hub.

Install iFIX and Operations Hub on different servers or on the same server.

> **Note:**
> You can display booleans and enumerations as strings in your mimics. When creating the mimic, use the `A_CV` attribute on your data sources. If you use `F_CV`, numeric values are rendered. For inline edits, only booleans currently support selecting a value via a dropdown box.

1. Log in to Proficy iFIX and perform these tasks:

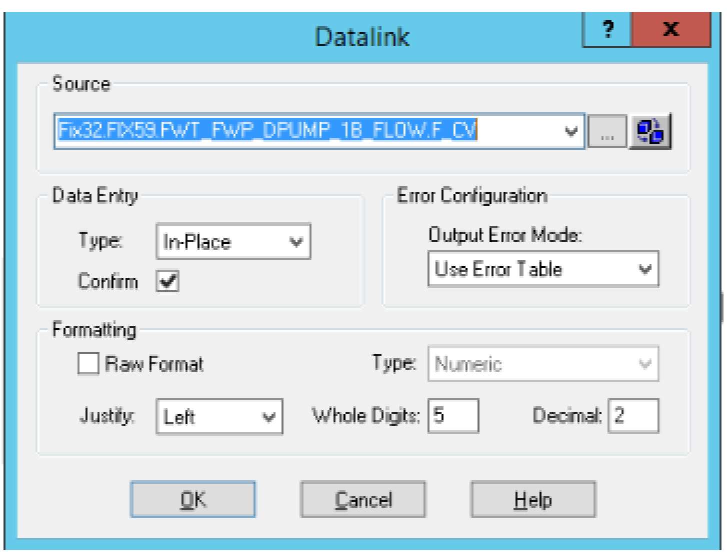
    a. Go to `C:\Program Files (x86)\GE\iFIX` and open the `secmgr.clr.dll.config` file in a notepad.

    b. Save the dll file after verifying and updating these details:
    Ensure that `uaa_oauthHost` points to the UAA server that provides the authentication services. If default UAA server is installed with Operations Hub, this will generally be the hostname (short or FQDN) used during Operations Hub installation.

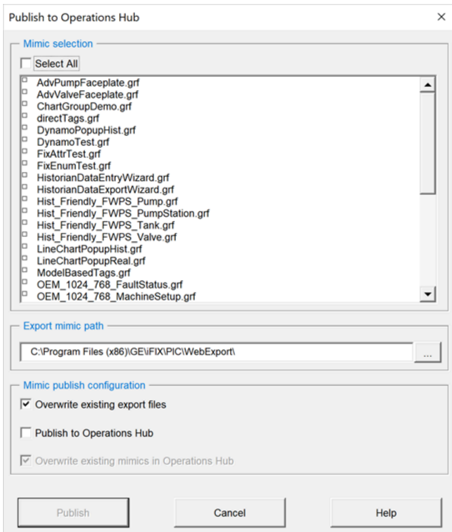
```xml
<?xml version="1.0" encoding="utf-8" ?>
<configuration>
 <appSettings>
  <add key="oauthHost" value="127.0.0.1"/>
  <add key="oauthPort" value="8443"/>
  <add key="oauthEndPoint" value="oauth"/>
  <add key="strictCertificatePolicy" value="false"/>
        <add key="ifix_oauthIssuer" value="ifix_auth_service"/>
  <add key="ifix_oauthHost" value="localhost"/>
  <add key="ifix_oauthPort" value="4857"/>
  <add key="ifix_oauthEndPoint" value="ifix-auth-service/v1/oauth"/>
  <add key="ifix_strictCertificatePolicy" value="false"/>
        <add key="confighub_oauthIssuer" value="ConfigHubAuthService"/>
  <add key="confighub_oauthHost" value="localhost"/>
  <add key="confighub_oauthPort" value="5678"/>
  <add key="confighub_oauthEndPoint" value="confighub-auth/v1/oauth/"/>
  <add key="confighub_strictCertificatePolicy" value="false"/>
  <add key="uaa_oauthHost" value="localhost"/>
  <add key="uaa_oauthPort" value="443"/>
  <add key="uaa_oauthEndPoint" value="uaa"/>
  <add key="uaa_strictCertificatePolicy" value="false"/>
 </appSettings>
</configuration>
```

c. Create pictures supporting the Operations Hub objects. To make an object a click target in a Operations Hub mimic, set its `is selectable` property to `true`.

d. To enable an operator to update an iFIX data source tag on a picture and answer an update confirmation question, access the **Datalink** screen and select the source tag. In the **Data Entry** section, select In-Place in the **Type** field, and then select the **Confirm** check box, as shown below.

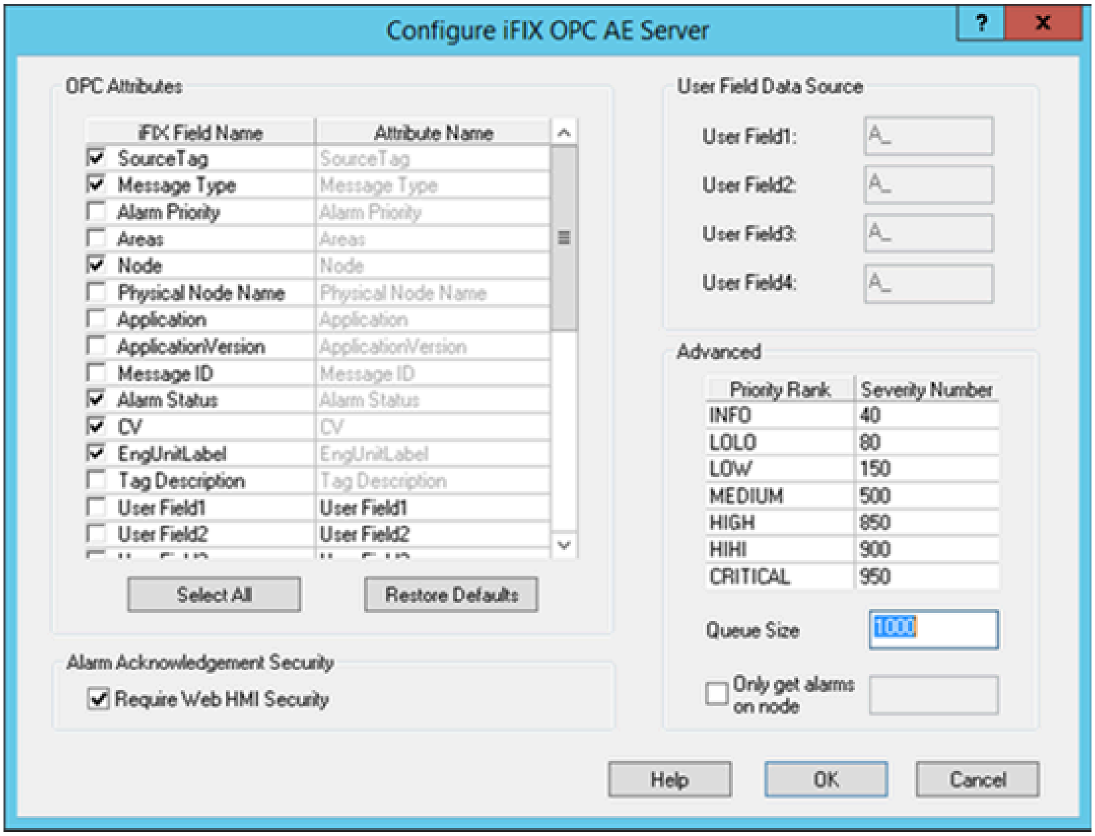


e. In the iFIX Tools Ribbon, select **Publish to Operations Hub** to export selected pictures in GRF format in to a Picture folder as shown below. These GRF files are exported in to JSON ZIP files. These pictures become mimics (process diagrams) that you associate with asset object types in Operations Hub.



f. Verify the values in the **Advanced** section of the **Configure iFIX OPC AE Server** screen conform to the OPC A&E specification guidelines and use the Operations Hub default dividing point values to separate the alarm severity ranges, as explained in Alarm Microservice.

The following provides a sample **Configure iFIX OPC AE Server** screen.



2. Log in to Operations Hub.
3. Create a data source with OPC UA configuration *(on page 293)* in Operations Hub.

> **Note:**
> The datasource name should match the iFIX node name.

4. Import the mimic *(on page 281)*.
5. Create an application *(on page 146)*.
6. Create application pages *(on page 308)* for Alarm card *(on page 458)* and Mimic Card *(on page 470)*.
7. Run the application and check to see if mimics are working.

Related information

Reference a Model Property in an Animation *(on page 476)*

Using the Operations Hub Toolbox *(on page 476)*

Controlling Data Sources in a Picture by Group Selection *(on page 477)*

Automatically Binding Child Assets to Click Zones using Group Names *(on page 478)*

Reference a Model Property in an Animation

You can reference a model property within an animation.

To reference a model property in an animation, you must type @ (at sign) at the beginning and at the end of the property name. This allows the Operations Hub software to differentiate the property name from ordinary text.

Example:

To enter a reference in an animation to the pump1.speed property in the model:

1. Enter the following in the Fill Expert as the Fill Data Source: `@pump1.speed@`
2. Export the picture using the Export Web HMI Picture utility. The following line appears in the JSON file: `"tag": "@pump1.speed@"`

Using the Operations Hub Toolbox

The Operations Hub Toolbox contains buttons for objects and picture composition tools that allow you to quickly create high performance HMI pictures. You can click and drag the Operations Hub Toolbox to a position anywhere on your picture, or click and drag one of its edges to resize it.

The Operations Hub Toolbox automatically appears by default when high performance HMI graphics are enabled under **User Preferences > General**.

You can disable the Operations Hub Toolbox by toggling the Toolbox button on the Tools tab in the Operations Hub group of the WorkSpace ribbon.

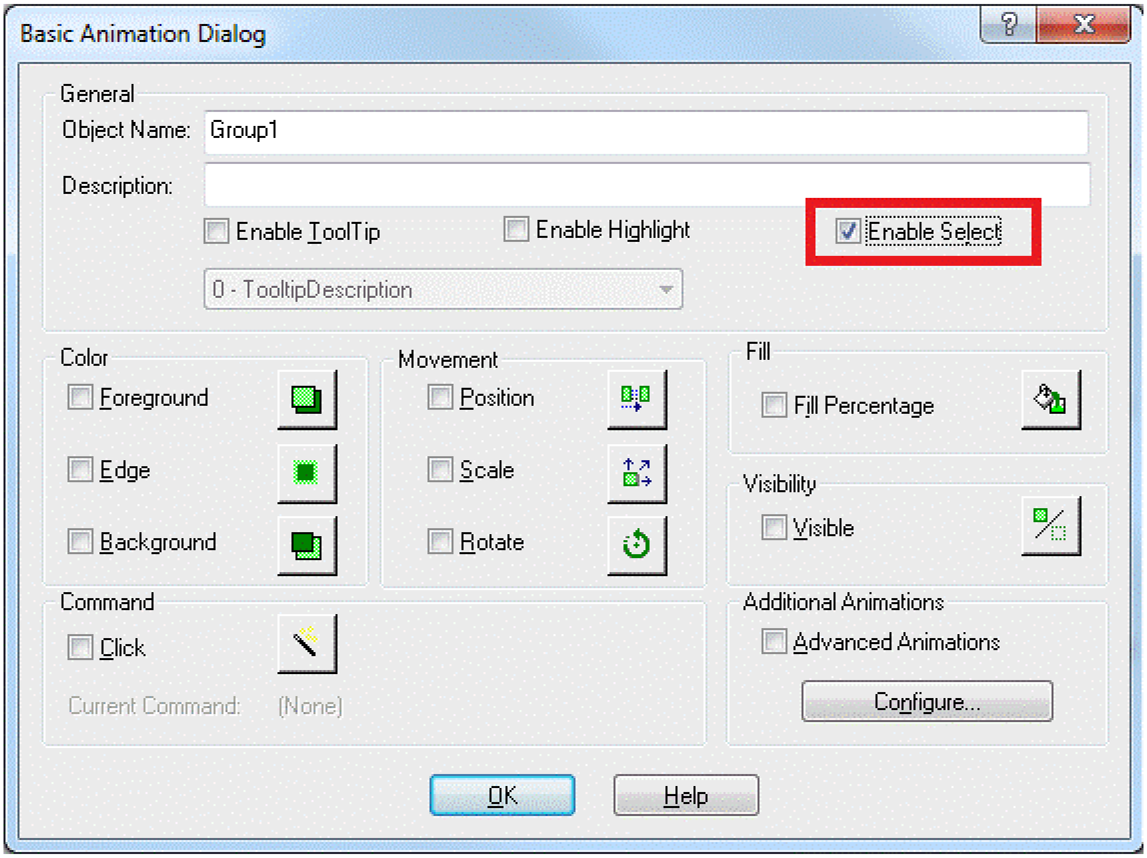
The following table lists the names of the Operations Hub Toolbox buttons. The layout of the cells in this table mimics the layout of the corresponding buttons in the Operations Hub Toolbox. A description of each button can be found in the Creating Pictures ebook.

Pointer Selection	Cut	Copy	Paste	Rectangle	Rounded Rectangle	Oval	Chord	Polygon	Pie

Arc	Line	Polyline	Line Connector	Right Line Connector	Text	Datalink Stamper	Bitmap	Set Color	Toggle Grid
Space Evenly Vertical	Space Evenly Horizontal	Align Top	Align Left	Align Bottom	Align Right	Align Horizontal Center	Align Vertical Center	Group	Ungroup
Bring to Front	Send to Back	Set Layer	Display Layer	Fill Expert	Rotate Expert	Foreground Color Expert	Visibility Expert	Undo	--

Controlling Data Sources in a Picture by Group Selection

Operations Hub allows you to write to tag values associated with an asset's properties in the Asset Model. It is possible to define a group of objects in a picture that can be selected at runtime, resulting in a control card appearing in which the operator can write to controllable properties of a given asset. This is accomplished with the `IsSelectable` property in the exported picture JSON file, which is only exported for iFIX Group objects that have **Enable Select** enabled in iFIX pictures.



With traditional iFIX pictures, selecting the **Enable Select** property allows an object to be selected in the runtime environment.

With iFIX pictures that are intended for export to Operations Hub, selecting the **Enable Select** property of a group designates that group as a "click zone" in that picture. A click zone allows properties of a certain asset to be controlled or modified by writing to the associated iFIX tags. When you click on a selectable group that has an asset associated with it, a control card opens to show the current values for a specified set of properties for that asset. Both controllable and non-controllable properties display, based on the configuration of the properties. (Controllable properties are indicated with a gear icon.) Clicking on the control card changes it to Edit view. Edit view allows you to enter new values for those properties. The new values are written to the iFIX database tags when the Confirm button is selected.

Automatically Binding Child Assets to Click Zones using Group Names

When creating the iFIX picture for a certain asset type, specifying a selectable group's name in a certain way results in the click zone being automatically associated with a child asset without further configuration once the exported iFIX picture is associated with an asset type.

In order to take advantage of this automatic click zone binding, the group name must be the same as the child asset's property name in the GE Operations Hub Asset Model. Each child asset in the model hierarchy is represented as a property of a parent asset. In order for the automatic binding to associate a click zone with a certain child asset, the group name must exactly match the name of the desired child asset property and the exported iFIX picture must be associated with the parent asset.

Example:

For example, say you have an asset type named StorageTank, which has two child asset properties defined in the model, – InletPump and OutflowPump, of asset type Pump. When creating an iFIX picture for the StorageTank asset type to use with GE Operations Hub, you can automatically enable the control card for each of these child assets by:

1. Creating a selectable group of objects within the iFIX picture for each of the child assets.
2. Naming these groups InletPump and OutflowPump. These are the child asset property names as defined in the asset model, (not the child asset instance names for a certain instance of StorageTank).
3. Exporting the iFIX picture from WorkSpace.
4. Importing the exported picture to GE Operations Hub and associating it with the StorageTank asset type (assuming that the asset model has already been created/imported).

After doing this, navigating to any StorageTank in GE Operations Hub at runtime and viewing the HMI display allows an operator to click on either of these groups of objects to display the control card for that child asset – without the need to navigate to that child asset. This allows control of child assets while in the context of a parent asset.

Rules for Automatic Binding of Group Names

- You must name the group the same as the child asset property of an asset type.
- Only child or other descendant assets of a given asset type can be bound to a click zone in a picture associated with that asset type.
- You can access the control card for grandchild assets and below by using double underscores (__) in the group name to separate each asset level. For example, if the above Pump asset type had a child asset property named RestrictionValve, a click zone could be auto-bound to this grandchild asset from the StorageTank picture by defining a selectable group with the name InletPump__RestrictionValve or OutflowPump__RestrictionValve. This shows the control card for one of these RestrictionValves, depending upon which name you used.

- You can display the control card for the asset type that is associated with the IFIX picture, rather than one of its descendants, by naming the selectable group the same as the asset type. In the previous example, naming a selectable group StorageTank would result in the click zone displaying the control card for the StorageTank itself when that group is selected at runtime.

> **Note:**
> It is not necessary to name the selectable groups in a certain way for them to be able to show the control card for an asset. It is only necessary in order to take advantage of the automatic binding feature. If you do not name them in this way, the click zones will still be selectable at runtime in GE Web HMI, but will require further configuration in GE Operations Hub Administration in order to associate them with the desired assets for control at runtime.

Configure CIMPLICITY for Mimics

When using the CIMPLICITY HMI/SCADA system as your data source, follow this quick walkthrough to successfully get mimics into Operations Hub.

- Install the latest versions of CIMPLICITY and Operations Hub on different servers or on the same server.
- Create an administrative user that you can use for both CIMPLICITY and Operations Hub. The user IDs must match in order to connect and manage communications and operations between the two systems, but the passwords must be different.

By integrating Operations Hub and CIMPLICITY, you can view CIMPLICITY data in Operations Hub using screens called mimics that were created in CimEdit.

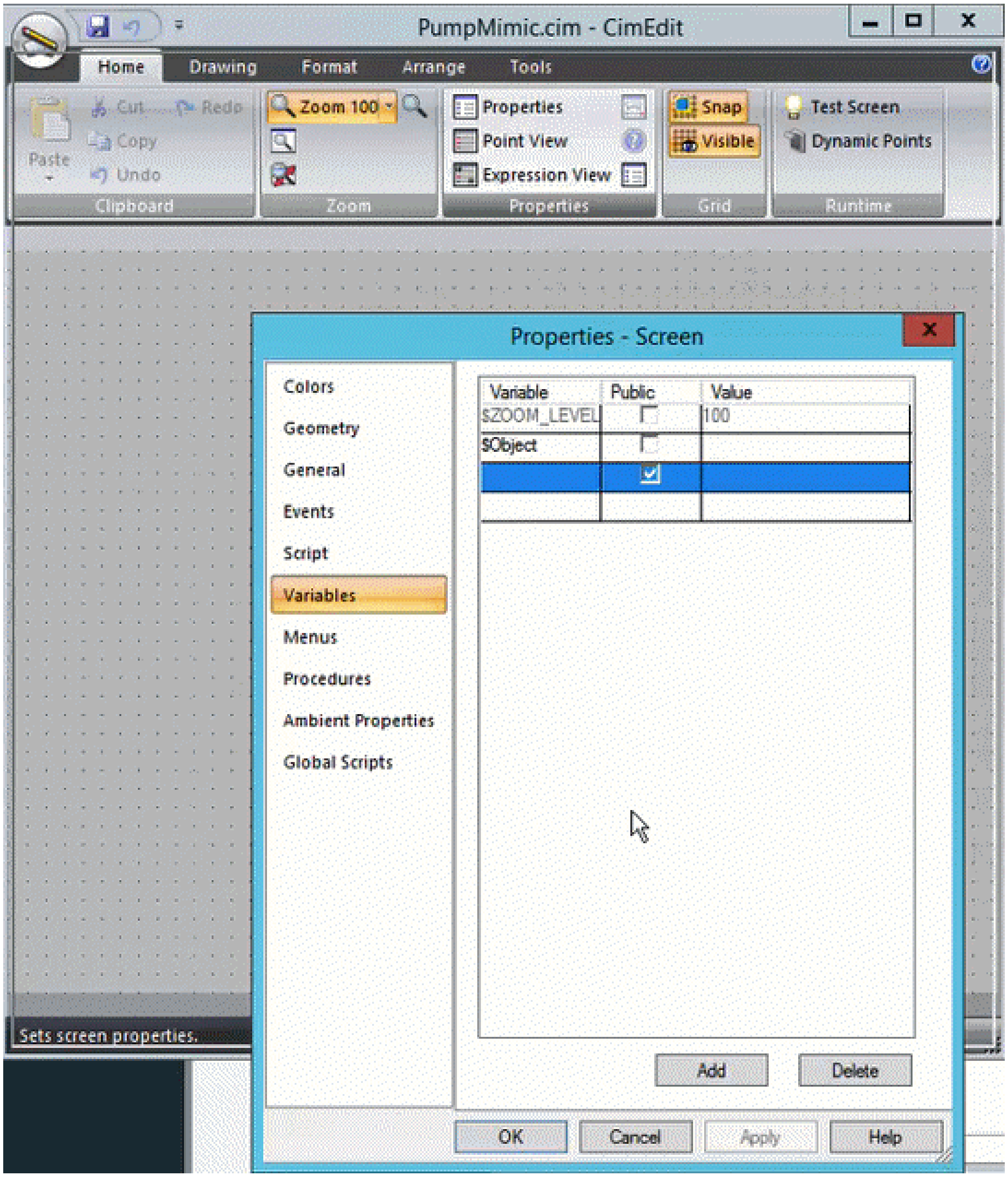
> **Note:**
> You can display booleans and enumerations as strings in your mimics. When creating the mimic, use the `.Value` attribute on your data sources. If you use `.$RAW_VALUE`, numeric values are rendered. For inline edits, both booleans and enumerations display a dropdown box with the possible values.

1. Start the CIMPLICITY Workbench application.
2. From the Workbench toolbar, go to **File > New > Project** and create a new project.
3. After creating the project, go to **Project > Properties**.
   The **Project Properties** screen appears.
4. On the **OPC UA Server** tab, perform these steps.

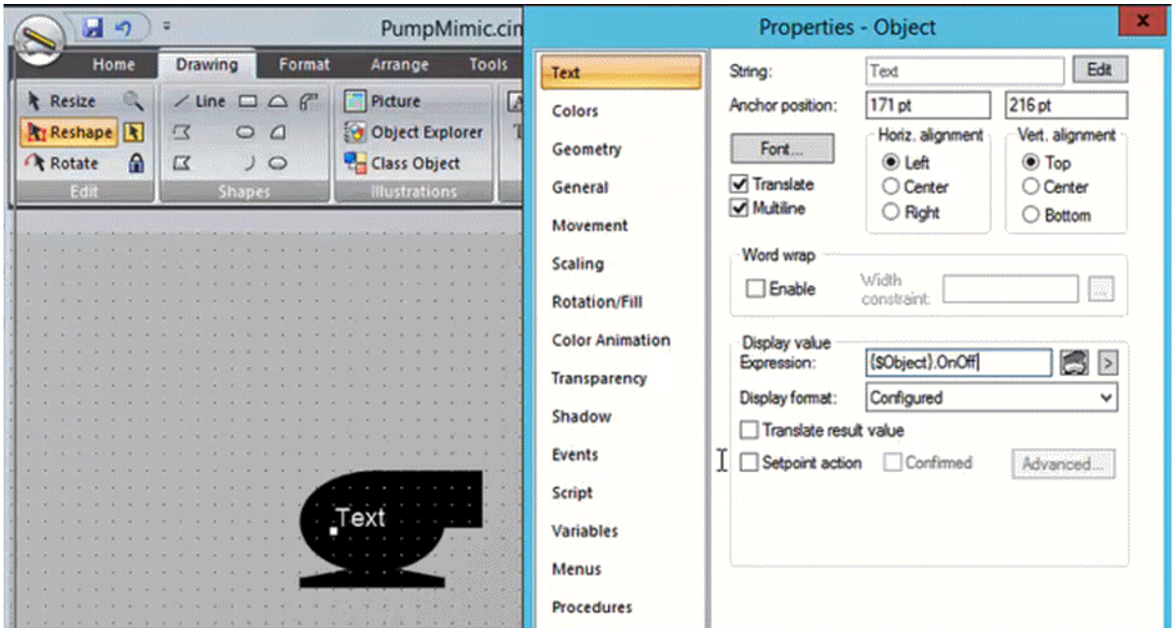
   a. Select the check box for **Enable Server**.
   b. Select **Security Configuration**, then select the check box for all the security options you want to enable for the OPC UA server.
5. On the **Operations Hub** tab, perform these steps.
   a. Provide the following details:

Field	Description
Server name	Enter the name of the Operations Hub server to connect.
Port	Enter the port number for Operations Hub UAA. For example, 443.
User name	Enter the account username that has permission to access the Operations Hub application.

   b. Select the check box for **Require trusted connection**.
   c. Select **View Certificate** and if `Untrusted`, select **Trust**.
   The certificate gets added to the CIMPLICITY project's `\data\WebHMIpki\server_certs` folder. The certificate status now appears as `Trusted`.
   d. Copy the certificate files from the CIMPLICITY project's `\data\WebHMIpki\server_certs` folder, and paste them to the project's `\data\WebHMIpki\trusted_issuers` folder.
6. In the CIMPLICITY project, create a `TPump` class with an alarm enabled.
7. Create a `Pump01` object that corresponds to the class.
8. Create a visual representation (PumpMimic) of the `TPump` on the CimEdit screen.
9. On **Properties**, enter `$Object` in the **Variable** column. CIMPLICITY uses this value to reference the context in the Operations Hub model, which is the TPump in this example.



10. On **Text**, type `($Object).OnOff` in the **Display value Expression** field. This value represents the `OnOff` value on the `TPump` object type in the Operations Hub model.



11. To export or publish the mimic, right-click on the CIMPLICITY screen and select **Publish to Operations Hub**.
12. In Operations Hub, do the following:
    a. Create a data source with OPC UA configuration *(on page 293)* in Operations Hub.
    b. Import the mimic *(on page 281)*.
    c. Associate the mimic to the `TPump` object type *(on page 281)*.
    d. Create an application *(on page 146)*.
    e. Create application pages *(on page 308)* for Alarm card *(on page 458)* and Mimic Card *(on page 470)*.
    f. Run the application and check to see if mimics are working.

Related reference

Referencing Data in CimEdit Screen Animations *(on page 483)*

Referencing Data in CimEdit Screen Animations

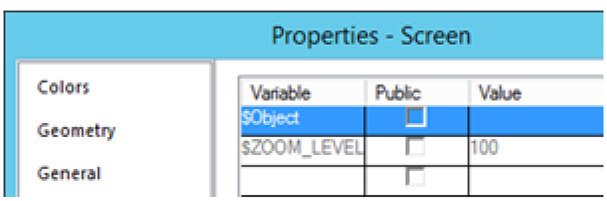
You can use the following two methods to reference data in CimEdit screens that will work in Operations Hub mimics.

> **Important:**
> The CIMPLICITY OPC UA Server does not support enterprise points; therefore, they are not supported in exports for Operations Hub. If you use enterprise points in your CIMPLICITY screens, they will not be available in the imported Operations Hub mimic.

Method	Description
Method 1	Continue to directly reference your CIMPLICITY point database in your animations – This method retrieves data directly from CIMPLICITY and shows the values of the points in the database. This is often useful when referencing data that is global to or outside of the model context you build in Operations Hub. For example, OverallPartCount.
Method 2	Reference model context-based data that resolves in accordance with the model context you are in when you display the mimic in Operations Hub. This is the most powerful way to use Operations Hub mimics because it allows you to create screens as templates using CIMPLICITY's existing local variable mechanisms that resolve at Operations Hub runtime. For example, if you have created a Operations Hub object type to represent a pump and created 2 pumps objects from that type, you can build one screen in Operations Hub to represent the pump object type, and then have the data resolve and appear in that screen/mimic based on the Pump instance that is selected.

You can reference both direct CIMPLICITY database points and context references in the same screen.

Use the $OBJECT local variable to reference context-based data. You must define this variable at the screen level and leave the value blank when you export the screen as a mimic for Operations Hub. You can use this local variable to represent the model context with which this screen is displayed. For example, a pump screen is shown when in the Pump01 or Pump02 context.

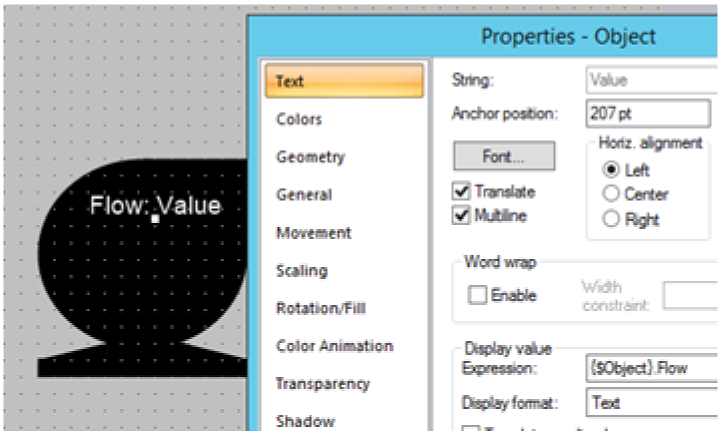


Note:
You should build the model in Operations Hub before you build Operations Hub mimics in CimEdit. If you reference model object variables using the same names, Operations Hub can automatically map your model context references in your animations to the model when you import the mimic into Operations Hub.

Example 1: Referencing Contained/Child Model Object Variables

When in the Inlet pump context, the animation shown below displays the value of Inlet Pump's flow. If on the Outflow Pump context, this same screen will show Outflow Pump's flow.

$Object.Flow



Example 2: Referencing Contained/Child Model Object Variables

You can also reference contained object properties in your Operations Hub mimics that will be exported from CimEdit. For example, if I want to build an overview screen to show two pumps in my pump station, then I can build a CimEdit screen where the $Object represents PumpStation01 and I reference my animations to show the individual pump values as follows:

{$Object}.InletPump.Flow

{$Object}.OutflowPump.Flow

Example 3: Referencing CIMPLICITY Point Attributes in Operations Hub Example

You can continue to reference CIMPLICITY attributes like engineering units, description, alarm limits, and so forth, in Operations Hub screens on direct point references and model context references as follows:

{$Object}.Flow.Description or

{$Object}.InletPump.Flow.EU_LABEL

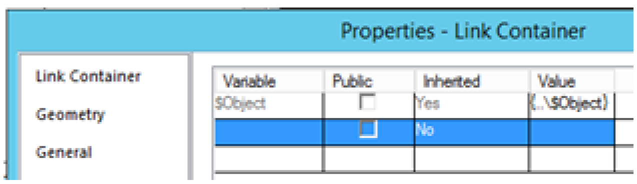
Using Linked Objects to Generate Operations Hub Screens

In order to build Operations Hub screens using linked objects, any Linked Object local variables that are used to reference Operations Hub Object variables must eventually resolve back to the screen $Object variable in which they are placed. When you create the source of a linked object, you create a public “$Object” local variable in your source group object. Use this $Object local variable to reference Operations Hub model variables.

For example:

{$Object}.Flow

When you create a linked object from this source group object, you set the value of the inherited $Object local variable to point to the screen $Object defined in the screen in which you created the linked object using local variable syntax like {..\$Object} or {..\$Object}.InletTank”



Update Values on Mimic Cards

When configured, you can modify values in the HMI/SCADA data source directly on mimic cards.

You must have permissions in the HMI/SCADA data source to perform this task.

1. Hover over the value you want to update on the mimic card.
   If the background of the value changes to blue, you can update the value.
2. Enter the new value in its entirety and press **Enter** or select the value from a drop-down list.
   If you specify an invalid value in any entry box on the mimic card, the box becomes outlined in red.
3. **Optional:** For mobile devices:

a. Select the entry field whose value you want to update. If its background changes to blue, you can edit this value, as shown below:

b. Select the entry field again and specify the new value or select it from a drop-down list.

c. **Optional:** Click outside the field if you do not want to update the current value.

d. If an update confirmation window appears, answer accordingly.

4. If an update confirmation window appears, answer accordingly.
An error can occur when you are not connected to the data source, you do not have permissions to write to your data source, or you entered a numeric value not within the acceptable minimum and maximum range for that value.

Display

Display Overview

The following list of plugins are available under the display category:

- DataGrid *(on page 488)*
- Gauge Bar *(on page 496)*
- Gauge Circular *(on page 497)*

DataGrid

Use this widget to access advanced features of a table.

The datagrid widget is available under **INTEGRATION > DISPLAY**. When designing application pages *(on page 308)*, drag-and-drop **DataGrid** to a container.

The following list of properties are specific to this widget. For common properties, refer to Page Components *(on page 575)*.

Table 27. DataGrid Properties

Property	Description
BEHAVIOR > Selected Items Changed BEHAVIOR > Edited Rows Updated	Use this property to define the action to be taken when a value is modified in the datagrid. For this behavior to work, you must also configure the **Add Table Column** for the modified value.
Source - Input	Use any of these options to provide values from a data source. • Select the **Query** tab. Choose a query and select output fields to view data on the grid. The data grid table displays the output field names as column headers. If **Alias** is provided for any output field, then the alias name overrides the column header name.

Table 27. DataGrid Properties (continued)

Property	Description
	• Select the **Global** tab. Choose an output field value that is available as a global parameter. • Select the **Formula** tab. Add a formula that returns columns as output. **Note:** Currently we do not support manually passing values to the widget.
Height (px) - 0 equals dynamic	Set the height in pixels. If set to 0, the datagrid table occupies 100% of its container.
Background Color	Select a color to apply as a background color to the datagrid.
Border Color	Select a color for the datagrid table border.
Show Borders	Select the check box to apply a border to the datagrid table. To remove the border, clear the check box.
Show Column Lines	Select the check box to display column gridlines. To remove gridlines, clear the check box.
Show Row Lines	Select the check box to display row gridlines. To remove gridlines, clear the check box.
Enable Search	Select the check box to add a search field above the datagrid widget to search the entire table.
Allow Grouping	Select the check box to allow grouping of columns at runtime. • The message `Drag a column header here to group by that column` is displayed at the top of the table. • Select the column you want to group by, drag and drop on the message.

Table 27. DataGrid Properties (continued)

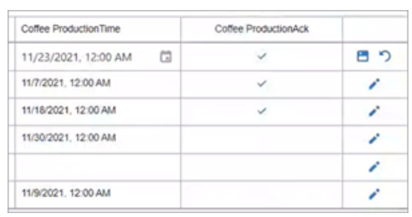
Property	Description
	• You can also group data by multiple columns. Drag and drop columns on the message one after the other to group data accordingly. To undo grouping, drag the columns back to their previous position.
Allow Filtering	Select the check box to allow filtering of data in every column. At runtime, to filter values: 1. Select and open the filter from the respective column header. 2. Select the check box for the values you want to use for filtering data. 3. Select **OK** to apply the filter to the column.
Allow Edit	Select the check box if you want to modify grid data. An edit option appears at runtime next to each row.  The modified data value must be sent to a target data source. To use the edit option successfully, configure the **Add Table Column** and **Output Target** properties. Changes are written to the target, and not to the input data source. Hence, you may lose edits on refreshing the page.
Allow Export	Select the check box to allow exporting data at runtime.

Table 27. DataGrid Properties (continued)

Property	Description
Pages or scroll	If the number of rows exceed page size, then specify whether you want to browse through pages, or scroll through data. • Select **Pages** to divide and display grid data in separate pages. Enter the number of rows to display per page in **Page Size**. • Select **Scroll** to add a scroll bar to the datagrid.
Rows	Use these properties to configure datagrid table rows: • **Header Font Size**: Set the column header text font size in pixels. • **Header Font Color**: Select a font color for the column header text. • **Body Font Size**: Set the font size for text in the datagrid. • **Body Font Color**: Set the font color for text in the datagrid. • **Selection Mode**: `Single` allows to select a single row in the grid. `Multiple` allows to select multiple rows using a check box. `None` disables row selection. • **Icon size (px)**: Set the icon size in pixels. The default value is 40px.
Add Animation	Use this property to highlight a row when a condition is met. Boolean values are represented with `1` or `0`. This property is similar to **Add Cell Animation**.
Add Table Column	Use this property to customize the datagrid columns *(on page 488)*. Select **+Add Item** to show configuring options.

Table 27. DataGrid Properties (continued)

Property	Description
	Note: Add only the columns you want to customize. It is not required to add all the columns. • Configure column *(on page 492)* • Configure output target *(on page 493)* • Add image/icon *(on page 493)* • Add cell animation *(on page 493)* To organize table columns: • Use and to rearrange order of columns in the datagrid. • To delete a column, select next to it.
Column	Use these properties to configure a column: • **Data Field**: Provide the column header name. This value must match the output field name (returned by query). If an **Alias** is configured for the output field for the specific column, then the value must match the alias name. • **Data Type**: Specify the type of data in the column. For example, select `Picture` if the column contains image URLs and images will be retrieved from the data source. • **Visible**: Select/Clear the check box if you want to show/hide the column in the datagrid. • **Allow Filtering**: Select/Clear the check box to enable/disable filtering on column.

Table 27. DataGrid Properties (continued)

Property	Description
	• **Allow Sorting**: Select/Clear the check box to enable/disable sorting by this column. • **Allow Edit**: Select/Clear the check box to enable/disable editing the column data.
Output Target	Specify the target data source for column data. At runtime, when column data is selected/modified, the target specified in this property is triggered. • Choose a query input value as target. (OR) Add or choose a global value as target. • Select `Unix timestamp` format to represent all time zones at once.
Add Image	Use this property to deliver an image when a condition is met. Boolean values are represented with `1` or `0`. Add as many conditions as required. Each item here refers to a separate condition. • **Condition**: Create a condition for the column data. For example, if column value is `>` than `150`, then update an image. • **Image or Font Awesome Icon**: Select whether you want to load an image, or icons from the Font Awesome Free library. • **URL or Icon name**: For image, enter its URL address. Also ensure that the column *(on page 492)* **Data Type** is `Picture`. For font awesome icon, enter the icon name. • **Icon Color**: Select a color for the icon.
Add Cell Animation	Use this property to highlight a cell when a condition is met. Add as many conditions as required. Boolean values are represented with `1` or `0`.

Table 27. DataGrid Properties (continued)

<table>
<tr><th>Property</th><th>Description</th></tr>
<tr><td></td><td>

- **Column**: Select a column and create a condition for it. For example, if the value in `Column 1` is `=` to `Alarm 1`, then trigger these changes.
- **Font Color**: Change cell text color to the selected font color.
- **Background Color**: Change cell color to the selected background color.

</td></tr>
<tr><td>Group By</td><td>

Set the default grouping of data by column.

- **Columns**: Select a column for default grouping.
- **Expanded**: Select/Clear the check box to expand/collapse data by default.

</td></tr>
<tr><td>Sort By</td><td>

Set the default sorting for data grid columns. For example, you can add multiple items to configure default sorting first by column X, then by column Y, etc in an ascending/descending order. The sequence of sorting order appears at runtime indicated by a number.

Coffee ProductionYear ↓1	Coffee ProductionLbsOutput ↑2
2022	10
2021	40
2020	30
2019	10
2019	11
2019	25

At runtime:

- Hold the **Shift** key and select column headers to sort in a sequential order.
- Hold the **Ctrl** key and select column headers to clear any column in a sequence.

</td></tr>
</table>

Table 27. DataGrid Properties (continued)

Property	Description
Selected Rows Output	Specify the target data source for a selected row data. A separated string or array can be written to a global variable. 1. Choose a query input value as target. (OR) Add or choose a global value as target. 2. Select the column to which you want to write data, and in which format. 3. Specify an output separator if format is separated string.

DataGrid at Runtime

You have the option to export and download the datagrid table data. Select  icon that appears at runtime at the top of the table to export the data to an Excel file.

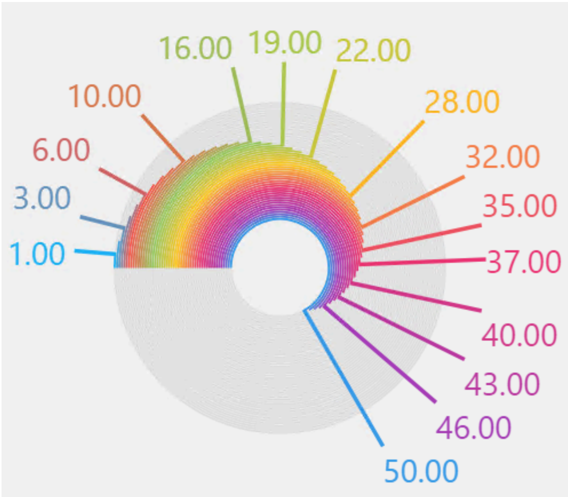
Gauge Bar

The plugin is available under **INTEGRATION > DISPLAY**. When designing application pages *(on page 308)*, drag-and-drop **gaugeBar** to a container.

Table 28. Gauge Bar Properties

Property	Description
Source > Input Value	To get values for gauge bar from a data source, use any of these options: • Select a query output. • Select a global parameter. • Enter source data manually. • Add a formula.
Source > Minimum Value	Sets the minimum scale value.
Source > Maximum Value	Sets the maximum scale value.
Advanced Settings	• Select the **Show Label** check box to display a label name, if provided. • Select the **Show Animation** check box to display animation. • Select the **Show Legend** check box to display a legend.
Angles	• **Start Angle**: Defines the point on the circumference of the gauge at which the bar will begin to appear in displaying the input value. • **End Angle**: Defines the point on the circumference of the gauge at which the bar will complete its appearance in displaying the input value.

Bar Gauge at Runtime



> **Note:**
> If you choose to show legend on a graph with large amounts of data values, the graph may become unreadable.

Gauge Circular

The plugin is available under **INTEGRATION > DISPLAY**. When designing application pages *(on page 308)*, drag-and-drop **gaugeCircular** to a container.

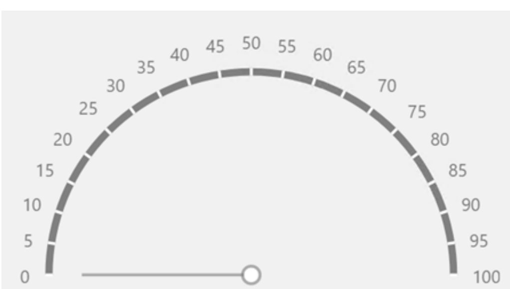
Table 29. Gauge Circular Properties

Property	Description
Source > Input Value	To get values for gauge circular from a data source, use any of these options: • Select a query output. • Select a global parameter. • Enter source data manually. • Add a formula.
Source > Minimum Value	Sets the minimum scale value.
Source > Maximum Value	Sets the maximum scale value.

Table 29. Gauge Circular Properties (continued)

Property	Description
Advanced Settings	• Select the **Show Label** check box to display a label name, if provided. • Select the **Show Animation** check box to display animation. • Select a **Needle Color**. • Choose a **Needle Style** from available options - rectangle needle, triangle needle, range bar, marker, text.
Angles	• **Start Angle** • **End Angle**
Range(s)	You can specify one or more ranges to display in different colors. 1. Select **+Add Item**. 2. **Start of Range** 3. **End of Range** 4. Select a color *(on page 585)* **Color in Range**.

Circular Gauge at Runtime



Gauge Linear

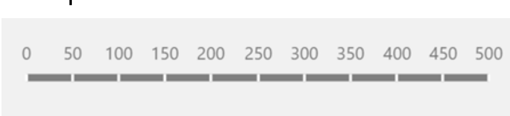
The plugin is available under **INTEGRATION > DISPLAY**. When designing application pages *(on page 308)*, drag-and-drop **gaugeLinear** to a container.

Table 30. Gauge Linear Properties

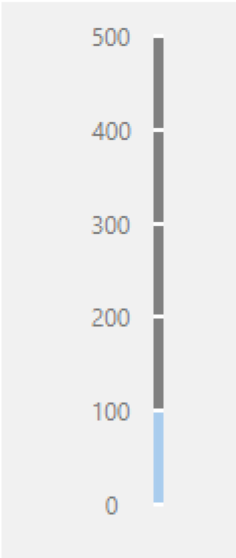
Property	Description
Source > Input Value	To get values for gauge linear from a data source, use any of these options: • Select a query output. • Select a global parameter. • Enter source data manually. • Add a formula.
Source > Minimum Value	Sets the minimum scale value.
Source > Maximum Value	Sets the maximum scale value.
Advanced Settings	• Choose an orientation for the linear gauge: ◦ `Horizontal`: Data values appear on a horizontal scale. ◦ `Vertical`: Data values appear on a vertical scale. • Select the **Show Range Bar** check box to dynamically show the highest and lowest value on the linear gauge scale. • Select a default color for the range bar.
Range(s)	You can specify one or more ranges to to display in a different color. 1. Select **+Add Item**. 2. Specify a value range by entering values for **Start of Range** and **End of Range**. 3. Select a unique color *(on page 585)* for the specific range.

Linear Gauge at Runtime

Example of a horizontal orientation:



Example of a vertical orientation:



iFrame

Use the iFrame widget to load content from another website within Operations Hub.

The iFrame widget is available under **INTEGRATION > DISPLAY**. When designing application pages *(on page 308)*, drag-and-drop **GEIFrame** to a container.

The following list of properties are specific to this widget. For common properties, refer to Page Components *(on page 575)*.

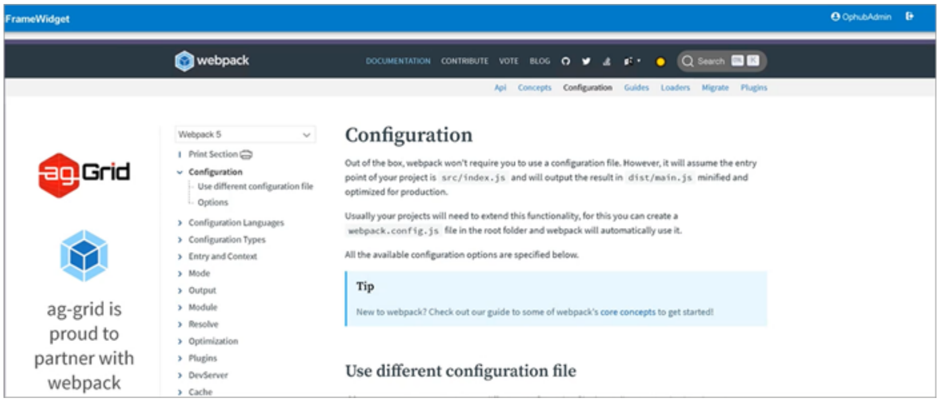
Table 31. iFrame Properties

Property	Description
Source - URL	Use any of these options to provide the URL address of the website you want to load in the iFrame widget. • Select the **Query** tab to choose from queries that return an URL as output. **Note:** If the query output returns an array with multiple URLs, then the first URL value is taken into consideration.

Table 31. iFrame Properties (continued)

Property	Description
	• Select the **Global** tab to choose from URL outputs available as global parameters. • Select the **Manual** tab, and enter the URL address in the text field. • Select the **Formula** tab to add a formula that returns an URL as output. ◦ Select **Add Formula > Add text**. ◦ Enter the URL address in the text field. ◦ Select **Done** to save and add the formula to the iFrame widget.
Hide Scrollbars	If selected, hides the scroll bar. The horizontal and vertical scroll bars appear only when the content in the iFrame widget extends beyond the widget's width and height.
Enable Full Width	If selected, the iFrame widget occupies 100% of the width of the container. Enabling this property overrides the **Width (px)** set for the widget.
Width (px)	If you do not select **Enable Full Width**, then set a width for the iFrame widget in pixels.
Height (px)	Set a height for the iFrame widget in pixels.
Border Style	To apply a border to the iFrame widget, select from any of the available styles, or select **None** for no border. • Solid: Applies a solid border • Inset: Applies a 3D inset border • Outset: Applies a 3D outset border
Border Width (px)	Enter a value that defines the thickness of the iFrame border.
Border Color	Select a color to apply to the four borders of the iFrame widget.

iFrame at Runtime



> **Note:**
>
> - When you print preview a webpage, it may not look like the actual web page. The print stylesheet formats the web page to print in a user-friendly format.
> - Some website URLs may not load within an iFrame due to their security policies.
> - To load YouTube videos within an iFrame, use the video's embed URL.

Pivot Grid

Pivot grid allows to visualize data in a multi-dimensional format.

Use the pivot grid to arrange your data in a two-dimensional table, and compare tag names and their columns against timestamps. With the pivot grid, you can:

- Rename rows/columns to replace lengthy tag names
- Apply conditional formatting to rows/columns based on values
- Calculate values quickly using totals
- Sort, filter, and summarize data
- Export pivot data to Excel

The pivot grid is available under **INTEGRATION > DISPLAY**. When designing application pages *(on page 308)*, drag-and-drop **GEPivotGrid** to a container.

The following list of properties are specific to this widget. For common properties, refer to Page Components *(on page 575)*.

Table 32. Pivot Grid Properties

Property	Description
Source - Input	To enable the pivot grid, provide values from a data source. 1. Select a query. 2. Select the query output fields you want to use to get data for the pivot grid.
Height (px) - 0 equals dynamic	Set a height for the pivot grid in pixels. If set to 0, the widget occupies 100% of its container.
Row Header Width (px) - 0 equals dynamic	Set a width for the header row in pixels.
Show Borders	Select the check box to apply a border to the pivot grid table. To remove the border, clear the check box.
Allow Sorting	Select the check box to sort the rows and columns alphabetically by default.
Allow Sorting by Summary	Select the check box to provide an option to sort the rows by column. At runtime, right-click the column you want to sort by and select the sorting option.
Allow Filtering Row/Column Values	Select the check box to provide an option to filter data at runtime.
Allow Expand/Collapse All	Select the check box to enable expand/collapse data levels at runtime. Your pivot grid should have multiple data levels to use this property. For value-based table cell data, you can expand and collapse data details to aggregate values.
Allow Export	Select the check box to allow exporting data at runtime.
Show Row Totals	Select the check box to show totals for each row.

Table 32. Pivot Grid Properties (continued)

<table>
<tr><th>Property</th><th>Description</th></tr>
<tr><td>Show Row Grand Totals</td><td>Select the check box to show the grand totals for each row.</td></tr>
<tr><td>Show Column Totals</td><td>Select the check box to show totals for each column.</td></tr>
<tr><td>Show Column Grand Totals</td><td>Select the check box to show the grand totals for each column.</td></tr>
<tr><td>Field Configuration</td><td>Configure pivot grid rows, columns, and data. Map all the three areas (rows, columns, data).

1. Enter the tag names under Data Field.
2. Select the Data Type for the entered tag names. For example, <code>string</code>.
3. Enter a Caption.

Use this option to add user-friendly captions to your row/column/data fields. Avoid lengthy captions with special characters.

4. Select the Area for the tags to appear. For example, if you select column, then the respective tags appear in the column at runtime.
5. When area is data, define additional properties for data values.</td></tr>
<tr><td colspan="2">Formatting: Set default colors (on page 585) for the pivot grid.</td></tr>
<tr><td>Cell Color</td><td>Select a color for the pivot grid table cells.</td></tr>
<tr><td>Cell Font Color</td><td>Select a font color for the pivot grid table cell text.</td></tr>
<tr><td>Column Header Font Color</td><td>Select a font color for the pivot grid table column header text. This helps to differentiate the header text from the cell text.</td></tr>
<tr><td>Totals Background Color</td><td>Select a unique cell color for the row/column totals.</td></tr>
</table>

Table 32. Pivot Grid Properties (continued)

Property	Description
Totals Font Color	Select a font color for the row/column totals text.
Item Configuration: Allows to customize the pivot grid table to override the default settings. Select **+Add Item** for configuring options.	
Item Display	• **Row/Column Value**: Enter the value that is displayed in a row or column. For example, if you're viewing OPCUA tags and their values, you can enter a tag name such as `FIX.FWT_FWP_DPUMP_1A_FLOW.F_CV`. • **Display Value (optional)**: Use this option to display more user-friendly values instead of tag names. This display value overrides the **Row/Column Value**. For example, enter `Pump1A Flow` to replace the OPC UA tag name `FIX.FWT_FWP_DPUMP_1A_FLOW.F_CV` entered under **Row/Column Value**. At runtime, the column displays values for `Pump1A Flow` in the pivot chart.
Conditional Formatting	Apply conditions to format cells based on values. You can create more than one condition for a **Row/Column Value**. The conditions are applied according to their order of display. If more than one rule matches a particular cell, the first condition in the list to match takes effect and rule processing for that cell will stop. Select **+Add Item** for options to create conditions. For example, format a cell if its value is less than 9000: • **Comparison**: Select < from the list of comparison operators. • **Value**: Enter `9000`.

Table 32. Pivot Grid Properties (continued)

Property	Description
	• **Cell Color**: Select a color for the cells with values less than 9000. • **Cell Font Color**: Select a color for the cell text with values less than 9000. **Tip:** If you want to format a row/column with a color that does not change based on value, apply the `Always` comparison operator.

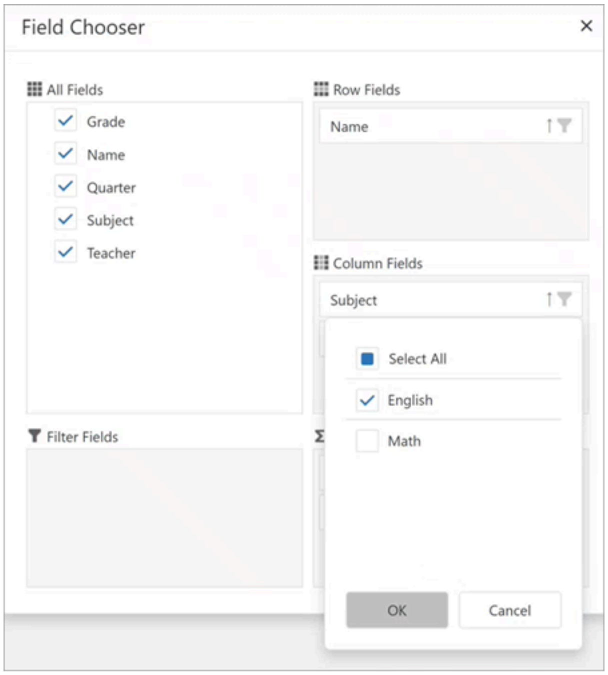
Pivot Grid at Runtime

Select  to export the data to an Excel file.

	FIX.FWT_FWP_DPUMP_1A_FLOW.F_CV	FIX.FWT_FWP_DPUMP_1A_PRESSURE.F_CV	FIX.FWT_FWP_DPUMP_1B_FLOW.F_CV	FIX.FWT_FWP_STO
2021-09-24T06:11:30.398	34	68.79197692871094	23	
2021-09-24T08:58:32.794	34	68.8282470703125	23	
2021-09-24T10:22:03.992	34	68.84638214111328	23	
2021-09-24T11:45:35.19	34	68.86450958251953	23	
2021-09-24T13:09:06.388	34	68.88264465332031	23	
2021-09-24T14:32:37.586	34	68.9007797241211	23	
2021-09-24T15:56:08.784	34	68.91891479492188	23	
2021-09-24T17:19:39.982	34	68.93704986572266	23	
2021-09-24T18:43:11.18	34	68.9551773071289	23	
2021-09-24T20:06:42.378	34	68.97331237792969	23	
2021-09-24T21:30:13.576	34	68.99144744873047	23	

Select  to show the **Field Chooser** option.

- You can switch the position of row and column fields. To switch a field position, drag and drop the field in the desired row/column.
- You can apply multiple filters to the data to get focused results.
- You can sort fields by ascending/descending order.



Note:
In **Field Chooser**, row/column/data fields may get misplaced if you remove and add fields to the pivot chart. This is a DevExtreme control behavior. For example (refer screenshot):

1. Under **All Fields**, clear the check box for `Name`. The field is removed from **Row Fields**.
2. Under **All Fields**, select the check box again for `Name`.

   The `Name` field may not show up under **Row Fields**. It may show up under column or data fields. In such cases, drag and drop the field to the appropriate location.

Solid Gauge

Use the widget to insert circular charts and monitor the status of industrial systems.

You can use both thin and thick gauges of these types:

- Half
- Three-fourths
- Full

The solid gauge widget is available under **INTEGRATION > DISPLAY**. When designing application pages *(on page 308)*, drag-and-drop 

to a container.

Table 33. Solid Gauge Properties

Property	Description
Title	Enter a title to help identify the solid gauge at run-time.
Engineering Unit	Enter the unit of measurement for the values on the gauge.
Width (px) (0 equals Dynamic)	Enter a width for the solid gauge. If set to 0, the widget occupies 100% of its container, and fills the area in the application.
Background Color	Select a background color *(on page 585)* to fill the widget.
Font Color	Select a font color *(on page 585)* for the widget text.
Font Size (px) (0 equals Dynamic)	Specify a font size in pixels for the solid gauge display text. If set to 0, the font resizes to match with the width of the widget.
Min	Enter the minimum value for the solid gauge scale.
Max	Enter the maximum value for the solid gauge scale.
Number of decimals	Enter the number of decimal places to format values.
Sparkline	The sparkline data is created based on the query applied to the widget. We can see a sparkline only if the query returns multiple records from the data source. The sparkline is not displayed for a single record even if it is enabled. Select the check box to enable the sparkline for the selected **Gauge Variant** at runtime.
Gauge Variant	List of different types of guages you can use in your application.

Table 33. Solid Gauge Properties (continued)

Property	Description
Text position	Select a position to display text for the solid gauge at runtime. • **Top Left** is the default position. • You can choose to position the text at the **Center** of the gauge.
Range(s)	You can specify one or more ranges to display in different colors. 1. Select **+Add Item**. 2. Enter a value for **limit**. At runtime, the gauge is displayed in the selected color on reaching this value. 3. Select a color *(on page 585)* for the range limit. 4. Use and to reorder ranges. The ranges are implemented in the specified order. 5. Select to delete a range.
Alert Limit(s)	You can add one or more alerts on a gauge, each with unique values. 1. Select **+Add Item**. 2. Enter a value for **limit**. At runtime, a line alert is displayed on the gauge on reaching this value. 3. Select a color *(on page 585)* to identify the line alert. 4. Use and to reorder alerts. The alerts are implemented in the specified order. 5. Select to delete an alert.

Table 33. Solid Gauge Properties (continued)

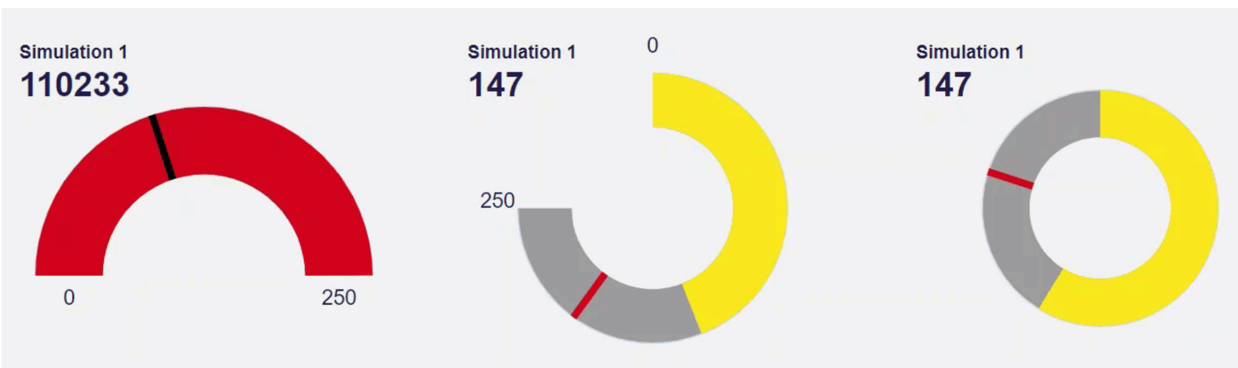
Property	Description
Value	To get values for the widget from a data source, use any of these options: • Select a query output. • Select a global parameter. • Enter source data manually. • Add a formula.
Result Set Index	This property is applicable for REST queries only. It allows to define which index of the result set the widget should use as input data. Default is 0. For example, consider a Historian REST query that returns data for three tags. • If you want the widget to use the first tag data from the query result set, then set the index value as **0**. • To direct the widget to use the second tag data, enter the index value as **1**. • Similarly, you can set index values as 2, 3, 4, etc. based on the data to provide as input to the widget.
Reverse Order	This property helps to reverse the query result set. Select the check box to provide the bottom record value as input to the widget. Clear the check box to provide the top record value as input to the widget. When you apply this property to REST queries that return more than one record for each input tag, the records of the selected tag (use **Result Set Index** to select the tag) are reversed.

Table 33. Solid Gauge Properties (continued)

Property	Description
	For example, consider a Historian REST query with two input tags (tag1 and tag2); each with 100 records as result. Set the **Result Set Index** as **0** and verify the following: • If you selected the **Reverse Order** check box, then the 100th record (last) value of tag1 is displayed on the gauge. • If you cleared the **Reverse Order** check box, then the first record value of tag1 is displayed on the gauge.

Solid Gauge at Runtime

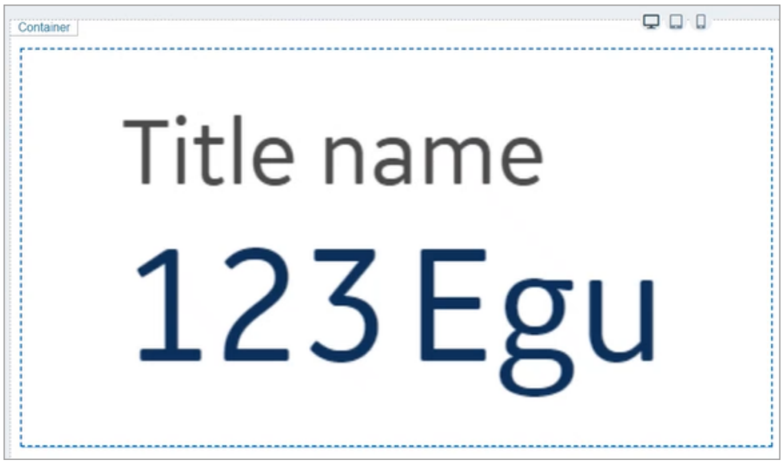
The change in values are indicated with changing colors.



Value Display

Use this widget to display any type of data value.

The value display widget is available under **INTEGRATION > DISPLAY**. When designing application pages *(on page 308)*, drag-and-drop **GEValueDisplay** to a container.



The following list of properties are specific to this widget. For common properties, refer to Page Components *(on page 575)*.

Table 34. Value Display Properties

Property	Description
Title	Enter a title for the widget, which is displayed at runtime.
Engineering Unit	Enter the engineering unit of measurement for the values, which is displayed at runtime.
Height	Set a height for the value display widget in pixels.
Width	Set a width for the value display widget in pixels.
Padding	Enter a value that defines the space between the content and the widget's borders.
Background Configuration	
Options	Choose from:

Table 34. Value Display Properties (continued)

Property	Description
	• Select **Transparent** to apply a transparent background for the widget. • Select **Color** to apply a colored background for the widget.
Color	If you opted for a colored background, specify a color for the background.
Border Configuration	
Width	`0` implies that the widget has no border. `1` implies that the widget has a border. With every increasing value, the thickness of the widget's border is determined.
Radius	`0` implies that the widget has no round corners. `1` implies that the widget has a round corner. With every increasing value, the curve at the corners are determined.
Color	Applies a color to the widget's border.
Font Size	Enter a font size for the widget's **Title** and **Current value and EGU**.
Font Color	Select a font color for the widget's **Title** and **Current value and EGU**.
Font Style	Select a font style for **Title** and **Current value and EGU**, whether normal, bold, or italic.
Rotate	Allows to rotate the widget based on the selected degree of rotation.
Align	
Text	Allows to align the text left, right, or center within the widget.
Horizontal	Allows to align the widget left, right, or center within its container.

Table 34. Value Display Properties (continued)

Property	Description
Vertical	Allows to align the text either at the top, middle, or bottom of the widget.
State Configuration	You can configure how the widget should appear whenever there is a change in its status. Use any of these options: • Select the **Query** tab to specify a query, which returns output values that indicate the status change. The query should include these output fields - `value`, `operator`, `text-Color`, `borderColor`, `background`, `background-Color`, and `blinking`. • Select the **Global** tab to choose from values that are available as global parameters. • Select the **Manual** tab, and enter the values for all fields in the text field. However, if you are manually entering values, then it is recommended to use the **Manual State** property. • Select the **Formula** tab to add a formula that returns output values to indicate the status change. ◦ Select **Add Formula > Add text**. ◦ Enter the values for all fields in the text field. ◦ Select **Done** to save and add the formula to the value display widget. Example: For **Global**, **Manual**, and **Formula**, you can paste the following sample code in the text field: `[` `{` `"value": "130000",` `"operator": ">=",`

Table 34. Value Display Properties (continued)

Property	Description
	`"textColor": "red",` `"borderColor": "green",` `"background": "color",` `"backgroundColor": "blue",` `"blinking": true` `}` `]`
Manual State	You can manually configure each field (instead of applying a query) how the widget should appear on reaching a specified value. Select **+Add Item** and provide these field values that help to indicate the change: • Enter a threshold **Value**, and select an **Operator** for comparison. For example, consider the value is `100` and operator is `=`. It means that when the widget value is equal to `100`, the following changes apply to the widget. • Selected **Text Color** and **Border Color** are applied. • **Background**, if not transparent applies the selected **Background Color**. • If selected, applies **Blinking** animation on the widget when the value is equal to `100`. You can configure several manual states using **+Add Item**. • Use  and  to reorder manual states. • Select  to delete a configured manual state.
Value Configuration	You can configure the values on how they should appear at runtime.

Table 34. Value Display Properties (continued)

Property	Description
	• Select a **Format** for the value, whether the value should be a number or string. • If value is a number, specify the **Number of decimals** for the value. If value is a string, decimals do not apply.
Value	Use any of these options to provide data source values for the widget. • Select the **Query** tab to choose from queries that return data source values as output. • Select the **Global** tab to choose values that are available as global parameters. • Select the **Manual** tab, and enter the value in the text field. • Select the **Formula** tab to add a formula that returns data source values as output.
Result Set Index	This property is applicable for Historian REST queries only. It allows to define which index of the result set the widget should use as input data. Default is 0. For example, consider a Historian REST query that returns data for three tags. • If you want the widget to use the first tag data from the query result set, then set the index value as **0**. • To direct the widget to use the second tag data, enter the index value as **1**. • Similarly, you can set index values as 2, 3, 4, etc. based on the data to provide as input to the widget.

Table 34. Value Display Properties (continued)

Property	Description
Reverse Sorting Order	This property is applicable for Historian REST queries only. It helps to reverse the query result set. Select the check box to provide the bottom record value as input to the widget. Clear the check box to provide the top record value as input to the widget. When you apply this property to REST queries that return more than one record for each input tag, the records of the selected tag (use **Result Set Index** to select the tag) are reversed. For example, consider a Historian REST query with two input tags (tag1 and tag2); each with 100 records as result. Set the **Result Set Index** as **0** and verify the following: • If you selected the **Reverse Order** check box, then the 100th record (last) value of tag1 is displayed on the value display. • If you cleared the **Reverse Order** check box, then the first record value of tag1 is displayed on the value display.

Image

The widget is available under **INTEGRATION > DISPLAY**. When designing application pages *(on page 308)*, drag-and-drop **image** to a container. To use the old version, refer to Image *(on page 351)*.

Table 35. Image Properties

Property	Description
BEHAVIOR > Click Event	You can choose from these available actions:

Table 35. Image Properties (continued)

Property	Description
	• `Submit`: This action submits the data to the selected entity. • `Go to page`: This action leads to the specified page within the application. • `Go to previous page`: Use this action to navigate between historical entries created for the current application session. If there is no previous history, then the plugin remains idle. • `Go to next page`: Use this action to navigate between historical entries created for the current application session. In the absence of next session entries, the plugin remains idle. • `URL`: This action leads to the specified (external) URL. • `Set global value`: This action enables the data to be available globally. • `Show Component`: This action displays a hidden component in the end app. • `Hide Component`: This action hides a component. • `Toggle Show/Hide`: This action allows to switch between hidden and shown views of a component.
Source > Input Value	Provide the input data source to receive values for the image. **Note:** This property applies only when you select **Data** as the image source.

Table 35. Image Properties (continued)

Property	Description
Image Source	• **Data**: When you select this option, specify the input data source. • **File**: Allows to upload an image file from your local system. • **URL**: Allows to provide an image from a URL. Provide the source image URL.
Image Height	Enter the height in pixels.

Simple Indicator

The widget is available under **INTEGRATION > DISPLAY**. When designing application pages *(on page 308)*, drag-and-drop **simpleindicator** to a container. For advanced features, use Indicator *(on page 558)*.

Table 36. Simple Indicator Properties

Property	Description
Source > Input Value	Provide the input data source to receive values for the simple indicator.
Source > Label (False)	The label that appears when the indicator is in false state. For example, `Off`.
Source > Label (True)	The label that appears when the indicator is in true state. For example, `On`.
Legacy Support (act like original widget)	
Icon Size (px)	Enter the icon size in pixels.
Label Styling	Formats the label: **Font Family** and **Font Size** formats the label text.
State Colors	Select colors that appear in the background for true/false status.

Table 36. Simple Indicator Properties (continued)

Property	Description
	• **False Background Color**: This color appears when the simple indicator is in false state. • **True Background Color**: This color appears when the simple indicator is in true state.
State Icons	Choose from font awesome icons to represent true and false states.

List

The widget is available under **INTEGRATION > DISPLAY**. When designing application pages *(on page 308)*, drag-and-drop **list** to a container. To use the old version, refer to List *(on page 374)*.

Table 37. List Properties

Property	Description
Source > Input Value	Provide the input data source to receive values for the list.
Target > Selected Item	Provide the target data source to send information.
Prefix Icon (Font Awesome)	Adds a prefix icon. Choose icons from Font Awesome icon library.

Text

The widget is available under **INTEGRATION > DISPLAY**. When designing application pages *(on page 308)*, drag-and-drop **text** to a container. To use the old version, refer to Text *(on page 349)*.

Table 38. Text Properties

Property	Description
Source > Label	Provide the input data source to receive label names for the text plugin.
Source > Input Value	Provide the input data source to receive values for the text plugin.

Table 38. Text Properties (continued)

Property	Description
Label Styling	Formats the label: **Font Family**, **Font Size**, and **Font Color** formats the text.

General

General Overview

The following list of plugins are available under the general category:

- Date Picker *(on page 521)*
- Breadcrumb *(on page 523)*
- DateTime Range Picker *(on page 525)*
- Dropdown *(on page 527)*
- Favorite Organizer *(on page 530)*
- Trend Card *(on page 535)*
- Task Client *(on page 551)*
- Indicator *(on page 558)*

Date Picker

Add a calendar to display date and time in a variety of formats.

The calendar allows you to select specific date and time to use with queries and other data in the end application. All time related queries can make use of the date and time selection.

The date picker widget is available under **INTEGRATION > GENERAL**. When designing application pages *(on page 308)*, drag-and-drop **GEDatePicker** to a container.

Specify these plugin properties:

> **Note:**
> When configuring input targets for plugins, ensure that no other binding exists for the target query input. To remove a binding from the query input, select the unlink icon next to the binding.

The following list of properties are specific to this widget. For common properties, refer to Page Components *(on page 575)*.

Table 39. DatePicker Properties

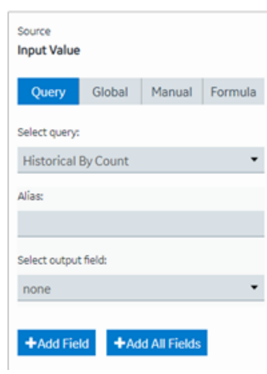
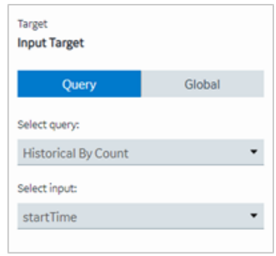
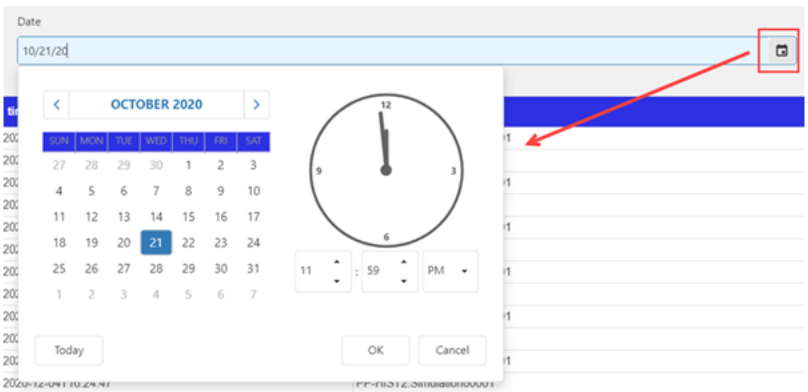
Property	Description
Title	Provide the text that appears as a label above the plugin in the end application.
Type	Select from these options for display in the end application: • date: displays only date • time: displays only time • datetime: displays both date and time
Display Format	Select the format for the date and time display.
Timezone	Select the timezone as local or UTC. **Note:** For Historian sources, use 'local' for timezone.
Source Input Value	Set this value to allow the plugin to start displaying a specific date and/or time when it loads in the end application. 
Input Target	This is the value the plugin provides as an output in the end application. For example, you can choose a date/time/datetime that is passed to the query, which requires a date time.

Table 39. DatePicker Properties (continued)

Property	Description
	

Date Picker at Runtime



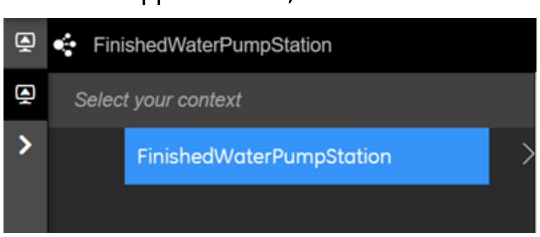
Breadcrumb

With the GEBreadcrumb plugin, you can navigate through the asset model.

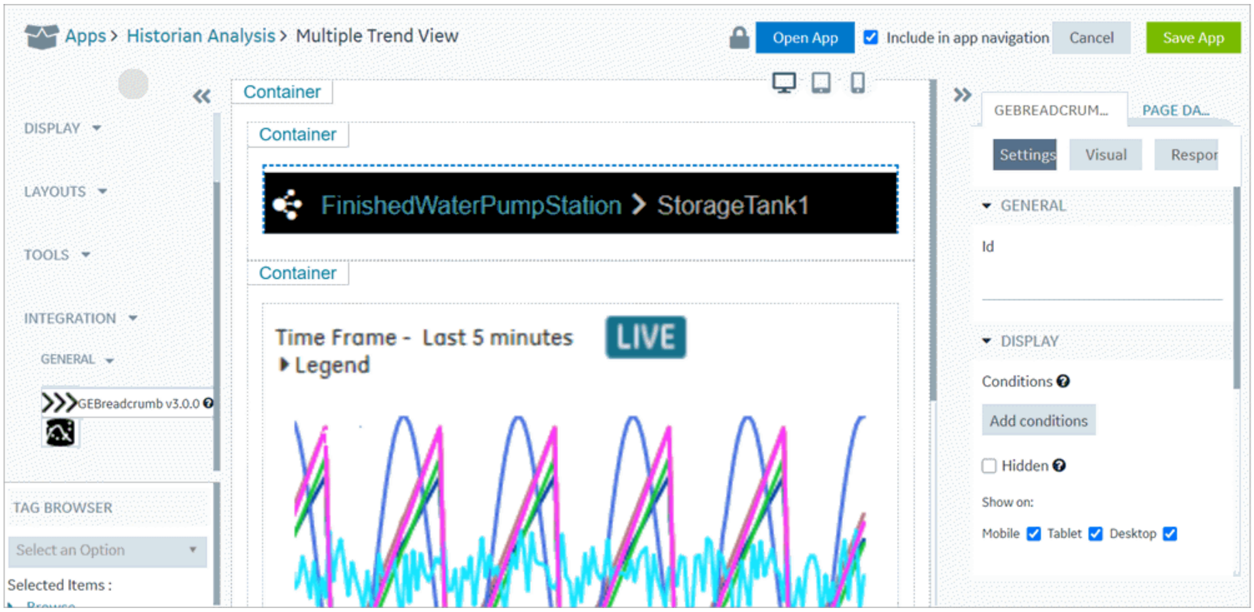
The purpose of a breadcrumb is to allow you to access an asset's information located anywhere in the asset model hierarchy. A breadcrumb navigation also defines the relationship between different assets in a model.

The breadcrumb navigation is available for all the widgets in Operations Hub. You can navigate in the trend card using breadcrumb.

In the end application UI, to access the breadcrumb, select  and browse your model.

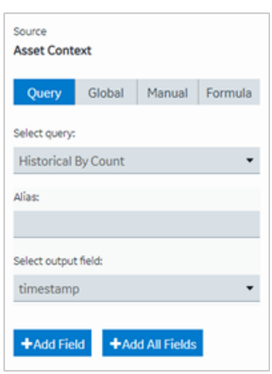


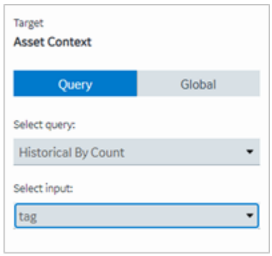
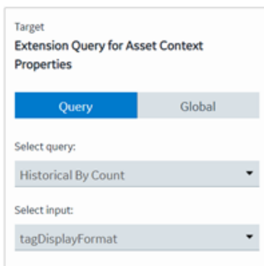
To use the plugin in the page designer, drag  from **Integration > General** to a container in the page.



You must specify these breadcrumb properties:

Note:
When configuring input targets for plugins, ensure that no other binding exists for the target query input. To remove a binding from the query input, select the unlink icon next to the binding.

Item	Description
Source Asset Context	Select the source (asset name) for an asset context. The selected context appears as a default breadcrumb view in the end application. This asset name must exist in your asset model *(on page 272)*. 

Item	Description
Target Asset Context	Select the target for an asset context. This target defines where that output goes on selecting an asset in a breadcrumb, so that it can be fed either to a query or a global. 
Target Extension Query for Asset Context Properties	Select the target for an extension query. This is a formatted string with a list of properties that defines the hierarchy of the breadcrumb in the end application. For example, consider these crumbs in a hierarchy - first is 'pump', second is 'pump pressure', 'pump frequency', 'pump vibration', or 'pump flow'. 

The breadcrumb is customizable, enabling you to add conditions for display navigation. Refer to Page Components *(on page 575)* for common widget properties.

DateTime Range Picker

Use preset date ranges or create your own custom ranges for the calendar.

The datetime range picker widget is available under **INTEGRATION > GENERAL**. When designing application pages *(on page 308)*, drag-and-drop **GEDateTimeRangePicker** to a container.

The following list of properties are specific to this widget. For common properties, refer to Page Components *(on page 575)*.

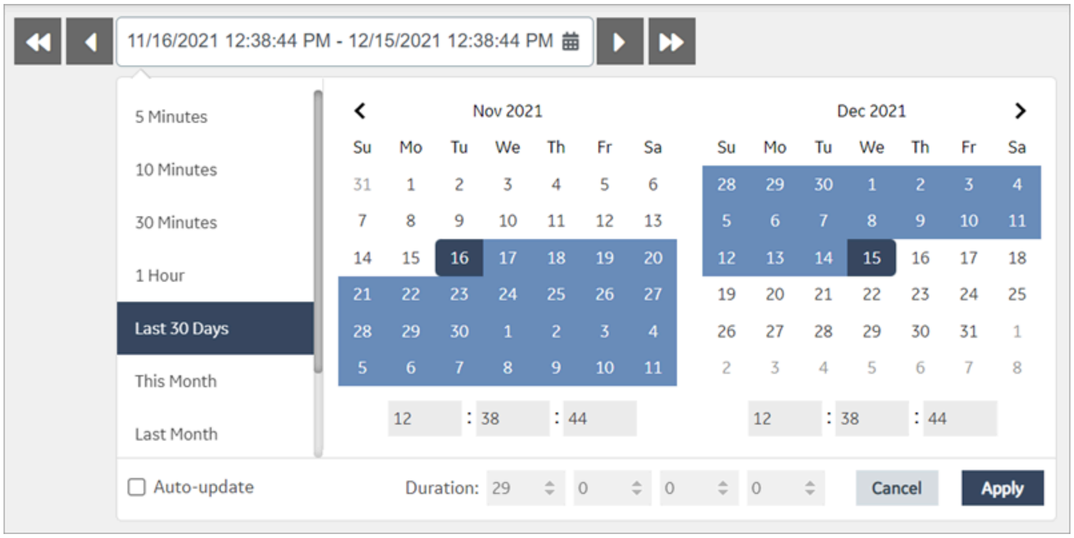
Table 40. DateTime Range Picker Properties

Property	Description
Label	Enter a label name for the datetime range picker.
Default Duration	This is the default date range set for the widget.

Table 40. DateTime Range Picker Properties (continued)

Property	Description
Preset Ranges	These are pre-defined datetime ranges. Select the check box of the range to add to your calendar.
Auto update at startup	Select the check box to allow the datetime range picker to automatically update the value of an input element it's attached to at initialization and when the selected dates change. **Note:** Selecting the auto-update option disables datetime selection in the calendar.
Custom Ranges	Create one or many customized datetime ranges to add to the calendar.
Data Targets	Configure one or more target outputs to receive values from the widget. **Note:** For Historian queries, format data target values as `StartLocalISO` and `EndLocalISO` for Start Time and Stop Time respectively.
Data Sources	Configure one or more data sources to get values for the widget.
Show Scroll Buttons	Select the check box to allow scrolling through the dates.

Datetime Range Picker at Runtime



Dropdown

Allows for multi-select, search, and select values.

Use this widget to select between multiple choices, search through a large list of choices, perform multiple selections, include a header, etc. For a simpler version, use a standard Dropdown *(on page 339)*.

The dropdown widget is available under **INTEGRATION > GENERAL**. When designing application pages *(on page 308)*, drag-and-drop **GEDropdown** to a container.

The following list of properties are specific to this widget. For common properties, refer to Page Components *(on page 575)*.

Table 41. Dropdown Properties

Property	Description
Source - Dropdown Data	Use any of these options to provide values from a data source to populate the dropdown. • Select the **Query** tab. Choose a query that can return dropdown values as output. Add as many output fields as required. Here's a sample query response:

Table 41. Dropdown Properties (continued)

Property	Description
	`{"status":{"success":true,"code":0,"reason":"Ok "}, "result":[{"State Data.value":"dd-historian:// ${his1}/KALYANMR2_Simulation.Simulation00002","State Data.key":"graduate"}, {"State Data.value":"dd-historian:// ${his1}/KALYANMR2_Simulation.Simulation00003","State Data.key":"school"}],"more":false}` • Select the **Global** tab. Choose an output field value that is available as a global parameter. • Select the **Manual** tab. In the text field, enter the output field value you want to pass. • Select the **Formula** tab. ◦ Select **Add Formula > Add text**. ◦ Enter the output field value in the text field. ◦ Select **Done** to save and add the formula to the dropdown widget. These are the two basic formats to manually enter values for a dropdown. `[ {"key1":"abc", "value1" : "1"}, {"key2":"def","value2":"2"}, ]` (OR) `[{"key1": "value1"}, {"key2":"value2"}]`

Table 41. Dropdown Properties (continued)

Property	Description
Target - Dropdown Target	Use any of these options to specify the target source for a dropdown value. At runtime, when you select a value from the dropdown, the value gets assigned to the target specified in this property. • Select the **Query** tab. Choose a query input value as target. • Select the **Global** tab. Add or choose a global value as target.
Output Format	Specify whether the output value should be an array or string format.
Manual Input	You can also use this property instead of using options in **Dropdown Data** property. Manually create values for a dropdown widget: 1. Select **+Add Item** to add a dropdown item. 2. Enter **Display Name** and **Value**. 3. Add as many items as required. 4. Use  and  to rearrange the items order of display in a dropdown. 5. To delete an item, select  next to it. **Note:** If you configured both **Manual Input** and **Dropdown Data** properties for the widget, then the dropdown is populated with a list of combined values. Make sure to validate and rectify your data to avoid duplicates in the dropdown.
Label	Enter a label name that appears above the dropdown widget. For example, `Choose an item`

Table 41. Dropdown Properties (continued)

Property	Description
Dropdown Placeholder	Enter the placeholder text that appears in the drop-down. For example, `-Select-`
Dropdown height (px)	Set a height for the dropdown list in pixels.
Multiple selection	Allows to select multiple values from a dropdown. If you select this property, specify the **Output Format** and **Output Separator**.
Max Selections	Specify the maximum number of values that can be selected from the dropdown.
Enable search	Select the check box to enable a search option for dropdown values.
Output Separator	By default, multiple values are separated by a comma. You can also use other symbols like semi-colon.
Width (px) (0 equals Dynamic)	Enter a width for the dropdown. If set to 0, the widget occupies 100% of its container, and fills the area in the application.

Favorite Organizer

Use the widget to create folders and organize your favorite trend charts.

This widget allows you to group all your favorites under a meaningful folder structure, and get to them quickly. The favorite organizer can be used along with the trend card on the same page to display favorites effortlessly.

When you import/export apps in Operations Hub, only favorites are imported/exported as unparented items. The folder structure is not imported/exported.

The favorite organizer widget is available under **Integration > General**. When designing application pages *(on page 308)*, drag-and-drop **GEFavoriteOrganizer** to a container.

Table 42. Favorite Organizer Properties

Property	Description
Title	Provide a title name for the favorite organizer.

Table 42. Favorite Organizer Properties (continued)

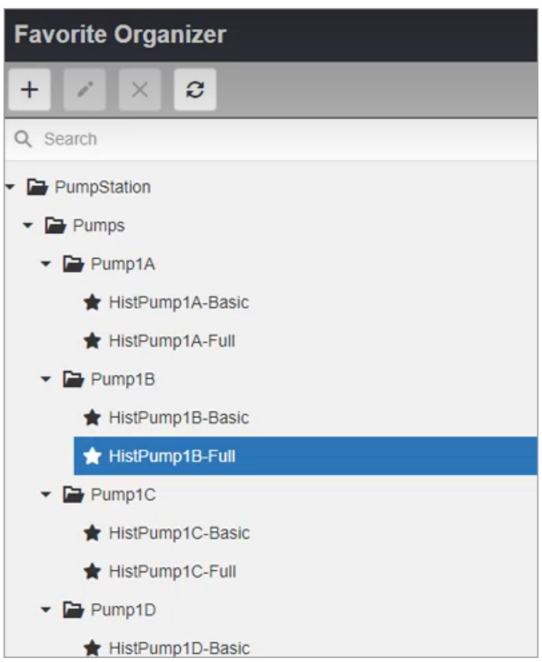
Property	Description
Unparented items folder	By default, the folder that contains the unparented items is called `Unorganized`. You can modify the default name. Unparented items are orphaned favorites, which are not yet organized in a tree folder structure.
Height	Set the height for the favorite organizer widget.
Header Background Color	Set a background color for the favorite organizer header.
Header Color	Set a color for the favorite organizer header text (if a title name is set).
Toolbar Background Color	Set a background color for the favorite organizer toolbar (contains menu options to create, rename, refresh, and delete folders).
Icons	You can customise the icons that represent folders and favorite items. Choose icons from Font Awesome or DevExtreme icon libraries. To use a Font Awesome icon, you need to specify that it is from the font awesome library, such as `fa fa-star`. https://fontawesome.com/icons To use a DevExtreme icon, use the icon name (such as `folder`). https://js.devexpress.com/Documentation/Guide/Themes_and_Styles/Icons/
Source > Input Selection	Select a global parameter to control the selected favorite within this widget. This global drives the selection of the favorite in the tree.
Target > Output Selection	Select a global parameter for capturing output selection. When you select a favorite item in the favorite organizer at runtime, your selection is published to this global. Select **Output Format** from these options:

Table 42. Favorite Organizer Properties (continued)

Property	Description
	• `Favorite Name`: When you select a favorite in the favorite organizer, the name of that favorite is published to this global. • `Favorite JSON`: When you select a favorite in the favorite organizer, a string containing a JSON representation of the data stored in that favorite (depending on the format selected), is published to this global.

Favorite Organizer at Runtime

Use the toolbar menu to create *(on page 532)*, rename *(on page 533)*, delete *(on page 533)*, and refresh folders.



Create a Folder

1. Select + to access the **Add Folder** screen.
2. Enter a name for the new folder.
3. Select **Add**. The new folder is created under its parent folder.
4. Drag and drop the favorites into the newly created folder.

Rename a Folder

1. Select the folder to rename.
2. Select to access the **Rename Folder** screen.
3. Enter the new name for the folder.
4. Select **Rename**.

Delete a Folder

Deleting a folder does not delete favorites in the folder.

1. Select the folder to delete.
2. Select . The **Remove Folder** confirmation dialog appears.
3. Select **Delete**. Any favorites in the deleted folder are moved to `Unorganized` folder.

Trend Card

Use the trend card widget to build trend charts in your application.

Refer to Trend Chart Overview *(on page 535)* for more information.

The trend card widget is available under **Integration > General**. When designing application pages *(on page 308)*, drag-and-drop **GETrendCard** to a container.

Table 43. Trend Card Properties

Property	Description
Source > Asset Name (Optional Override)	Select an asset name.
Source > Select Favorite	With this property, you can configure the trend chart to load an existing favorite at runtime. To use this property along with the Favorite Organizer *(on page 530)* widget, configure the Target Output Selection global with an Output Format *(on page 531)* of `Favorite Name`, then bind the output of favorite organizer widget to this property in order to drive the trend chart via favorite.
Source > Trend Config Input	The selected input value (global or query) contains a JSON representation of the data to trend. The format of this JSON is same as the output of **Trend**

Table 43. Trend Card Properties (continued)

Property	Description
	Config Output, and is very similar to a trend favorite (excluding favorite name). This property is typically used along with the Favorite Organizer *(on page 530)* widget. Set the favorite organizer Output Format *(on page 531)* to `Favorite JSON`, then bind the output of favorite organizer widget to this input property in order to drive the trend chart without selecting the favorite at runtime.
Target > Trend Config Output	The output of this property is a string representation of the configuration of the currently trending chart. This contains all of the data that is saved as part of a favorite, such as trend mode (real-time/historical), time settings, selected tags, etc.
Source > Default Sampling Mode	Select a sampling mode. This mode is set as default, and loaded at runtime for historical sources on both Live and Historical trends.
Source > Height	Set the height of the trend chart.
Source > Chart Title	Provide a title name for the trend chart. The value must be a text string.
Source > X-Axis Label	Provide a label name for the x-axis. The value must be a text string.
Source > Y-Axis Label	Provide a label name for the y-axis. The value must be a text string. Depending on the plotted data, the y-axis label is displayed either on the left or right side of the chart. The label name appears on the y-axis only if you opted for a single y-axis configuration *(on page 550)*.
Source > Historian Tag Page Size	Paginates large tag lists from Historian.

Table 43. Trend Card Properties (continued)

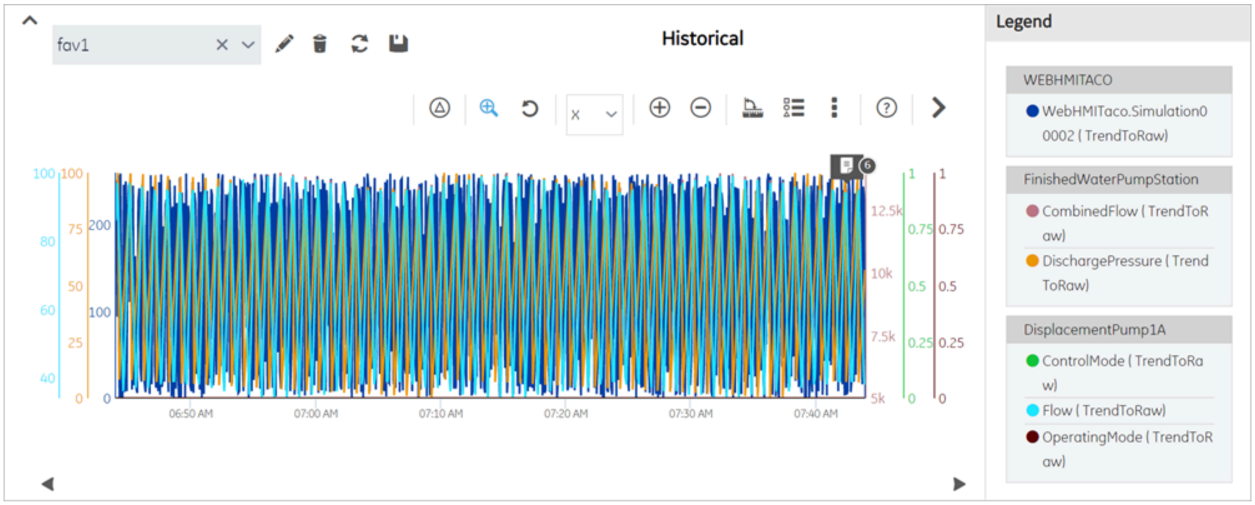
Property	Description
Source > Show Header Controls	Specify a boolean value. `True` shows chart header controls. `False` hides chart header controls.
Source > Show Trend Value Axes	Specify minimum and maximum axis values for the trend chart.
Source > Show Trend Legend	Select to show legend on a trend chart.
Source > Show Favorites	Select to show favorites on a trend chart.
Source > Scroll Percentage	Configure the scroll percentage based on the total time range.
Background Color	Adds a background color to the trend chart.
Show Border	Select the check box to add a border to the trend chart.
Border Color	If you choose to add a border, then set a color for the border.
Source > Logging Level	Applies to log messages. You can control the level of data logged to the browser console. The default value is `info`. Other valid values are `step`, `trace`, `debug`, `warning`, `error`, and `none`.
Source > LoggedIn Username	A default user name, which is used to add annotations in the trend chart.
Enable Compact View Mode	Select the check box to allow for a maximized chart area. This is a view-only mode. You cannot pan across the chart in this mode. You can hide the toolbar and legend.

Trend Chart Overview

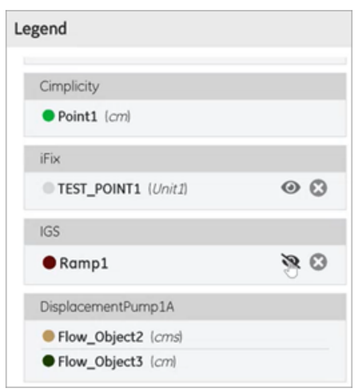
The trend chart allows you to plot real time data from OPC UA servers and historical data from Historian servers. You can plot the data using the context of a model or browse for a Historian or OPC UA server. You can then add tags to the chart.

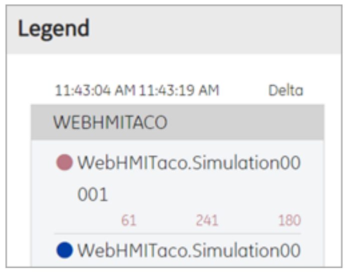
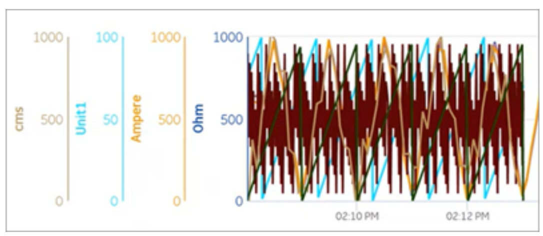
The model contains asset types and assets. The assets have properties associated with them, which are, in turn, associated with tags defined in Historian or OPC UA.

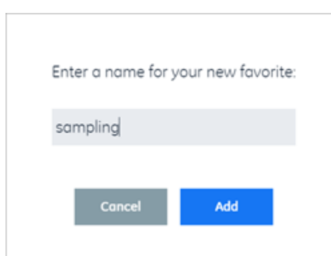
The following image shows an example of a trend chart.

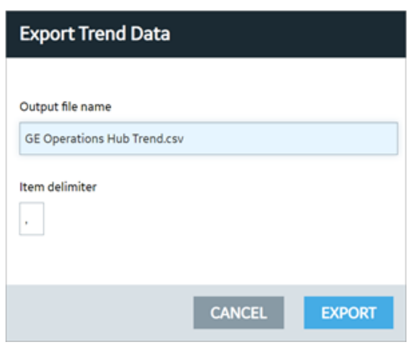


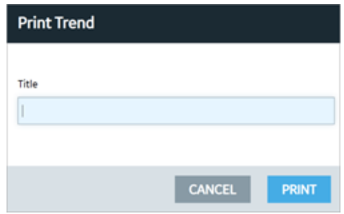
The following table describes the tasks that you can perform on a trend chart.

Task	Procedure
Access the properties used in a trend chart.	The properties used in a trend chart appear in the **Legend** section.
Show/Hide the plotted data	To display this option, select a property from the trend chart legend. Use to show or hide the data on the chart. 
Remove a property from the trend chart.	To delete plotted data from the trend chart, select the respective property from the legend, then select .
Increase the area of a trend chart.	• Hide the toolbar by selecting . • Hide the **Legend** section by selecting .

Task	Procedure
Pause the data flow of a trend chart.	This option is available only for the live mode. • On the toolbar, select to pause trending. • You can resume the data flow by selecting .
View the delta value between two data points.	The delta values for the trend is displayed in the **Legend** section.  On the toolbar, select , and select the two data points whose delta value you want to view.
Display units on the Y-axis	If a source tag has engineering units, then the unit information appears on the chart's y-axis, legend, and tooltip.  Units do not appear on a single y-axis. If you opted for a single y-axis configuration *(on page 550)*, the units appear only on the chart's legend and tooltip.
Drill down a trend chart.	On the toolbar, select to drill down or zoom into a trend chart for more granular information. To zoom out, select . If you want to zoom in or zoom out a single axis, select the axis in the drop-down list box next to .

Task	Procedure
	If you want to enlarge an area on the chart, select , and then select the area on the chart. Data is refetched only in historical mode when zoomed in/out (changes chart start time/duration) of a chart. For example, consider trending 500 samples from 1-2pm, then zoom in to 1:00 -1:10pm to request 500 samples data for that 10 minute span.
Pan across a trend chart.	You must zoom in/out of a chart to be able to pan across a trend chart. The pan icon is enabled when you perform the zoom operation. The pan icon is visible only in the **Live** mode. • Zoom in/out of a chart *(on page 537)*. • On the toolbar, select , and then drag the icon to the area on the chart that you want to view. • Move the icon left/right to pan across the x-axis. • Move the icon up/down to pan across the y-axis. In **Historical** mode: • Zoom in/out of a chart *(on page 537)*. • Use the scroll icons *(on page 540)* for Shift Left/Right to move horizontally on the x-axis. • Use the scroll icons *(on page 540)* for Shift Up/Down to move vertically on the y-axis.
Mark a trend chart view as favorite. It is an easy way to view the trend chart for commonly used configuration settings.	On the toolbar, select , enter a name for the view, and then select **Add**. 

Task	Procedure
	Important: Special characters `? / \ # ; %` are not supported. Do not include them in your favorite name. To load a favorite view, select the view from the drop-down list box next to . You can also access the list of saved favorites while creating application pages *(on page 308)* in Operation Hub. Under Trend Card widget properties, select a favorite chart view from **Select Favorite** drop-down list. The selected view loads by default when you launch the trend chart at runtime.
View the statistics of tags plotted on a trend chart.	On the toolbar, select to show/hide the statistical data for Historian tags used in the trend chart. The statistics appear below the chart. In historical mode, tag statistics are refetched on zooming in/out (changes chart start time/duration) of a chart.
Export the trend chart data.	The trend chart data is exported and saved as a CSV file. On the toolbar, select , then select to export data. 
Print a trend chart.	On the toolbar, select , then select . You have the option to provide a title that appears above the trend chart.

Task	Procedure
	
Reset the trend chart options.	On the toolbar, select , then select . Any changes you have made to the duration, start time, axis preferences, and properties are reverted.
Scroll through the historical data.	Select and to move back and forth in the chart, and access historical data. Scrolling back and forth changes the start time for the chart. For example, if you are currently viewing trends during 1-2pm, you can scroll back in time to view 12:45-1:45pm, then return to current view.

Recommendations While Using a Trend Chart

When you create a trend chart, we recommend that you apply the following guidelines:

- When you add a trend chart to a page using the page designer, use separate containers for the breadcrumb and the chart. For the trend chart, set the height to 100%.
- When accessing a trend chart on a mobile device:
  - Use a device with medium to high resolution.
  - Use the device in landscape mode.
  - To print a trend chart using an Android device, use the screen capture feature rather than selecting .
  - Configure the trend chart using a desktop rather than an Android device. This is because when you attempt to search for an asset or a Historian tag on an Android device, the in-built keyboard of the device appears, which may not allow you to enter the search criteria.
  - When you view the delta between two data points, the value may not be clearly readable on a mobile device with low to medium resolution. Therefore, we recommend that you view the delta value on a desktop or a mobile device with high resolution.

- When you view statistical data, the trend chart area may be limited. To avoid this issue, plot up to two properties on the trend chart.
- To pan across the trend chart or drill down the trend chart on an iPad, use the Zoom feature of the iPad rather than selecting , , or , respectively.

Configuring a Trend Chart

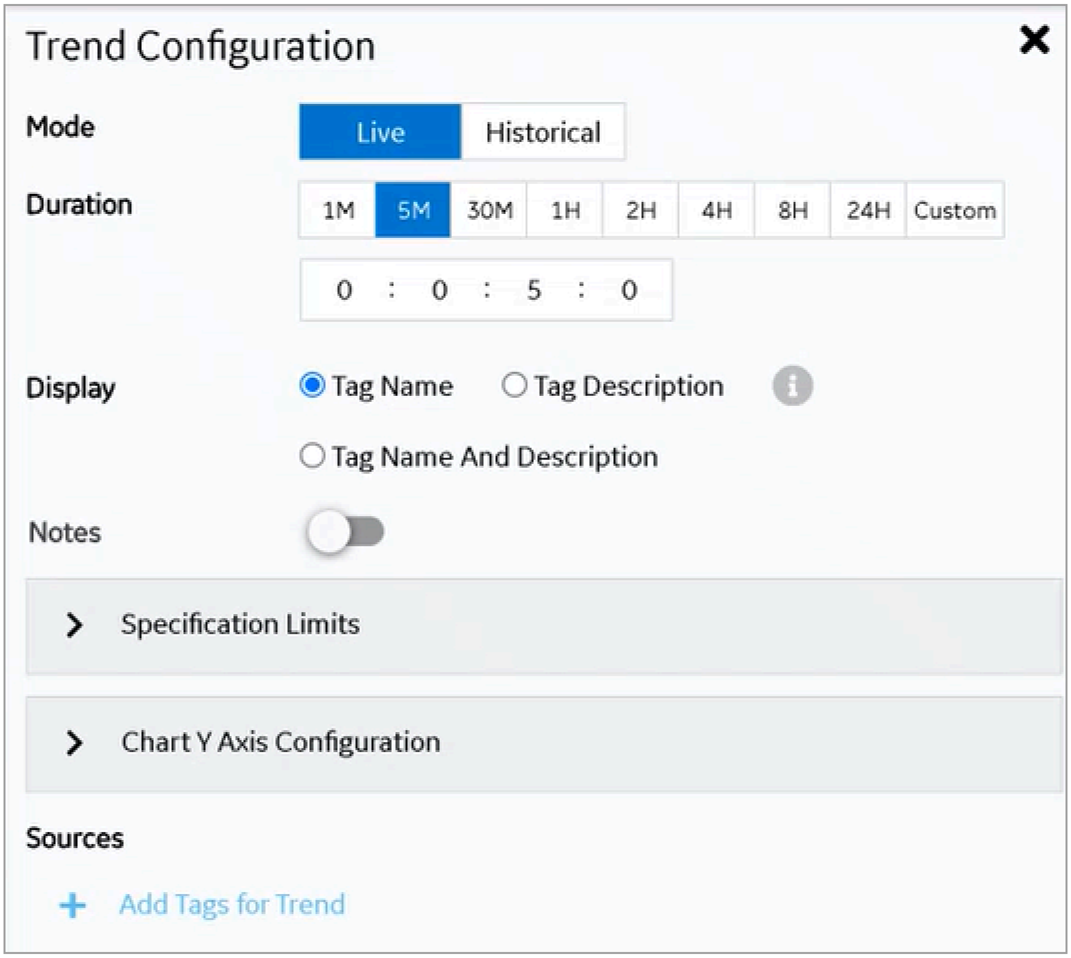
Use the trend configuration settings to create or modify your charts.

Create a Data Source *(on page 285)* for Historian or OPC UA.

For information on building trend charts, refer to these topics:

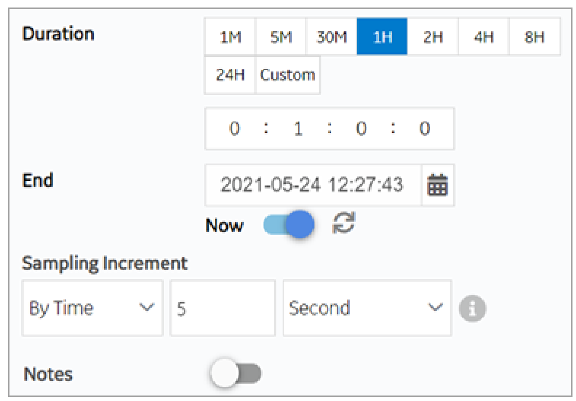
- Use the Trend Widget for OPC UA Data Sources *(on page 110)*
- Use the Trend Widget for Historian Data Source *(on page 85)*

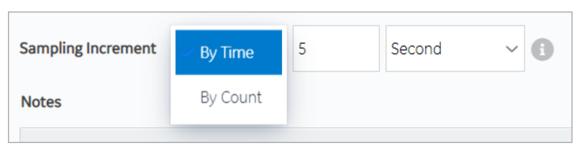
1. Access the trend chart whose settings you want to configure.
2. In the toolbar of the chart, select .
   The **Trend Configuration** window appears.



3. Modify the trend chart settings as specified in the following table.

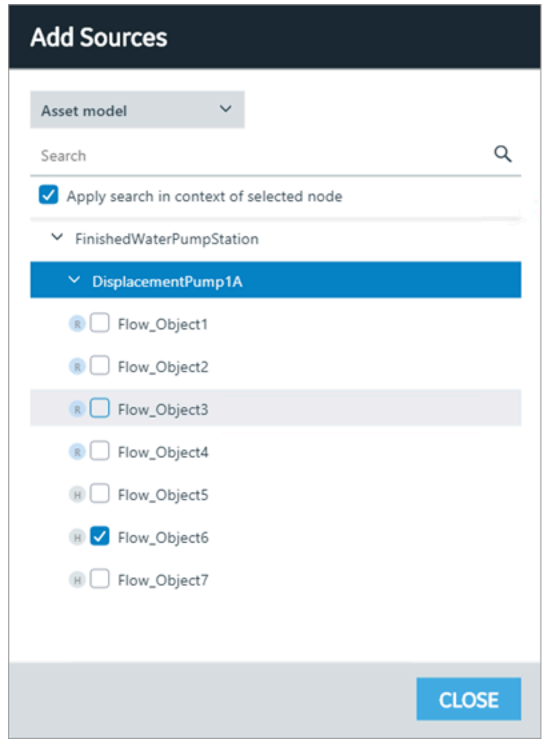
Setting	Description
Mode	Select the mode of the trend chart. The following options are available: ◦ **Live**: Plots real-time data from a Historian server and/or OPC UA server. ◦ **Historical**: Plots historical data from a Historian server. **Note:** Changes made to Live affect Historical as well. For example, if you add/delete properties from the chart in the Live

Setting	Description
	mode, these changes reflect when you move to the Historical mode as well.
Duration	Select a duration for which you want to plot the data. The selected duration is subtracted from the **End** time to deliver past trends. You can go back in time in minutes, hours, or provide a customized duration. ◦ 1, 5, or 30 minutes ◦ 1, 2, 4, 8, or 24 hours ◦ Choose **Custom** and enter a different duration in the time format text box. 
End	Allows to set an end date and time for trending historical data. Select  to update a specific date and time. ◦ If you have set a date and time in the past, select **Done** to apply. ◦ If you want to set the current date and time, select **Now** to apply. The current time can also be set by enabling the toggle switch.
Now	Allows to update the **End** time to your current system time. The toggle is enabled by default when you enter the **Historical** mode for the first

Setting	Description
	time. Choosing a different date and time automatically disables the toggle. ◦ Select to refresh 'Now' configured charts. Use this option to instantly update the end time to current time if the chart is already configured for 'Now'. ◦ You can also save a 'Now' configured chart as your favorite. When you reload such charts from favorites, the end time is set to the current system time, and trends are displayed. **Note:** After upgrading to 2.1, values from previously saved favorites are updated to represent the range for end time instead of the start time. The 'Now' toggle remains disabled for old favorites.
Sampling Increment	Select whether you want to increment the sampling data based on time or count, and then specify the time or count, respectively.  **Note:** The sampling increment may not always be honored. The maximum number of data points plotted on the trend chart is 3000 when sampling by time, and 8000 when sampling by count. You

Setting	Description
	can zoom in to view more accurate data.
Display	You have the option to set a display style on how tags appear across the trend card. The selected display style applies to configured source tags *(on page 546)* (except third party OPC UA and asset model tags), chart tooltip/legend, and Historian statistical data *(on page 539)*. Choose from these options: ◦ **Tag Name**: Displays only tag name. ◦ **Tag Description**: Displays only tag description. Lengthy descriptions are truncated with an ellipsis. Move your cursor over **...** to reveal the complete description. In the absence of a description, tag name is displayed by default. ◦ **Tag Name and Description**: Displays both tag name and description.
Notes	You can add notes only to historical trends, and not for OPC UA based trends. Switch the toggle to enable viewing or adding a note on the trend chart. On the trend chart: ◦ To add a note for the first time for a specific data point, select the data point, and then select . ◦ To access a note, select . **Note:** You cannot modify or delete a note; if you want to augment

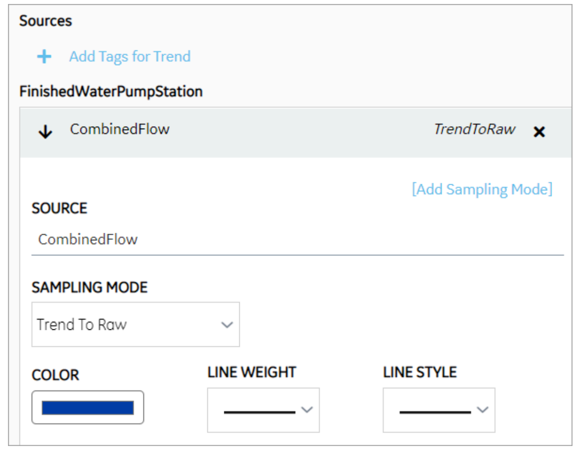
Setting	Description
	a note, you can add additional notes. ◦ To add an additional note for a data point, select . ◦ To navigate through multiple notes, use and . When you access an existing note, the timestamp and tag values that appear during the initial loading of the note correspond to the x-axis and y-axis values for the data point, respectively. If you select each individual note, the actual raw and timestamp values to which the comment was added in the Historian archive appear. If you add a note to an interpolated value, it is added to the nearest raw value. Due to this, the value displayed in the note may not always match the value plotted on the chart.
Sources	Data can be plotted to the trend chart using properties from an asset model. In the absence of an asset model, you can also directly browse the data source address space and select tags for the trend chart. Select **Add Tags for Trend** to select the properties or tags that you want to add to the trend chart *(on page 299)*.

<table>
<tr><th>Setting</th><th>Description</th></tr>
<tr><td></td><td>


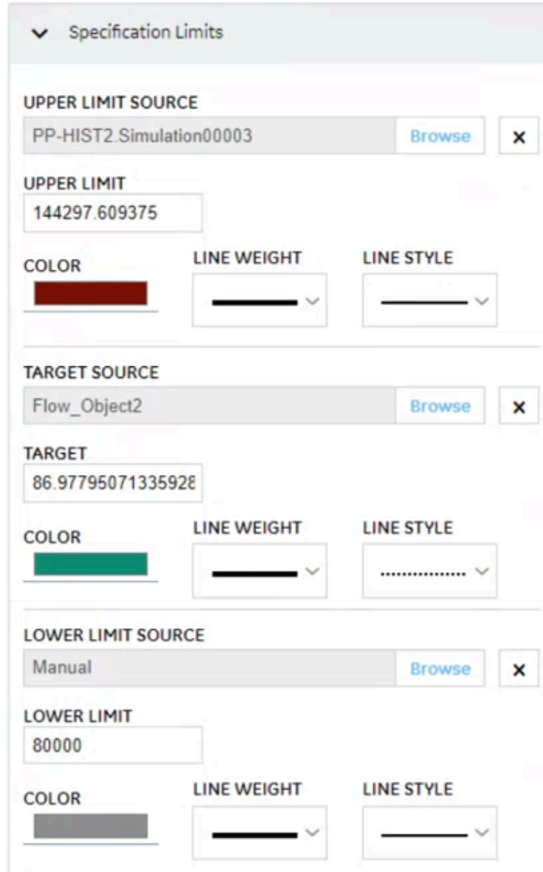
Tags marked as  are from the Historian data source. Tags marked as  are from the real time data sources such as iFIX, CIMPLICITY, and any other OPC UA server.

Note:
Nodes only work for plotting historical data. They do not work in Live mode.
</td></tr>
<tr><td>SAMPLING MODE</td><td>
For each tag SOURCE, you can add multiple sampling modes. This option is available only for the historical mode.

Select [Add Sampling Mode] to add additional sampling modes for a tag. For example, you can have 3 different sampling modes for a single tag in the trend chart. Highlight each mode with a different line color, style, and thickness.
</td></tr>
</table>

Setting	Description
	 These are the modes available to plot data: ◦ Trend To Raw ◦ Minimum ◦ Maximum ◦ Average ◦ Total ◦ Standard Deviation ◦ Interpolated ◦ Lab ◦ Lab To Raw ◦ Delta ◦ Delta Positive ◦ Delta Negative You can trend each tag-sampling mode combination only once. For example, if *Trend To Raw* mode is applied to *Water Temp* tag, this mode becomes inactive for this tag. The other modes are available to use.

Setting	Description
	To delete a plotted sampling mode, select next to the tag. For more information on the sampling modes, refer to the Historian documentation.
Specification Limits	To monitor a process performance, you can define upper, lower, or targeted limits (from varied data sources) and plot these lines on the trend chart. Provide specification limits for **UPPER LIMIT**, **TARGET**, **LOWER LIMIT** as follows: ◦ Enter values manually, (OR) ◦ Select **Browse** to browse the data source and select a tag to populate realtime data (current value). To highlight each plotted line with a unique line color, thickness, and/or style, choose a **COLOR**, **LINE WEIGHT**, and **LINE STYLE**.

Setting	Description
	 To remove a plotted limit from the chart, select  next to the specification limit. You can set the specification limits for both live and historical mode, and save the chart to favorites.
Chart Y Axis Configuration	Allows to compare two or more tags/sources by having a common Y-axis on the trend chart. ◦ **Individual Y Axis for each source**: Select this option to include an individual Y-axis for each source on a trend chart. For example, if you have multiple tags trending on your chart, each tag has its own Y-axis. ◦ **Single Y Axis for all sources**: Select this option to include a common Y-axis for all the sources on a trend chart. For exam-

Setting	Description
	ple, if you have multiple tags trending on your chart, all the tags share only a single Y-axis.
SHOW Y-AXIS	Select the toggle to switch between showing or hiding the y-axis on a trend chart. This option is available under each tag/source if you selected individual y-axis for each source.
AUTOFETCH LIMITS	By default, the toggle is always turned on, to automatically fetch minimum (Low) and maximum (High) limits. Turn off the toggle if you want to provide manual limits for the chart. Enter values for **AXIS LOW** and **AXIS HIGH** to trend the data accordingly. In case you do not enter High and Low limits when the toggle is off, the values are auto scaled. For Individual Y-axis, the option to set limits is available under each tag/source. For Single Y-axis, you can browse and select the tag/source, and set custom limits. Turn on the toggle to be able to browse tag/source.

Task Client

Configure the Task Client

This topic describes how to enable the task client widget to operate in the Operations Hub web server environment.

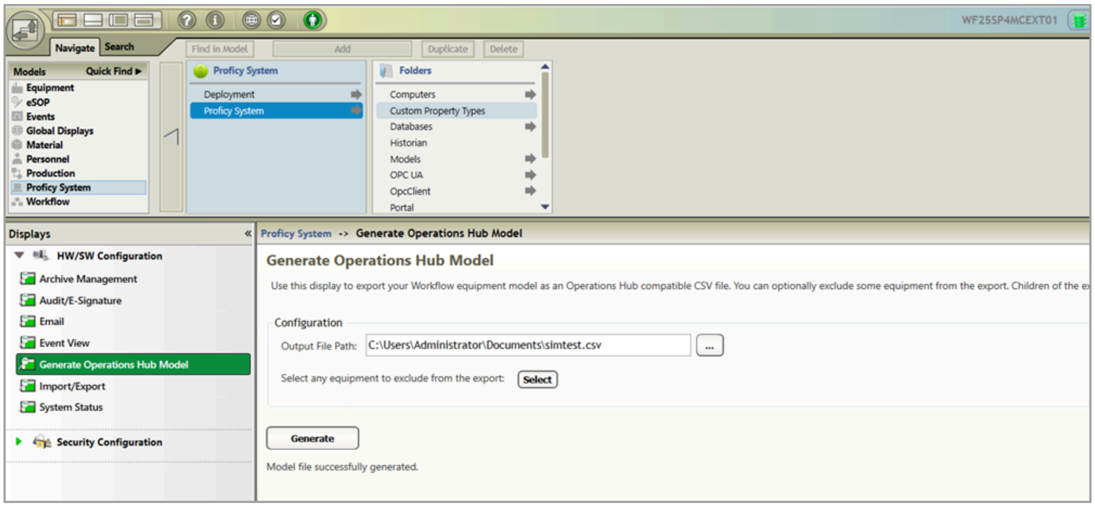
Install the Workflow and the Operations Hub applications on different servers.

To configure the task client widget, equipment models from the Workflow application are exported to a .csv file, and imported into the Operations Hub application.

1. In the Workflow server, do the following:

    a. Select an equipment model you want to export, and then select **Generate Operations Hub Model**.

    b. Provide a location to save the exported file, and select **Generate**.

    The equipment model data is exported to a .csv file format, and saved in the specified location.

2. In the Operations Hub server, do the following:

    a. Import the .csv file created in step 1 to Operations Hub. For steps, refer to the Import Equipment Model *(on page 553)* topic.

    b. In the main navigation menu, select **APPS**, and then select Workflow Tasklist application. The Pages workspace appears.

    c. Select **Tasklist View**.
    The pages associated to the task list appear in a container. `TASK LIST`, and `TASK COUNT` are system widgets that cannot be deleted.

    d. Select the **Task List** page in the container.
    The **GETASKLIST PROPERTIES** tab settings appears on the right pane.

    e. Provide **DATA** settings as specified in the table below:

    > **Note:**
    > Scroll down in the settings section to find the data settings after the general and display settings.

Parameter	Selection	Description
WorkflowServer	Manual	Enter the URL address of the Workflow server to connect.
RefreshRate	Manual	Enter the time in seconds at which rate the task client will refresh to get the latest data from the Workflow server (for example, 5).
Height	Manual	Enter the preferred height of the task client widget (for example, 600).

f. Select **Save App**.
The application settings are saved.

Log in to the Operations Hub web client to connect and work with the task client widget. Refer to the Access the Task Client *(on page 554)* topic.

Import Equipment Model

By importing the Workflow equipment models, you can manage the tasks assigned to you from within the Operations Hub application.

Ensure that the Workflow equipment models are exported to a Web HMI model .csv file.

An equipment model is configured in the Workflow application. For more information, refer to the Equipment Model topic in the *Resource Information and Configuration* section of the complete Workflow user guide.

1. Access Operations Hub.
2. In the main navigation menu, select **ADMIN**.
3. In the Admin workspace, select **Import/Export**.
   The **Model Import/Export** page appears.

Tip:

Select to hide the navigation pane that overlaps the page.

4. To import, browse and select the exported .csv file from Workflow, and select **Import**.

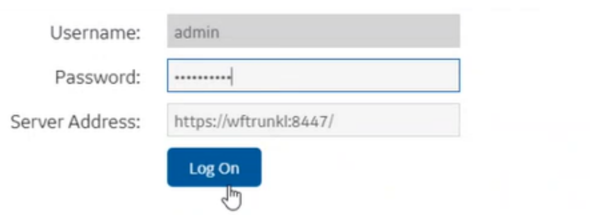
The imported information is visible under Objects and Object Types in the Admin workspace.

Access the Task Client

Use the Task Client widget to display task lists from the Workflow application in Operations Hub.

Create identical user accounts for the Operations Hub web server and the Workflow server. You must be able to log in to both the servers using the same username and password combination. Refer to the Configure the Task Client *(on page 551)* topic.

The Workflow Task List is integrated with Operations Hub. You do not have to log in to the Workflow application to manage your tasks. You can log in to the Operations Hub application, and connect to Workflow with the help of the task client widget to manage tasks.

1. Log in to the Operations Hub web client.
   The login page to connect to the Workflow server appears.
   

2. Enter the details as specified in the following table:

Field	Description
Username	The account username that has permission to access the Workflow application.
Password	The password for the username you entered in the **Username** box.
Server Address	The URL address to connect to the Workflow server. This URL is populated based on the

Field	Description
	properties provided for the Task Client widget in Operations Hub.

3. Select **Log On**.

   The task count icon indicates the status of your workflow connection.

Status	Description
	Indicates that the Workflow server is disconnected due to either of these reasons: ◦ You are not logged in to the server. ◦ Internet connection is lost. ◦ Workflow server is down. **Note:** All tasks in Operations Hub remain disabled until a connection is established.
	Indicates that the Workflow server is connected. Once connected, the task count shows the number of workflow tasks. If the count is 0, it means there are no workflows.

The user login credentials are encrypted and stored under **ENTITIES** in Operations Hub. You will not be prompted for login details again for the saved user accounts.

> **Note:**
> Whenever the Workflow server is down, or if there is no internet, the lost connection status is indicated in red. All tasks in Operations Hub remain disabled until a connection is established.

4. Select  to show the workflow equipment context navigation.

   For more information, refer to the Equipment Context topic in the *Operator Task List in the Workflow Client* section of the complete Workflow user guide.

5. Select  or  to navigate and select any of these equipment contexts: Big Enterprise, Big Unit, or Big Area.
   The equipment context set up shown in Operations Hub is created in the Workflow application.
   The list of tasks for the selected equipment context appears. Based on the list of tasks, the task count number  also gets updated.

   > **Note:**
   > Logged in users in Operations Hub can view only the tasks that are assigned to them in the Workflow application.

6. Use these options to work with the tasks:

Icon	Description
	Select to filter tasks or task steps by task name, priority, personnel assignment, step state, and expiry values. For more information, refer to the Task List Filtering topic in the *Operator Task List in the Workflow Client* section of the complete Workflow user guide.
	Select the **Tasks for Equipment** toggle to show or hide the tasks associated to the equipment location only.
	Select to start and run scheduled tasks. For more information, refer to the Start Task topic in the *Operator Task List in the Workflow Client* section of the complete Workflow user guide.
	Select to manually start a specific task step.
	Select to view and save a copy of the linked documents. For more information, refer to the Document(s) topic in the *Operator Task List in the Proficy Client* section of the complete Workflow user guide.

Icon	Description
	Select to view the instructions to complete a task or task step. This option is available only when there are work instructions defined for the task or task steps.
	Select to access the following menus, and perform task related actions: ◦ **Set Priority**: You can set a priority number for the task to run. ◦ **Jump to Task Step**: You can skip some steps and jump to a specific task step in a scheduled flow. ◦ **Enter Expiry Comment**: You can enter a reason for the task delay. The option to add a comment is available only after the task or task step has expired. ◦ **Cancel Task**: You can cancel running a specific task or task step. ◦ **Reassign Personnel**: You can reassign specific task steps to a different person or equipment location. ◦ **Acquire**: You can acquire a specific task step if it is available. ◦ **Release**: You can only release those steps that you have acquired. When you release a task step, it is available for other operators to acquire. For more information, refer to the complete Workflow user guide.
	Select to access the forms attached to a task step, and update them. For more information, refer to the *Forms and User Displays Authoring Guide* section of the complete Workflow user guide.

Icon	Description
	Note: You can load only HTML forms in the Operations Hub Task Client. Windows presentation framework (WPF), Silverlight, and .NET rich client forms are not supported.

Note:
For added security, electronic signatures are configured in Workflow for specific tasks, task steps, or forms. In such cases, a dialog box appears requesting you to sign in for verification before accomplishing any task related action.

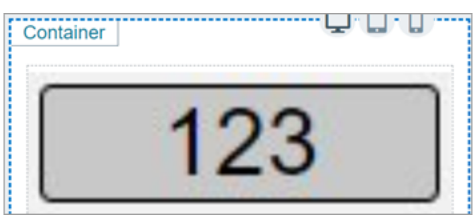
Indicator

Use the indicator widget to monitor and interpret the status of your industrial systems.

You can apply different colors and introduce gif animations to communicate a value or state effectively. The indicator widget helps to draw attention towards the changing status of a system and the indication to take corrective actions, if necessary. For a simpler version, use Simple Indicator *(on page 519)*.

The indicator widget is available under **Integration > General**. When designing application pages *(on page 308)*, drag-and-drop 

to a container.



Bind the widget to a query and set the properties to appear at runtime. You can define unique properties for values within specific ranges, and also for values that are outside of any range.

Important:
This rule applies if you have upgraded to a SIM version. Make sure to upgrade your applications *(on page 157)* before attempting to modify them in Operations Hub.

Table 44. Indicator Properties

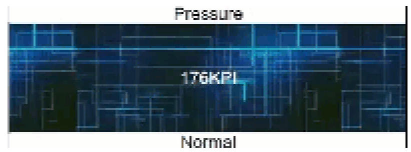
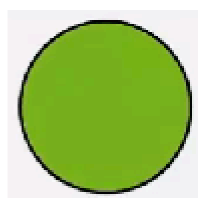
Property	Description
Multistate Indicator Value	The value is populated when you bind the indicator widget to a query.
Indicator Mode	Select to display output in any of these modes: • Analog: In this mode, the widget provides analog values as output. You can choose to add a background image, and use several other options to indicate the current status.  • Status: In this mode, the widget functions as a simple indicator status. It provides a push button to indicate the change in current status. You can also choose to show the analog values.  • Image: In this mode, you can provide a background image to indicate the change in current status. You can also choose to show the analog values along with the image. 
Display Value?	Select the check box to display the analog value.
Repeat Background Image	**Analog** indicator mode:

Table 44. Indicator Properties (continued)

Property	Description
	Select the check box to apply the background image repeatedly to provide a continuous background across the widget.
Width	**Analog** indicator mode: By default, the indicator widget occupies the width of its container. Reset the width in percentage or pixels.
Height	**Analog** indicator mode: By default, the indicator widget occupies the height of its container. Reset the height in percentage or pixels.
Size	**Image** and **Status** indicator modes: For the image mode, enter the image size in pixels. For the status mode, enter the size to set the diameter of the indicator button.
Decimal Precision (Whole Number Only)	Enter the number of significant digits after the decimal point to consider for formatting large numbers (for example 2, 3, 4). Based on the significant digits, the displayed value is rounded off to the nearest whole number.
Insert Commas	Select the check box to use comma as a thousands separator. A comma is inserted for every three digits.
Prefix Units	Enter the unit of measurement to appear as a prefix for the value.
Suffix Units	Enter the unit of measurement to appear as a suffix for the value.
Label Above	Enter the text to appear above the value.
Label Below	Enter the text to appear below the value.

Table 44. Indicator Properties (continued)

Property	Description
Font Size	Enter the size of the font for the label text.
Font Family	Select a font family for the label text.
Font Color	Select a font color *(on page 585)* for the label text.
Background Color	Select a color *(on page 585)* to fill in the background for labels and values.
Background Image	Allows to set a background image for the widget. You can: • Enter the file name of the image if copied to this location on the server `C:\Program Files\GE\Operations Hub\iqp-endapp\public\custom\Images` (OR) • Enter the complete URL address for the image from a different server. **Note:** For background image visibility, make sure that your background color has the alpha channel set to include some transparency. You can even apply a partial transparency to tint the image.
Border Type/Style	Select a border style for the widget.
Border Width	Enter the width size if the widget has a border.
Border Radius	Enter the radius size to style the corners of a border.
Border Color	Select a color *(on page 585)* for the border.
+Add Item	Select to customize settings for values within a specific range. Create an input range and highlight with unique colors and style.

Table 44. Indicator Properties (continued)

Property	Description
Input Range Low (Greater than or Equal)	Enter the lowest value to create an input range.
Input Range High (Less than)	Enter the highest value to create an input range.

About Custom Range Settings

You can add several custom ranges to the widget; each with a different input range. The custom ranges are implemented in the specified order, from first to last. If the input ranges overlap with each other, the custom range setting at the top of the order is applicable. Arrange the custom ranges in the order you want them to be implemented.

- Select for the custom range to move upwards in a list.
- Select for the custom range to move downwards in a list.
- Select for the custom range to remove from the list. These inputs are deleted.

Batch

Batch Widgets Overview

This topic describes the widgets used for batch processing.

Within Operations Hub, the batch widgets provide the same functionality as Proficy Batch Execution thick client. Also refer to Set up Batch *(on page 123)*. The batch widgets use their own data source.

The batch widgets are available under **INTEGRATION > BATCH**. When designing application pages *(on page 308)*, drag-and-drop the respective batch widget to a container and configure its properties.

1. Batch Menu *(on page 565)*
2. Batch List *(on page 565)*
3. Batch SFC *(on page 566)*
4. Batch Prompt *(on page 567)*
5. Batch Binding Prompts *(on page 568)*
6. Batch Alarms *(on page 569)*
7. Batch Phase Control *(on page 569)*
8. Batch Control *(on page 570)*
9. Batch Parameter *(on page 572)*

Table 45. Properties

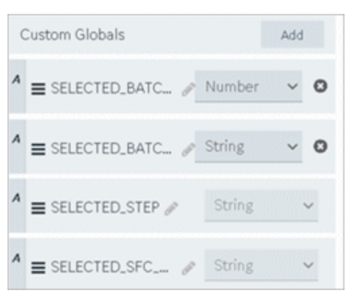
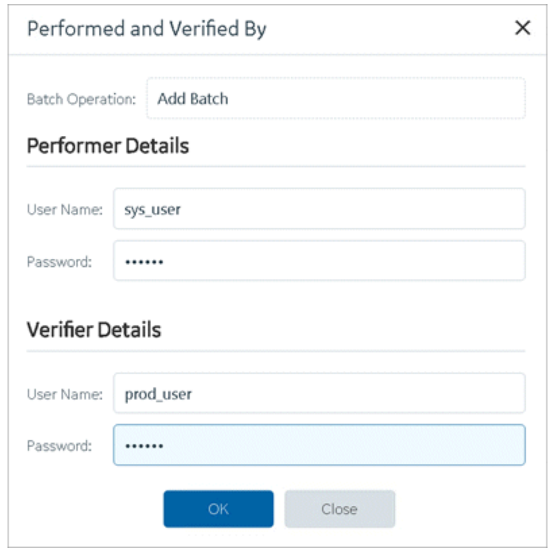
Property	Description
Style Theme	Select either **Light** or **Dark** display theme for all the batch widgets across the application. Do not mix and match themes.
API Base URL	Enter the REST API base URL you want to access.
Data Source	Select the batch data source.
Source > Batch Serial Number Source > Procedure ID Source > API Batch ID Source > Batch Id Source > Step Id Source > Recipe ID Target > Selected Batch Serial Number Target > Selected Batch ID Target > Selected Batch Description Target > Selected Recipe ID Target > Selected Recipe Version Target > Selected Step Target > Selected Batch SFC Branch Target > Selected Batch Procedure ID	Configure the properties to these global variables. • SELECTED_BATCH_SERIAL_NUMBER • SELECTED_BATCH_ID • SELECTED_BATCH_RECIPE_ID • SELECTED_STEP • SELECTED_SFC_BRANCH • SELECTED_PROCEDURE_ID • SELECTED_BATCH_CMD_MASK • SELECTED_STEP_CMD_MASK • SELECTED_BATCH_RECIPE_TYPE The global parameter values contain batch instance information to execute batch related operations. Global variable can be a string or a number. 
Enable hide columns	Select/Clear the check box to hide/show columns at runtime.

Table 45. Properties (continued)

Property	Description
Request Interval (Seconds)	At runtime, the widget is updated with new information in the set amount of time in seconds.
eSignature Requirement	By default, e-Signatures are turned off for batch widgets, which is `None`. To enable e-Signatures, select any of the following options: • `Performed By`: If you select this option, enter the user authorized to e-sign in the **Performed By** field. • `Performed By/Verified By`: If you select this option, enter the user/s authorized to e-sign and verify in the **Performed By** and **Verified By** field. **Note:** To e-sign and verify, user/s should be part of the Windows domain group on the Batch system. e-Signature is available for Batch Control, Batch Step Control, Batch Parameter, Batch Phase Control, Batch Prompts, and Batch Binding Prompts. This is an example of an e-sign user name and password request at runtime:

Table 45. Properties (continued)

<table>
<tr><th>Property</th><th>Description</th></tr>
<tr><td></td><td>
</td></tr>
</table>

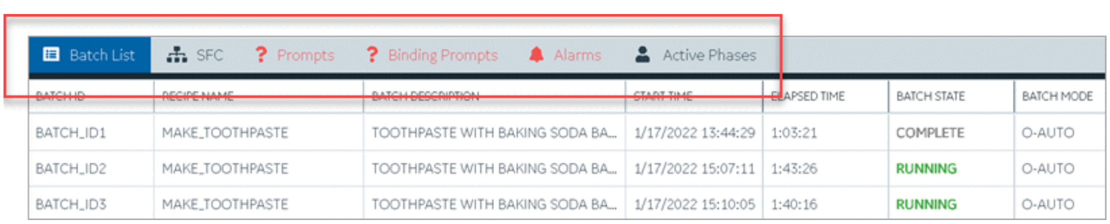
Batch Menu

Set up a navigation menu for other batch widgets.

Configure batch menu in Operations Hub designer:

1. Drag-and-drop **Batch Menu** to a container.
2. On the properties tab, go to the **BEHAVIOR** section.
3. To set up an action for each batch menu header, select **Go to page**, and then select the batch widget you want to link.

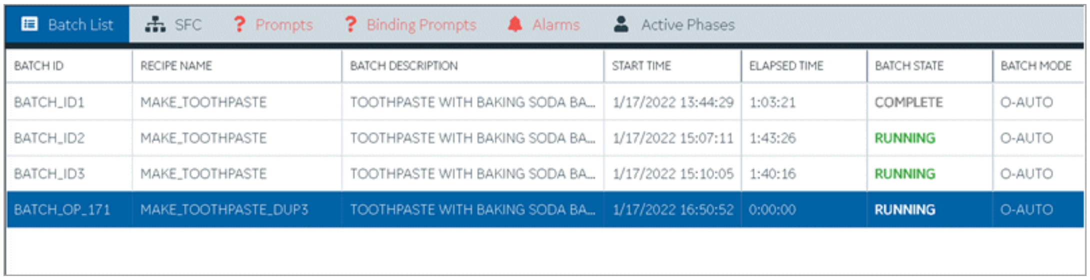
At runtime, the horizontal menu bar provides quick access to Batch List *(on page 565)*, Batch SFC *(on page 566)*, Batch Prompts *(on page 567)*, Batch Binding Prompts *(on page 568)*, Batch Alarms *(on page 569)*, and Batch Phase Control *(on page 569)*.



Batch List

Provides a list of your batch instances at runtime.

Select a batch from the list and use the Batch Control *(on page 570)* widget to perform operations.



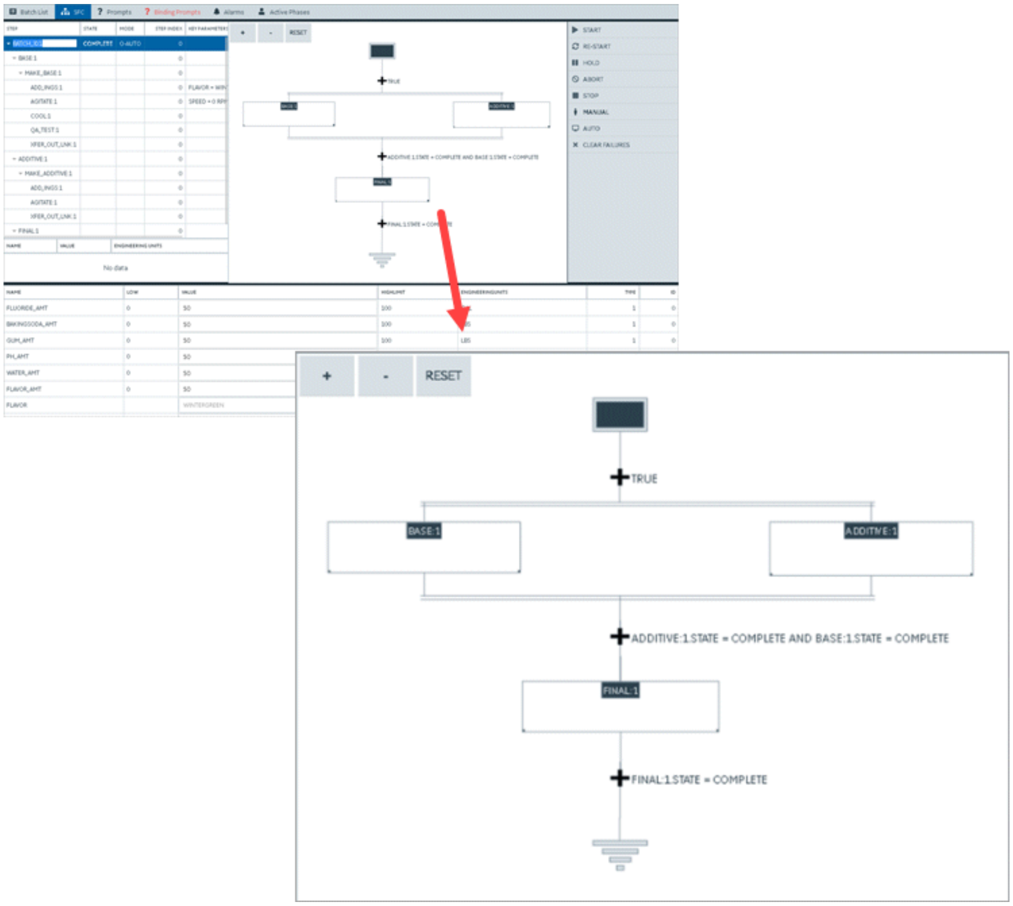
Batch SFC

Manage your batch instances in a sequential and controlled manner.

To set up the batch SFC page in Operations Hub designer:

1. In the main container, drag-and-drop **Batch Menu**.
2. Add a secondary container and drag-and-drop **Batch Step List**, **Batch SFC**, **Batch Reports** and **Batch Step Control**.
3. In the main container, drag-and-drop **Batch Parameter** and **Batch Recipe Info**.
4. Configure properties for all the widgets added to the SFC page.

At runtime, select the **SFC** tab to review batch related sequential tasks, and control their execution process. A flow chart provides a visual representation of the executed steps.



Batch Prompts

Monitor and acknowledge prompts at runtime.

To set up the batch prompts page in Operations Hub designer:

1. In the main container, drag-and-drop **Batch Menu** and **Batch Prompts**.
2. Configure properties for all the widgets added to the prompts page.

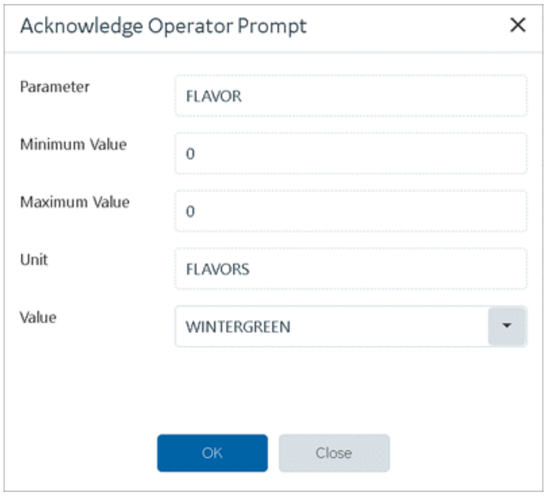
At runtime, the **Prompts** tab is highlighted to indicate pending items for acknowledgment.

Acknowledge Prompts

1. Select the **Prompts** tab.
2. Select the prompt you want to acknowledge.
3. If e-Signature is enabled, enter the user name and password to proceed.

   The **Acknowledge Operator Prompt** screen appears.

4. Select a **Value** and select **OK**.



A message appears on acknowledging the prompt.

Batch Binding Prompts

Monitor and acknowledge binding prompts at runtime.

To set up the batch binding prompts page in Operations Hub designer:

1. In the main container, drag-and-drop **Batch Menu** and **Batch Binding Prompts**.
2. Configure properties for all the widgets added to the binding prompts page.

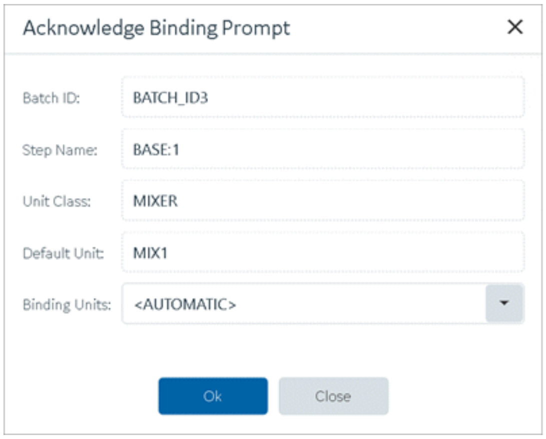
At runtime, the **Binding Prompts** tab is highlighted to indicate pending items for acknowledgment.

Acknowledge Binding Prompts

1. Select the **Binding Prompts** tab.
2. Select the binding prompt you want to acknowledge.
3. If e-Signature is enabled, enter the user name and password to proceed.

   The **Acknowledge Binding Prompt** screen appears.

4. Select **Binding Units** and select **OK**.



A message appears on acknowledging the binding prompt.

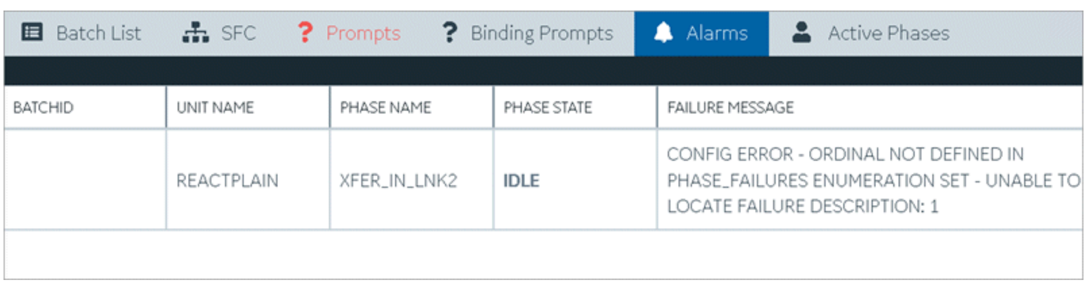
Batch Alarms

Displays alarms triggered during batch processing.

To set up the batch alarms page in Operations Hub designer:

1. In the main container, drag-and-drop **Batch Menu** and **Batch Alarms**.
2. Configure properties for all the widgets added to the alarms page.

At runtime, the **Alarms** tab is highlighted to draw your attention to the triggered alarms.



Batch Phase Control

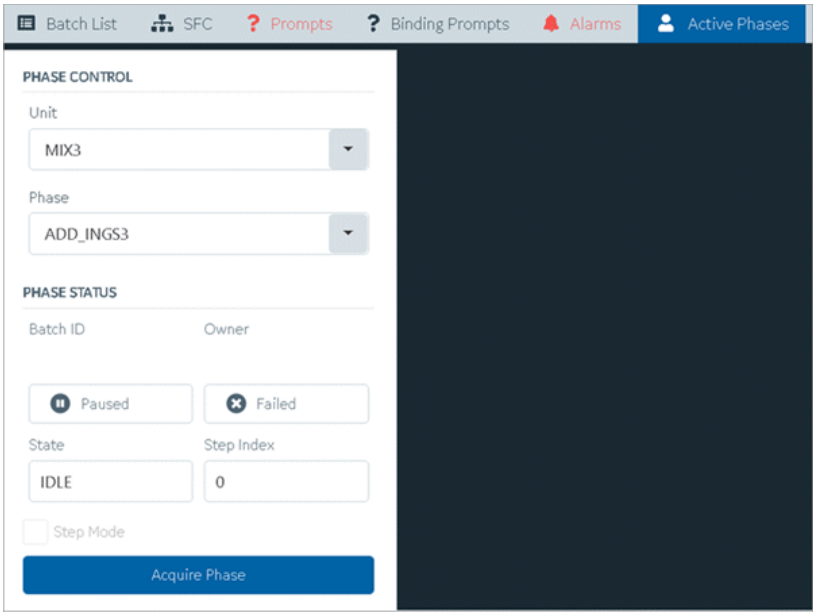
Allows to individually execute a phase in a batch process.

To set up the batch phase control page in Operations Hub designer:

1. In the main container, drag-and-drop **Batch Menu** and **Batch Phase Control**.
2. Configure properties for all the widgets added to the phase control page.

At runtime,

1. Select the **Active Phases** tab.
2. Select a **Unit** and **Phase**.
3. Select **Acquire Phase**.



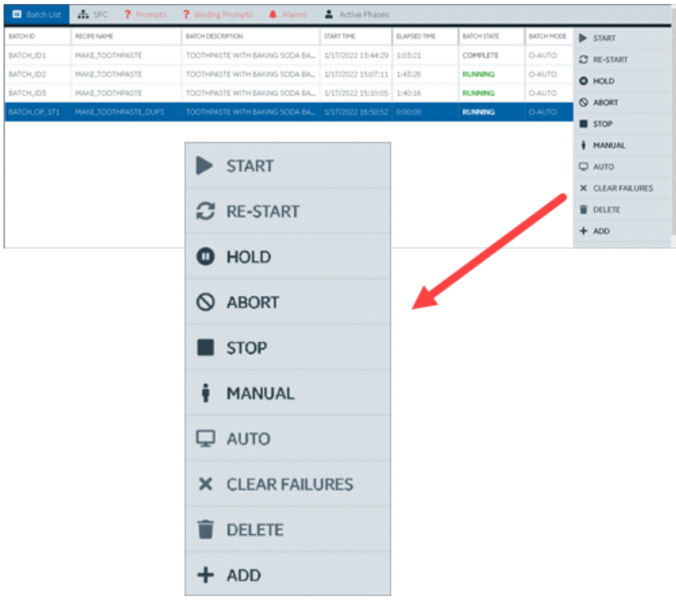
4. After acquiring the phase, select a **Command** to execute from the available commands for the phase.

   The commands are based on the status of the acquired phase.
5. Enter the batch ID for the phase and select **OK**.

   Go to **Batch List** tab to verify that the phase is executed.

Batch Control

Create and manage batch instances at runtime.

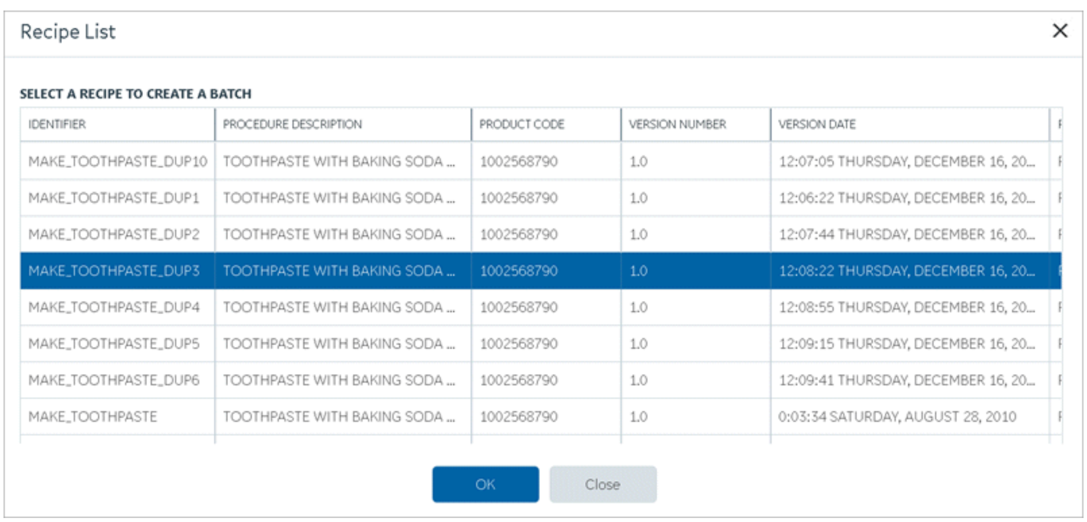


Create a Batch

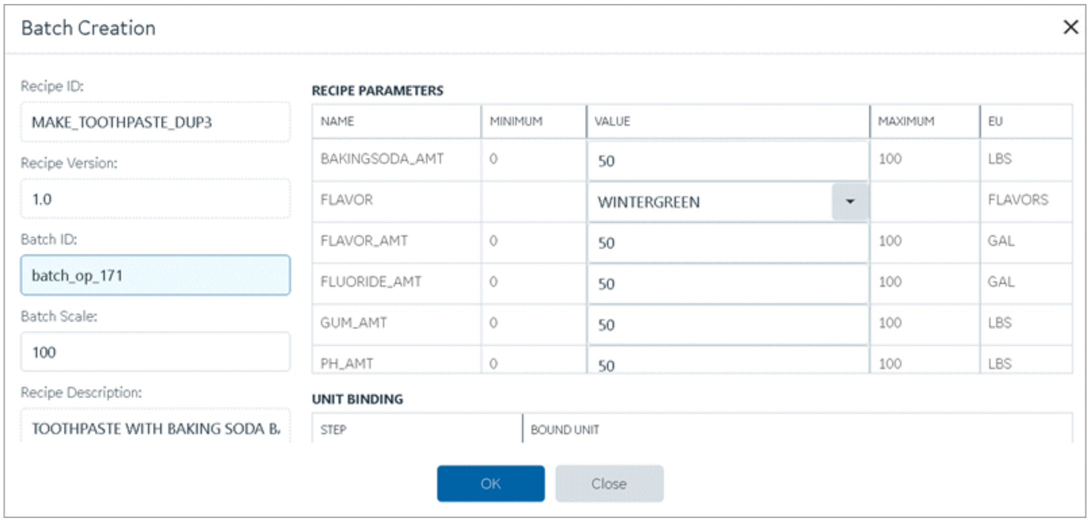
1. Select the **Batch List** tab.
2. Select **ADD**.

   If e-Signature is enabled, you are prompted to enter user name and password to proceed.

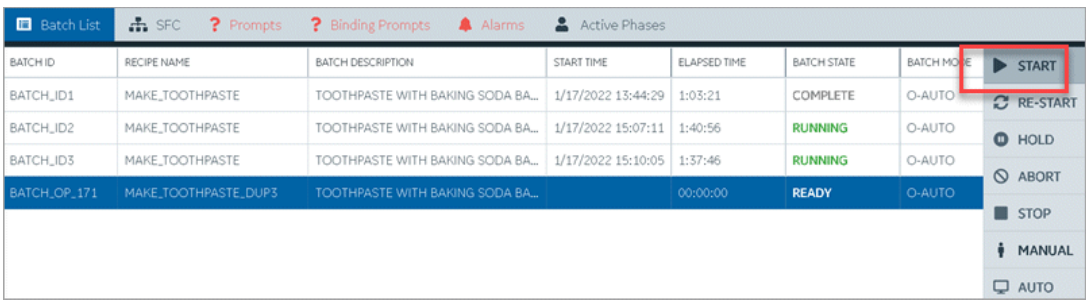
   The **Recipe List** screen appears.
3. Select a recipe and select **OK**.



   The **Batch Creation** screen appears.
4. Enter the **Batch ID** and select **OK**.



5. Select the newly created batch and select **START**.



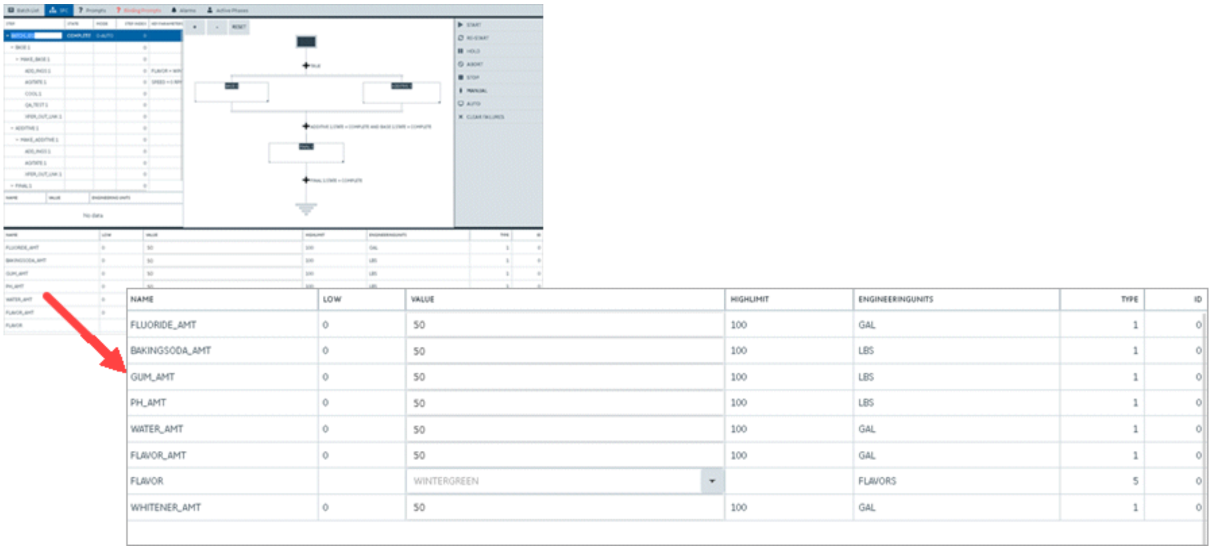
6. If e-Signature is enabled, you are prompted to enter user name and password to proceed.

   The batch state appears as `RUNNING`.

Batch Parameter

Displays parameters for batch processing.

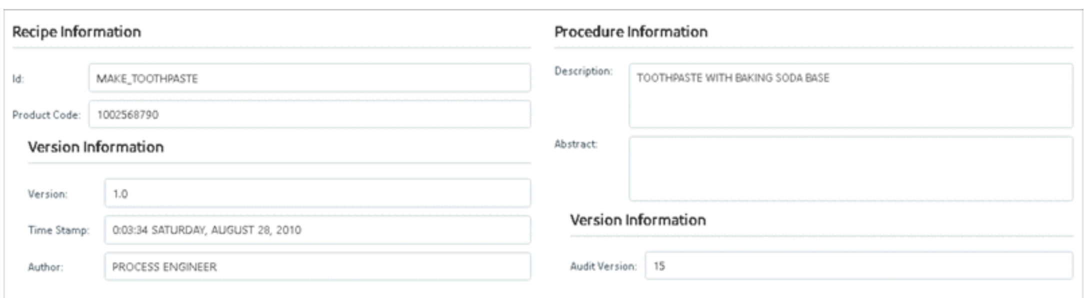
Select the **SFC** tab to review the parameters.



Batch Recipe Info

Displays batch recipe information.

Select the **SFC** tab to review the recipe information.

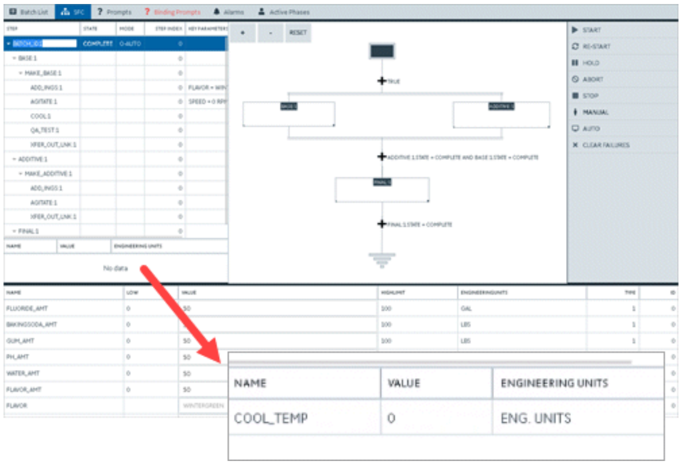


Batch Reports

Generates a report for specified steps.

You can configure reports while creating your batch recipes. If a specific step in a batch is configured for reports, then a report is generated after the completion of the step at runtime.

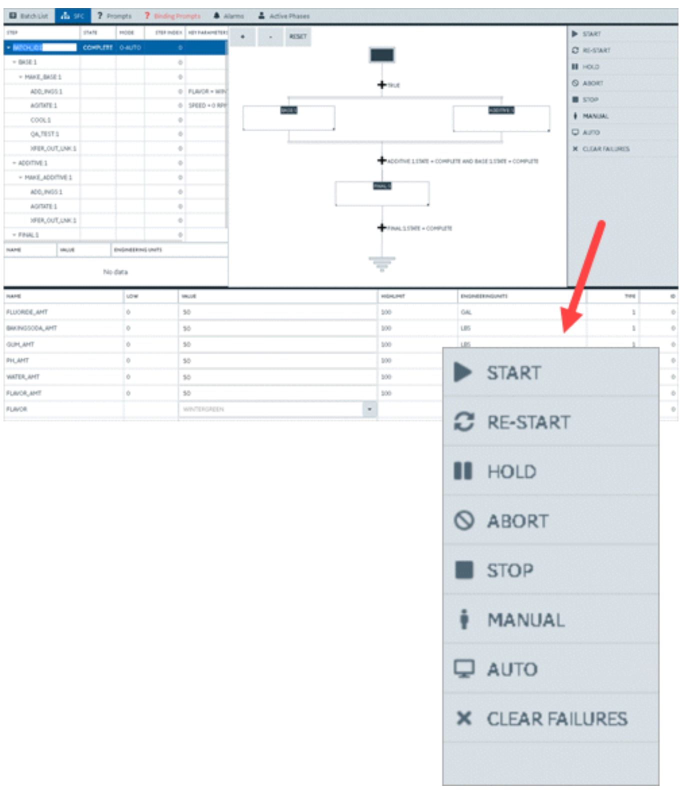
Select the **SFC** tab to view reports.



Batch Step Control

Run operations on selected batch steps at runtime.

Select the **SFC** tab to access step control options.



Batch Step List

Displays the status of each step in a batch process.

Select the **SFC** tab to review batch related steps.

General Reference

Page Components

This topic describes the various UI components that you can use to design your page and configure the data.

Page Design

You can add components *(on page 334)* of the following categories to a page:

Field	Description
INPUTS	Contains UI components that receive input from application users. • Check Box *(on page 336)* • Radio Button *(on page 337)*

Field	Description
	• Dropdown *(on page 339)* • Input *(on page 341)* • Slider *(on page 344)* • Toggle *(on page 345)* • Button *(on page 346)* • Camera *(on page 348)* • Text Area *(on page 349)*
DISPLAY	Contains UI components that display information in the application. • Text *(on page 349)* • Header *(on page 350)* • Image *(on page 351)* • Graph *(on page 352)* • Visualization *(on page 356)* • Big Data *(on page 360)* • Grid *(on page 364)* • Map *(on page 367)* • Table *(on page 372)* • List *(on page 374)* • Gauge *(on page 375)* • Html *(on page 380)* • Interactive Map *(on page 393)*
LAYOUTS	Contains UI components that are used to design a page layout. • New Line *(on page 397)* • Separator *(on page 397)* • Container *(on page 397)* • Repeater *(on page 398)*
TOOLS	Contains UI components that allow application users to upload an Excel worksheet to load data into an entity, upload a list of devices in a CSV format, or manage events.

Field	Description
	• Event Settings *(on page 414)* • Upload Excel *(on page 415)* • Upload Devices *(on page 418)*
INTEGRATION	Contains system plug-ins/widgets.
CUSTOM	Contains custom UI plug-in components that have been uploaded by an application developer.

Component Properties

To access the properties of a UI component, select the component (a container, graph, or a breadcrumb).

Note:
Some of these fields are displayed based on the selected UI component. This list is not comprehensive.

Field	Description
Settings > General	
Label	The text that appears for components such as check boxes and drop-down list boxes.
Global Data	Allows the data to be available globally for use by other components or query inputs. This check box is enabled only after you specify an **Id** for the component.
Allow Export	Indicates whether data that appears in the component can be exported. By default, this check box is cleared.
Tooltips	Indicates whether data in a table cell should contain tooltips displaying the content. By default, this check box is cleared.
Type	The data type of an input component. If you are configuring the settings of an component of the type graph or gauge, this field contains a list of graph or gauge types.

Field	Description
Style	The style of a meter-type gauge component.
Settings > Display	
Conditions	Applies a condition that executes an action at runtime. For example, you can create a condition for the component/widget to display a control button or a warning image if the temperature recorded by the sensor exceeds 40 degrees Celsius. Select **Add conditions** to build and apply conditions *(on page 582)*.
Hidden	Select the check box to hide the component/widget at runtime. By default, this check box is cleared. When a component/widget is marked as hidden, it can be shown only on associating with a button *(on page 346)* using the toggle show/hide action. As a best practice, either use **Conditions** or **Hidden**. Avoid using these properties together.
Show on	Indicates that the component/widget is visible in the selected devices. By default, the options Mobile, Tablet, and Desktop are selected.
Settings > Data	
X-axis Label	The label of the horizontal axis of an component of the type graph.
Y-axis Label	The label of the vertical axis of an component of the type graph.
Required	Indicates whether it is mandatory to enter a value for the component that is used as an input to a query. By default, this check box is cleared.
Target Data	The query input that is the target for the value of the component.
Source	The source from which data should be retrieved to initialize the component. If you are configuring the

Field	Description
	settings of an input component, you can select one of the following options: • Data: Fetches data that from a global variable or the output value of a query. • Manual: Allows you to enter a value manually. • Formula: Allows you to create a formula using global variables and the output values of a query. If you are configuring the settings of a display component, you can select one of the following options: • Data: Displays data from a global variable or the output value of a query. • Manual: Allows you to enter a value manually. • Formula: Allows you to create a formula using global variables and output values of a query. • URL: Displays an image from a URL. • File: Allows you to upload an image for the component.
Group By	Enables to group the data in a graph by the selected tag name.
Options	Indicates whether the values in the component are hard-coded or displayed dynamically from a query.
Actions	The action that should be triggered when the component is selected.
First Option	The first option that appears in an component of the type drop-down list box (for example, select an asset).
Step	The step value used for a slider component.

Field	Description
Settings > Behavior	
Minimum	The minimum value for an component that contains a range (such as a slider or a gauge).
Maximum	The maximum value for an component that contains a range (such as a slider or a gauge).
True Label	Customized text that appears when a toggle or an indicator is active.
False Label	Customized text that appears when a toggle or an indicator is inactive.
Width	The width of the component of the type toggle.
Show <number> rows at a time	The number of rows that can appear at a time in an component of the type grid.
Validation	The validations to be applied on the value entered in an input component. You can select the following options: • Capital: Select this check box if you want application users to enter a value only in uppercase. • Minimum character: Select this check box if you want to set a minimum character limit to values entered in the component, and then enter the number of minimum characters that application users must enter in the component. • Range Limit: Select this check box if you want to set the maximum and minimum values that can be entered in a numeric, date, or time input component.
Disabled	Indicates whether you want the component to appear as disabled in the application.
Range Limit	The range of values that application users can enter in the component.

Field	Description
Stacked	Indicates whether the bars displayed in an component of the type graph should be stacked. By default, this check box is cleared.
Visual	
Rounded Corners	Applies rounded corners for the selected component.
Custom Colors	Select the check box to set these options: • Add text color. • Add container background color. • Add container border color, width, and style.
Horizontal Alignment	Aligns the component left, right, or center.
Columns/Rows	Allows to create a grid layout to design your pages. You can split the page into vertical columns and horizontal rows for better organization of page components. Enter the number of columns/rows in the text box. You can add upto 36 columns and 6 rows. **Tip:** • Use minimal columns while designing for smaller devices such as, tablets and mobile phones. • If adding more than 12 columns, avoid using nested containers. • For pages with more columns, it is recommended to test them across devices to ensure good user experience. • Consider the column gutter space and margins while planning your

Field	Description
	page layout. Columns with no content are added to the DOM and occupy few pixels of screen space.
Responsive	
Responsive Pattern	Select how the container layout must respond on web pages.

Apply Conditions

Build conditional statements that execute actions at runtime.

Create an application page, and add widget/s to a container.

1. Select the widget for which you want to add a condition.
2. Navigate to the widget's properties tab, then under **DISPLAY**, select 

.
   The conditions screen for the widget appears.
3. Create a condition using these options:

Populates values from the query/entity added to the component/widget.	Select the first value, which is used to build a conditional statement.
Use the operators to express the relationship between two values and return results that match.	◦ `=` returns true if the value on the left is *equal to* the value on the right. ◦ `>` returns true if the value on the left is *greater than* the value on the right. ◦ `<` returns true if the value on the left is *less than* the value on the right. ◦ `>=` returns true if the value on the left is *greater than or equal to* the value on the right. ◦ `<=` returns true if the value on the left is *less than or equal to* the value on the right. ◦ `<>` returns true if the value on the left is *less than or greater than* the value on the right.

	◦ `Has value` returns true if the value on the left has any value. ◦ `Doesn't have value` returns true if the value on the left is NULL.
Manual	Allows to enter a hardcoded value.
Flow	Allows to select a value from a query.

To delete a condition, select next to it.

4. **Optional:** Select to create more conditional statements and combine them.
    ◦ Select `AND` to get values that satisfy two or more conditions.
    ◦ Select `OR` to get values that satisfy atleast one from the multiple conditions specified.
5. Select **Done** to save and add the condition/s to the widget.

Globals

Globals are variables with a global scope, and are available to use with all the widgets/plugins in Operations Hub.

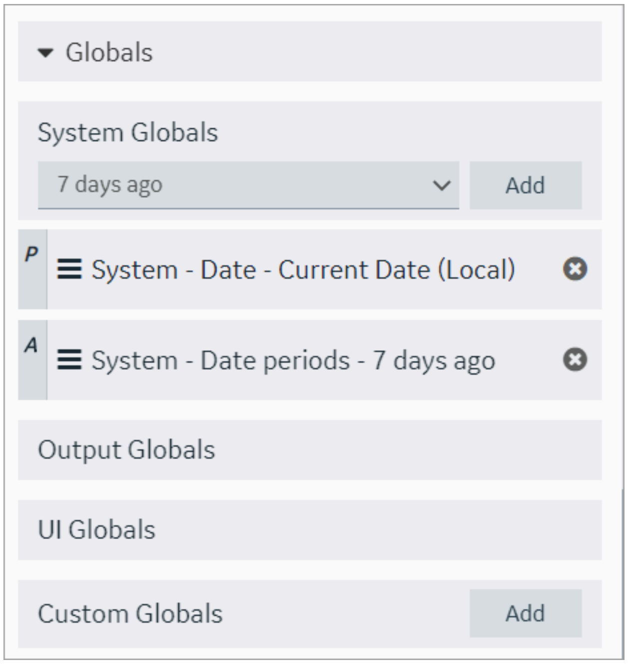
Globals are applied outside of a query. Save variables as global if you want multiple widgets to access the same data. You can also declare globals as:

- Page Global: Indicated with ***P***, this global variable is applicable only to the page.
- App Global: Indicated with ***A***, this global variable is applicable to all the pages in an application.

Note:
A particular global is used only once per page, and is applicable to the last assigned widget/plugin.

- For example, consider `abc`, `xyz`, and `123` as globals. You can assign each of these global variables as input only once on a page.
- If you first assign `abc` to a radio button as input, and assigned it later to a slider as input, then `abc` is applicable as input for the slider plugin.

To modify an added global, select to switch between Page Global and App Global.



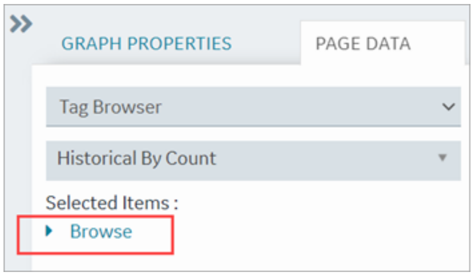
These are the different types of globals you can use with the widgets in Operation Hub:

- System Globals
- Output Globals
- UI Globals
- Custom Globals
- URL Parameters

Sample Page with Historical Data

This topic describes how to create a sample page using historical data.

1. Create an application *(on page 146)*.
2. Create a page *(on page 308)*.
3. Design a page layout using widgets such as a guage, line graph, etc.
   Refer to Page Components *(on page 575)*.
4. Select the graph in the page container to access its **PAGE DATA**.
5. Under the page data tab, select **Tag Browser** from the dropdown list.
   A list of data options appear.
6. Select Historical data from the dropdown list.
7. Select **Browse** to search the data source and select tags *(on page 299)*.



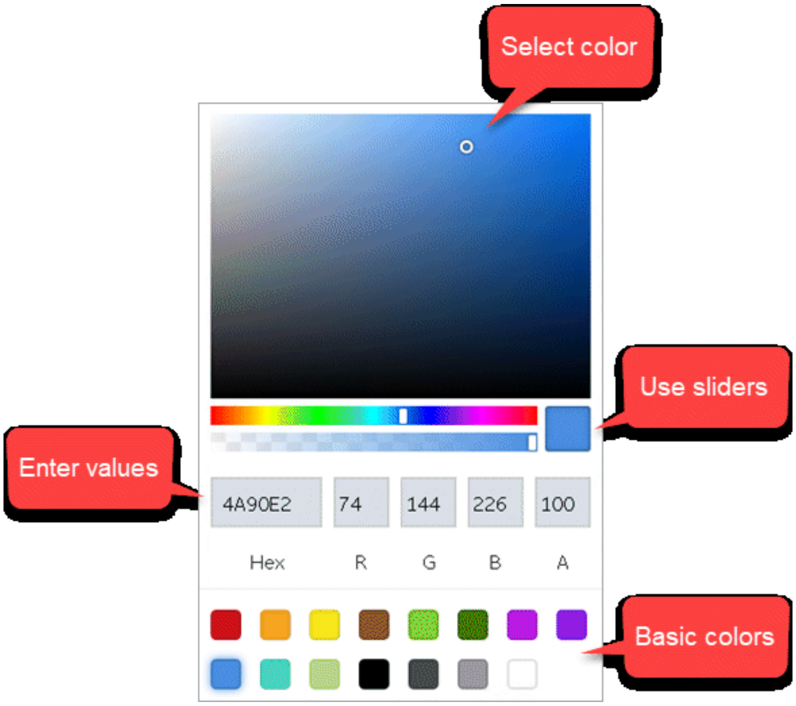
8. Drag this data and drop it on the graph.
   A message appears that the data is bound successfully.
9. Select **Save App**.
10. Select **Open App**.
    The application page opens in a web browser.

Select Colors

Use the color picker to select and apply a color to text, borders, and backgrounds.

You can:

- Select and apply a basic color scheme.
- Slide across the color wheel and make it lighter or darker.
- Enter the hexadecimal or RGB values to get the exact color.
- Use the alpha (A) value to set the transparency of the color.



LIKE Operator with Wildcards

The LIKE operator is used with wildcard characters to compare a string to a pattern, and return matched values from the database.

You can use these wildcards with LIKE to build your pattern:

- **%** The percent symbol stands for zero or more characters in a sequence.
- **_** The underscore symbol stands for only one character. This single character can also be a number or any punctuation character.

> **Note:**
> If using the MS Access database, use these wildcards instead of % (percent) and _ (underscore):
>
> - ***** Asterisk to represent zero or more characters in a sequence.
> - **?** Question mark to represent a single character.

The LIKE pattern is case insensitive, and is set in single quotes. Employ % and _ with any other character/s (denoted by XY in the table) to search through your database. The wild cards can also be used in combination.

Pattern	Description
LIKE '%X'	Returns values that end with X. These values can have zero or more characters before X.
LIKE '%XY'	Returns values that end with XY.
LIKE 'X%'	Returns values that start with X. These values can have zero or more characters after X.
LIKE '%X%'	Returns values that contain X. These values can have the X character in any position (start, end, second, fourth, etc.)
NOT LIKE '%X%'	Returns values that do not contain X.
LIKE 'X%Y'	Returns values that start with X and end with Y. These values can have zero or more characters between X and Y.
LIKE 'X_'	Returns values that start with X and has one character after X.
LIKE 'X___'	Returns values that start with X and has three characters (3 underscores) after X.
LIKE 'X__Y'	Returns values that start with X and end with Y, and has two characters (2 underscores) between X and Y.
LIKE 'X__%'	Returns values that start with X and has two characters (2 underscores) after X, followed by zero or more characters.
LIKE '%_X_%'	Returns values that contain X if matches with these rules: • X cannot be in the first or last position. • Implies atleast 3 characters including X. • Can have zero or more characters before and after the 3 characters.

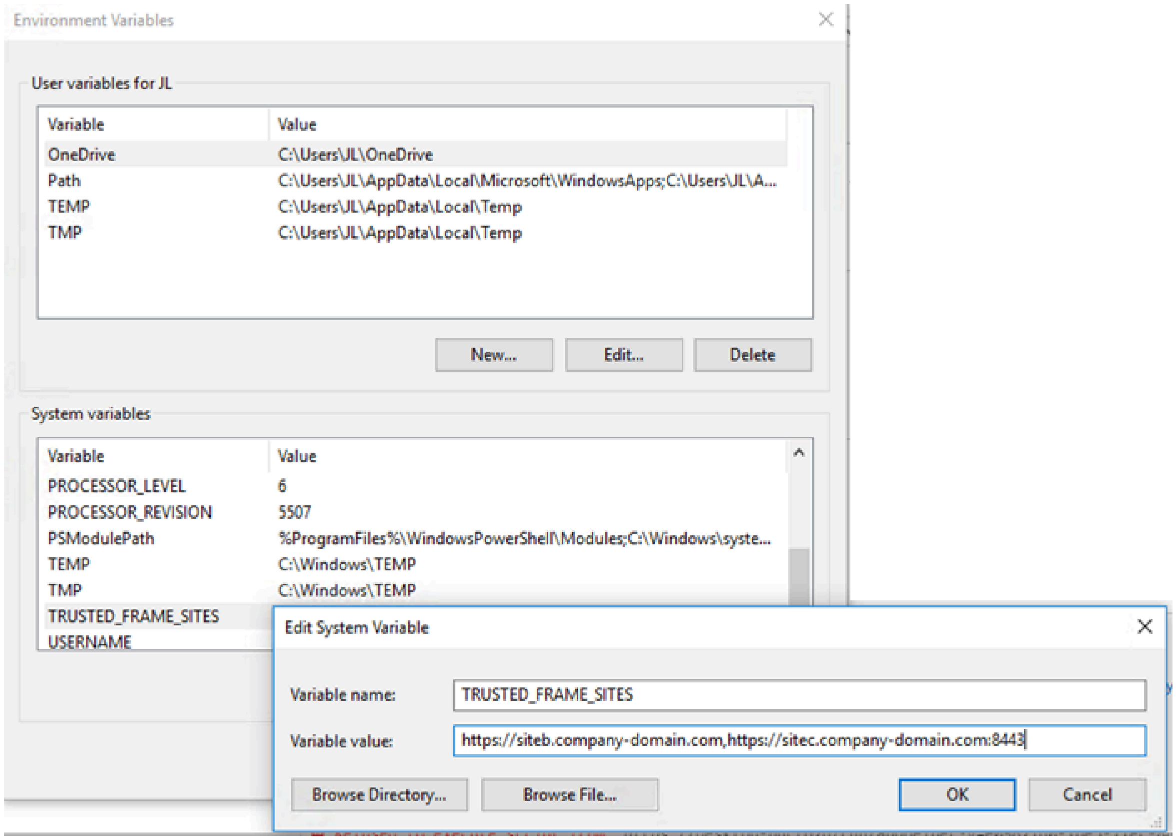
Whitelist Websites

Operations Hub allows to load content from whitelisted URLs.

With Operations Hub v2.1 release, third party websites are no longer allowed to use iframe to embed End Apps into their pages because of security considerations.

Starting with Operations Hub v2.1 SIM2, it is possible to whitelist trusted sites to use iframe with End Apps. Note at this time, this whitelist applies to all End Apps.

1. Gather a list of one or more websites that you want to use iframe to embed EndApps.
    a. Format each website URL as follows with the actual hostname and port number:
    ```
    https://hostname:port
    ```
    b. For hostname, enter simple names or fully qualified domain names (FQDNs). It is recommended to include all referenced aliases.
    c. Ignore the port if it is `443`.
2. On the host machine where Operations Hub is installed, add an environment variable `TRUSTED_FRAME_SITES`.
    a. Open the Windows Run command.
    b. Enter `sysdm.cpl` and select **OK**.
    The **System Properties** window appears.
    c. On the **Advanced** tab, select **Environment Variables**
    The **Environment Variables** window appears.
    d. Select **New** to create a system variable with **Variable name** `TRUSTED_FRAME_SITES`.
    e. For **Variable value**, enter a comma-separated list of the sites gathered in the previous step. For example, `https://siteb.company-domain.com,https://sitec.company-domain.com:8443`



3. Save and close all the windows.
4. Restart GE Operations Hub IQP EndApp service for this change to take effect.

You have successfully set up a list of whitelisted websites.

Note:

- An End App authenticates users for access. Recent versions of Chrome have enforced a default SameSite policy on cookies. Hence, sites that embed an End App must be on the same parent domain as the Operations Hub's host domain. For example, if Operations Hub is on `domain ophub.company-domain.com`, then`foo.company-domain.com` is acceptable, but not `bar.company.local`.
- By default, Operations Hub End Apps can embed 3rd party contents using iframes without restriction. However, customers may choose to whitelist such 3rd party contents using an

environment variable `TRUSTED_FRAME_SOURCES` similar to `TRUSTED_FRAME_SITES`. In such cases, ensure that the certificates used for https protocol by 3rd party websites are trusted on client (browser) nodes.

Language Support

Updated language support is provided with a SIM, which includes additional translated strings for all languages. Operations Hub currently supports these languages:

- Chinese
- Czech
- English
- French
- German
- Italian
- Japanese
- Korean
- Portuguese (Brazilian)
- Russian
- Spanish
- Turkish

You need to update your browser settings to translate in your preferred language. For example, to change the language in Chrome browser:

1. Open Chrome **Settings**.

   `chrome://settings/`

2. From the menu, go to **Advanced > Languages**.
3. In the languages screen, select **Language** to expand.
4. If your preferred language is not listed, select **Add languages**.
5. Select the check box for the language you want to show up in the list.
6. Select the *More actions* icon next to your preferred language.
7. Select the check box for **Display Google Chrome in this language**.
8. Restart Chrome to apply the changes.

APIs

Operations Hub M2M Device RESTful APIs

Operations Hub allows sensors to connect directly to the Operations Hub server using RESTful services to broadcast sensor data and receive commands. The connection to the Operations Hub server uses Standard REST POST calls.

The Operations Hub gateway identifies the information source based on the following parameters::

- Remote Device Unique Identifier: By remote device, we refer to gateways of any type supporting an http connection. Usually, the best way to create a unique ID is by using the gateway's MAC address.
- Remote Sensor/Controller Unique Name: Any name can be used as long as it is unique to the gateway. It could be a logical name (for example, Sensor1 or the address of the sensor (if it has one)).
- The Operations Hub Account: Account username and password.

API Handshakes

The handshakes define the message structure and message types exchanged between the device and the Operations Hub cloud. The Operations Hub API supports 3 types of request:

- Login: The device asks to be authenticated.
- Publish: The device sends new sensor data to Operations Hub.
- Subscribe: The device requests new commands or control instructions from Operations Hub.

JSON Message Format

Messages exchanged between the Operations Hub server and the device client are in the JSON format. JSON is a string representation of data; it is lighter than XML, and hence, it is more suitable for M2M messages. JSON messages are formatted as name/value pairs: `"variable name":"variable value"`

Messages can contain more than one variable using a comma as the delimiter: `{"variable name1":"variable value1","variable name2":"variable value2"}`

The variable value can be a list of parameters, enclosed in curly braces {} using a comma as the delimiter. For example: `{"variable name":{"parameter1":"value1","parameter2":"value2"}}`

Client Login

Before communicating with the Operations Hub server, the device client must login to the server. The login URL is: `https://<Operations Hub_Site_URL>/app/iqp/rest/login`

1. To login, the client sends a login request: `{"handshake":{"stage":"login"},"login":{"username":"user name of the user","password":"password of the user"}}`
2. The server responds with a success or failure message: If authentication succeeds; the server responds with code 1 and provides the client with a token: `{"handshake":{"stage":"login","code":"1"},"token":"token number"}`. If authentication fails, the server responds with code 0: `{"handshake":{"stage":"login","code":"0"}}`. If the login fails, the client must request the login again.
3. The token returned by the server is a unique identifier, which serves to identify the client during further communications with the server. The token must be included in all the publish and subscribe messages from the client to the server. The token remains valid as long as the client communicates with the server. If the device is inactive for 20 minutes or longer, the token will expire. If the client attempts to communicate with the server using the token after it has expired, an unauthorized message will be returned by the server. When this happens, the client must login again to receive a new token.

Publishing M2M Data

The publish stage is used by the Gateway/Device/Sensor to send new data to the Operations Hub server. The publish URL is: `https://Operations Hub site URL/app/iqp/rest/publish`. The published data is in the form of a JSON string. Each message contains the following information:

- Data Channel: The Data Channel tells the server where the data is coming from. The source is represented as a data source path, which is composed of 3 parameters, a combination of its Account name/Gateway id/Sensor id. For example: `"REST_DEMO/01-23-45-67-89-ab/temperature0"`.
    - For the Gateway id, it is recommended to use the device MAC Address or IMEI number.
    - The Sensor id can be any logical name. The name must be unique to this gateway.

> **Note:**
> The application developer in Operations Hub will use the sensor name to build their application. For this reason, it is recommended to use a logical name describing the sensor or device. For example, if the device represents a temperature sensor, use the word temperature in the name and add a number to make it unique: temperature9

> **Important:**
> For HTTP requests, avoid using spaces in names and ids.

- Metrics: The Metric Data Message defines a set of data from the sensor/device as a series of keyname:value pairs. The “keyname” in the keyname value pair defines the field in the Operations Hub M2M_data entity where the “value” will be stored. The following Keynames are supported.

Key-name	M2M_data Field	Storage	Format
met	metric	String	Developer-defined String (compulsory field)
val	data	String	Developer-defiined value (compulsory field)
lat	latitude	String	WGS84 recommended for online map compatibility (common field)
long	longitude	String	WGS84 recommended for online map compatibility (common field)
time	timestamp	Date-Time	ISO 8601 “YYYY-MM-DDThh:mm:ss.sss±TZ” (common field)
alt	altitude	String	Developer-defined value (common field)
desc	description	String	Developer-defined string
type	data_type	String	Data type of the data field “String” or “Number”
gen1	generic_1	String	Developer-defined string or value
gen2	generic_2	String	Developer-defined string or value

    - All Operations Hub payload messages must contain the metric and data keyname value pairs.
    - All other keyname value pairs are optional.
    - The order of the keyname value pairs in the payload is not compulsory.
    - If included, Timestamps must be formatted according to the ISO 8601 format specified above.
    - The Data Type entry can be used in cases where Operations Hub does not automatic identify the data type correctly.
- The Publish request process: To publish a message to the server, the client uses the following format:

```
{"handshake":{"stage":"publish"},"token":"token number","messages":[
                        {"dc":"data channel","cloud":"cloud server timestamp","data":[
                        {"alt":"value","lat":"value","long":"value","time":"timestamp recorded in the
 device","mets":[
```

```
{"met":"value","val":"value","type":"value","desc":"value","gen1":"value","gen2":"value",}
                        ]
                        }
                        }]}
```

The server will respond with a success failure message: `{"handshake":{"stage":"publish","code":"<0/1>","dc":"data channel"}}`, where code=1 represents success, and code=0 represents failure to process the message. The returned Data channel is the channel that was sent in the publish request that the response is replying to.

- Sending Multiple Metrics: Multiple metric data entries can be sent in a single publish message using the JSON array format. Arrays in JSON are in the format of "[array data]". For example: one published payload could contain several messages for a car's speed, engine temperature, fuel level, odometer, etc. or from an intermediary data server, it could contain multiple messages from several different devices. An example of a JSON publish request containing several entries:

```
{"handshake":{"stage":"publish"},"token":"00000000-00000000-00409DFF-FF521DB2", "messages":[
                        {"dc":"Operations
 Hub_Testing/REST_Device/Vehicle2","cloud":"2015-03-26T18:46:38.237+09:00","data":[


 {"alt":"1234","lat":"35.587562","long":"139.668916","time":"2015-03-26T18:44:38.195+09:00","mets":[
                        {"met":"Speed","val":"100","type":"double","desc":"kmh"},
                        {"met":"Heading","val":"180","type":"double","desc":"degrees"},
                        {"met":"Temperature","val":"98","type":"double","desc":"degrees"}
                        ]
                        },

 {"alt":"1240","lat":"35.587565","long":"139.668920","time":"2015-03-26T18:45:38.195+09:00","mets":[
                        {"met":"Speed","val":"75","type":"double","desc":"kmh"},
                        {"met":"Heading","val":"237","type":"double","desc":"degrees"},
                        {"met":"Temperature","val":"96","type":"double","desc":"degrees"}
                        ]
                        }
                        ]
                        }]}
```

Subscribing to receive M2M commands

The subscribe stage is used by the Gateway/Device/Sensor to check the Operations Hub server for commands. The subscribe URL is: `https://<Operations Hub_Site_URL>/app/iqp/rest/subscribe`. In the M2M world, Gateways/Devices can lose connection to the server from time-to-time. For this reason, the Operations Hub server does not push commands to devices. It is up to the embedded code in the device to periodically check with the server for any available commands. Subscribe requests use the following information:

- Data channel: The Gateway/Device asks the server for all commands available for a Data channel. Command requests may be for specific sensors, for all commands for a Gateway/Device or all commands for an account. The corresponding Data channel formats are as follows:
    - Specific sensor: `Account_name/Gateway_ID/Sensor_ID`
    - Specific Gateway: `Account_name/Gateway_ID`
    - Specific account: `Account_name`
- Request type: The request type identifies what stage of the subscription process we are in. The available request types are:
    - subscribe: The client requests for available commands.
    - command_list: The server sends a list of the commands.
    - no_commands: The server notifies the client that no commands are available.
    - result: The server replies to confirm whether or not the request has been processed correctly.
- Commands: The command or commands to execute. Commands are usually vendor-specific or device-specific. The commands could be AT commands or client code specific implementation commands.

Subscribe requests have the following stages.

1. Client to Server: The client requests for available commands. The client initiates the process by sending a subscribe request to the server: `{"handshake":{"stage":"subscribe"},"token":"<token>", "payload":{"dc":"<channel>","request_type":"subscribe"}}`
2. Server to Client: The server sends a list of commands to the client. If the server has commands available for the device, it will return a command list: `{"handshake":{"stage":"subscribe"},"payload":{"request_type":command_list", commands:[{"dc":"<channel>","command":"<command>"}]}}`

> **Important:**
> The server will return an array of channel specific commands. If the subscribe request was for all available commands for an account Data channel. The server response will be an array of commands where the Data channel for each command is specific to the gateway, device, or sensor that the command is assigned to.

If the server has no commands available for the device, it will return a no_commands response: `{"handshake":{"stage":"subscribe"},"token":"<token>","payload":{"request_type":"no_commands","dc":"<channel>"}}`. The datachannel, in this case, is the channel of the original request. For example, if it was for a device, it would be account/device.

M2M Device API Error codes

If an error occurs while processing requests, the server will return the following message: `{"handshake":{"stage":"error","code":"<code>"}}`

Possible error codes are:

- 1: Bad JSON Format
- 2: Unauthorized user

Operations Hub REST APIs for Integration

In addition to the existing APIs that allow devices to send data to the M2M_data entity, Operations Hub provides REST Integration APIs that enable 3rd party servers to pull data from the M2M_data entity. There are also APIs for pulling data from any custom entity in the Operations Hub database and for inserting data into custom entities.

Authentication

Before using the integration APIs, the client system must pass authentication on the Operations Hub server. The integration API login URL is `https://<Operations Hub_Site_URL>/app/iqp/api/rest/login`.

Message sent by the client: `{"username":"<user>","password":"<pass>"}`

Response of the server:

- If authentication succeeds, the server responds with code 1 and provides a token for the client to use in further communications: {"code" : "1" , "token" : "<token>"}
- If authentication fails, the server responds with code 0 and provides a reason for the failure: {"code" : "0" , "reason" : "<reason>"}. If the authentication fails, the client will need to request for authentication again before proceeding.

Get M2M data

The Get M2M data API allows a 3rd party server to retrieve data from the Operations Hub M2M_data entity: The URL for the API is: https://<Operations Hub_Site_URL>/app/iqp/api/rest/iot/data

Message sent by the client:

```
{"token": "<token>", "filters":
                [
                {"filter_type":"<column_name>","value":"<search_value>","value_type":"<type>","operator":"<operator>"}
                    ]
                    }
```

- “<token>”: The token provided to the client at login.
- “<column _name>”: The name of a valid field in the M2M_data entity.
- “<search_value>”: The value to search for in the selected field.
- “<type>”: The data type of the selected field. The following values are supported:
    - Boolean
    - Number
    - Real
    - String
    - Long string
    - Free text
    - Date
    - Time
    - DateTime
    - File
- “<operator>”: The operator to use in the search. The following values are supported:
    - =
    - >
    - <
    - >=
    - <=

  - <>
  - LIKE *(on page 586)*

> **Tip:**
> If required, multiple filters can be provided to filter the search results. All filters are treated as `{filter_1} AND {filter_2} AND … {filter_n}`.

An example of a request to retrieve all M2M_data for the device "REST_Device" after 12:00pm on 2015-03-19:

```
{"token":"08ad9058-9ec9-4363-85f1-c9071004d9992","filters":
                    [
                    {"filter_type":"device_id","value":"REST_Device","value_type":"String","operator":"="},

 {"filter_type":"iqp_timestamp","value":"2015-03-19T12:00:00.000Z","value_type":"DateTime","operator":">"}
                    ]
                    }
```

Response of the server:

- If there is data to match the search results, the server will respond with all of the matching rows in the following format:

  ```
  {"rows":
                          [
                          {"row":[<list of  <column_name>:<value>  pairs for all M2M_data columns>]},
                              {"row":[<list of <column_name>:<value>  pairs for all M2M_data columns>]},
                                  ….
                                  ]
                                  }
  ```

- If there is no data to match the search results, the server will respond with an empty list:

  ```
  {"rows":[]}
  ```

Get Entity data

The Get Entity data API allows a 3rd party server to retrieve data from any custom entity in the Operations Hub database: The URL for the API is `https://<Operations Hub_Site_URL>/app/iqp/api/rest/DB/data/get`.

Message sent by the client:

```
{"token": "<token>", "entity_name":"<entity_name>", "filters":
                    [
                    {"filter_type":"<column_name>","value":"<search
 value>","value_type":"<type>","operator":"<operator>"}
                        ]
                        }
```

- “<token>”: The token provided to the client at login.
- “<entity_name>”: The name of a valid custom entity.
- “<column _name>”: The name of a valid field in the specified entity.
- “<search_value>”: The value to search for in the selected field.
- “<type>”: The data type of the selected field. The following values are supported:
    - Boolean
    - Number
    - Real
    - String
    - Long string
    - Free text
    - Date
    - Time
    - DateTime
    - File
- “<operator>”: The operator to use in the search. The following values are supported:
    - =
    - >
    - <
    - >=
    - <=
    - <>
    - LIKE *(on page 586)*

Tip:

If required, multiple filters can be provided to filter the search results. All filters are treated as `{filter_1} AND {filter_2} AND … {filter_n}`.

An example of a request to retrieve all data from the custom entity “MathsData”, where the value in the column “Angle” is between “180” and “270” degrees:

```
{“token”:”5aad6209-bd6f-440c-9581-26ea80ec6fd32”,”entity_name”:”MathsData”,”filters”:
                [
                {“filter_type”:”Angle”,”value”:”180”,”value_type”:”number”,”operator”:”>=”},
                {“filter_type”:”Angle”,”value”:”270”,”value_type”:”number”,”operator”:”<=”}
                ]
                }
```

An example of a request to retrieve all rows of data from the custom entity “MathsData” with no conditions:

```
{“token”:”5aad6209-bd6f-440c-9581-26ea80ec6fd32”,”entity_name”:”MathsData”,”filters”:[]}
```

Response of the server:

- If there is data to match the search, the server will respond with all of the matching rows in the following format:

```
{"entity_name":"<entity_name>","rows":
                         [
                         {"row":
                         [
                         {"col_name":"<column_name>","type":"<column_type>","value":"<value>"},
                             {"col_name":"<column_name>","type":"<column_type>","value":"<value>"},
                                 ….
                                 ]
                                 }
                                 ….
                                 ]
                                 }
```

  - `“<entity_name>”`: The name of the entity the data was retrieved from.
  - `“<column _name>”`: The name of the field this value is from.
  - `“<column_type>”`: The data type of the field as specified in the entity.
  - `“<value>”`: The value of the field.
- If there is no data to match the search, the server will respond with a blank list: `{"entity_name":"<entity_name>","rows":[]}`

Insert Entity data

The Insert Entity data API allows a 3rd party server to insert data into any custom entity in the Operations Hub database: The URL for the API is `https://<Operations Hub_Site_URL>/app/iqp/api/rest/DB/data/insert`.

Message sent by the client:

```
{"token": "<token>","entity_name":"<entity_name>","rows":
                    [
                    {"row":
                    [
                    {"col_name":",column_name>","type":"<type>","value":"<value>"},
                        {"col_name":"<column_name>","type":"<type>","value":"<value>"},
                            ….
                            ]
                            }
                            ….
                            ]
                            }
```

- `“<token>”`: The token provided to the client at login.
- `“<entity_name>”`: The name of the custom entity that you want to insert data into.
- `“<column _name>”`: The name of the field in the specified custom entity that this value will be inserted into.
- `“<type>”`: The data type of the specified field. The following values are supported:
    - Boolean
    - Number
    - Real
    - String
    - Long string
    - Free text
    - Date
    - Time
    - DateTime
    - File

Note:
The type specified in the API call must be the same as the type specified for the field in the entity.

- `“<value>”`: The value to insert into the field.

An example of a message to insert 2 rows of data into the custom entity “MathsData”:

```
{"token":"9eb64909-3d08-43e8-b5ed-eae57bce32402","entity_name":"MathsData","rows":
                [
                {"row":
                [
                {"col_name":"Angle","type":"number","value":"370"},
                {"col_name":"SIN","type":"real","value":"0.1736"},
                {"col_name":"COS","type":"real","value":"0.9848"},
                {"col_name":"TAN","type":"real","value":"0.1763"}
                ]
                },
                {"row":
                [
                {"col_name":"Angle","type":"number","value":"380"},
                {"col_name":"SIN","type":"real","value":"0.342"},
                {"col_name":"COS","type":"real","value":"0.9397"},
                {"col_name":"TAN","type":"real","value":"0.364"}
                ]
                }
                ]
                }
```

Response of the server:

- If the insert is successful, the server will respond with code 1: `{"code" : "1"}`
- If the insert fails, the server will respond with code 0 and a reason: `{"code" : "0", "reason" : "<reason>"}`

Operations Hub REST APIs for App, Group, and Page Permissions

Operations Hub provides REST APIs for App, Group, and Page Permissions. The following sections outline what these APIs are and how they work.

Authentication

For proper authentication, obtain a valid UAA token with a valid scope that includes iqp.developer.

Import App

The Import App API takes a zip or xml file (same as from the UI) and returns the application id of the imported App.

- If the App is not already present, the type parameter is not required.
- If the App is already present and the type parameter is not provided, then the default is to duplicate.
- The type parameter can be explicitly provided as replace or duplicate.

Sample request for HTTP POST is as follows:

```
https://<hostname>/site/api/apps/import

https://<hostname>/site/api/apps/import?type=replace

https://<hostname>/site/api/apps/import?type=duplicate
```

The zip or xml file is part of the Request body with the key as file.

Sample response:

```
Http 200 Ok

{

     "uuid": <app id>

}
```

Get Apps

The Get Apps API returns all Apps from within Operations Hub .

Sample request for HTTP GET is as follows:

```
https://<hostname>/site/api/apps
```

The Get Apps API returns all of the Apps that are present.

Sample response:

```
Http 200 Ok

[

    {

        "name": "app name",

        "uuid": "app id"

    },

    {

        "name": "app name",

        "uuid": "app id"

    }

]
```

To filter a single App by name, the name parameter is used.

Sample request for HTTP GET is as follows:

```
https://<hostname>/site/api/apps?name={appname}
```

Sample response:

```
Http 200 ok

[

    {

        "name": "appname",

        "uuid": "app id"

    }

]
```

Get App Details for App Id

This API takes the App Id and returns the details of the App, including the UAA permitted groups.

Sample request for HTTP GET is as follows:

```
https://<hostname>/site/api/apps/{app id}
```

Sample response:

```
{

    "name": "app name",

    "id": "appid",

    "permittedUaaGroups": [],
```

```
    "pages": [
        {
            "id": "pageid",
            "name": "page name",
            "permittedUaaGroups": [],
            "queries": [
                {
                    "id": "query id",
                    "name": "query name",
                    "permittedUaaGroups": [
                        {
                            "id": "id",
                            "displayName": "group name"
                        }
                    ]
                }
            ]
        }
    ]
}
```

- Empty permission groups for App denotes **NONE** of the groups have permission to access the App.
- Empty permission groups for Page denotes **ALL** the groups have permission to access the Page.
- Empty permission groups for query denoted **ALL** the groups have permission to access the query.

Update App UAA Group Permissions

This API takes the application's universally unique identifier (UUID) and the list of UAA permissions to be updated. The permissions provided will overwrite the permission list already existing in Operations Hub.

Group id and name should match UAA group id and group name.

Sample request for HTTP POST is as follows:

```
https://<hostname>/site/api/apps/{app id}/permittedUaaGroups
Request body
[
  {
    "id": "group id",
    "displayName": "group name"
```

```
  },
  {
    "id": "group id",
    "displayName": "group name"
  }
]
```

Sample response:

```
Http 204 No content.
```

Update Page UAA Group Permissions

This API takes page's universally unique identifier (UUID) and the list of UAA permissions to be updated. The permissions provided will overwrite the permission list already existing in Operations Hub.

Group id and name should match UAA group id and group name.

Sample request for HTTP POST is as follows:

```
https://<hostname>/site/api/pages/{page id}/permittedUaaGroups
Request body
[
  {
    "id": "group id",
    "displayName": "group name"
  },
  {
    "id": "group id",
    "displayName": "group name"
  }
]
```

Sample response:

```
Http 204 No content.
```

Update Query UAA Group Permissions

This API takes the query's universally unique identifier (UUID) and the list of UAA permissions to be updated. The permissions provided will overwrite the permission list already existing in Operations Hub.

Group id and name should match UAA group id and group name.

Sample request for HTTP POST is as follows:

```
https://<hostname>/site/api/queries/{query id}/permittedUaaGroups

Request body

[

  {

    "id": "group id",

    "displayName": "group name"

  },

  {

    "id": "group id",

    "displayName": "group name"

  }

]
```

Sample response:

```
Http 204 No content.
```

Get Query Id from Query Name

This API takes the query name and returns the query id.

Sample request for HTTP GET is as follows:

```
https://<hostname>/site/api/queries?name={query name}
```

Sample response:

```
Http 200 OK

{

    "uuid": <query id>

}
```

Get Query UAA Permissions for Query Id

This API takes the query id and returns the UAA permission group list present in Operations Hub.

Sample request for HTTP GET is as follows:

```
https://<hostname>/site/api/queries/{query id}/permittedUaaGroups
```

Sample response:

```
Http 200 Ok


[
  {
    "id": "group id",
    "displayName": "group name"
  },
  {
    "id": "group id",
    "displayName": "group name"
  }
]
```

Delete App

The Delete App API removes the application from Operations Hub.

Sample request is as follows:

```
https://<hostname>/site/api/apps/{app id}
```

Sample response:

```
Http 204 no content.
```

Message Queuing Telemetry Transport (MQTT) APIs

Operations Hub MQTT Message Broker

Operations Hub includes an MQTT client. In the Operations Hub administrative console, the MQTT client can be pointed at any MQTT broker that is accessible from the network where the Operations Hub platform is installed. If there is no existing MQTT broker, a local broker can optionally be installed on the Operations Hub server during the Operations Hub installation. Refer to the Deployment section of the document.

Operations Hub MQTT implementation

Operations Hub receives status messages from devices and stores the information in the M2M_Data entity. Operations Hub defines a standard for the MQTT topic structure and how the payload is formatted in order to allow the server to identify the device source and correctly store the M2M data.

The messages contain the following information:

- Cloud ID: When a Operations Hub tenant account is created, it is assigned a unique cloud ID on the server. The cloud ID allows Operations Hub to control how the data from the device is collected and stored.
- Device ID: A device or asset could be a single machine with one or more sensors communicating directly with Operations Hub. Alternatively, a device could be a gateway device on a production line, acting like a router to forward data from multiple machines along the line to Operations Hub. All devices have unique IDs that often represent network card numbers, IMEI numbers, or MAC addresses. The device ID is the minimum requirement for Operations Hub to identify the data source.
- Instance: If you have multiple assets connected to Operations Hub through a single gateway device, the instance name provides the ability to identify which asset from which the data has been sent. The instance name is usually a logical name uniquely identifying the asset or sensor.
- Metric: The metric is a term used by Operations Hub to define the nature of the data send from a device (for example, temperature, speed, air pressure, fuel level). Metrics in the M2M_Data entity allow the application developer to define queries and events for retrieving data and triggering responses to specific conditions.

Operations Hub MQTT Topic Structure

When Operations Hub receives a message, it needs to identify the message source. The MQTT message format is defined as: <topic> <payload>

Operations Hub defines a standard topic format so that the server knows the source of the message.

The Operations Hub topic structure contains the following three components in the given order:

- Cloud_ID: This value must be the cloud_id defined in the entity cloud_users.
- Device_ID: This value can be anything. Normally, it identifies a specific device or gateway.
- Instance_Name: This value can be anything. Normally, it identifies a specific asset. It is optional.

A topic with an instance name appears as follows: `<Cloud_ID>/<Device_ID>/<Instance_Name>`

A topic without an instance name appears as follows: `<Cloud_ID>/<Device_ID>`

Operations Hub MQTT Payload Structure

For each message, Operations Hub needs to identify the metric. (For example, identify whether 32 is the reading for temperature or light.)

Operations Hub supports the following basic formats for the payload:

- Basic Payload format: The basic Operations Hub payload is usually used for simple sensors. The Operations Hub payload is formatted using keyname value pairs: `keyname=<value>`. The keyname value pairs are separated by a Tilde character (~). The basic Operations Hub Payload message uses two keyname value pairs to indicate the metric and the data. `met=<value>~data=<value>`

  Example: `met=Temperature~data=32`
- Multi Sensor Device/Gateway Payload format: For devices or gateways with multi sensor capability the Operations Hub payload supports extra keyname value pairs to allow them to send extra data.

Supported keynames: The following table provides the keynames that are supported.

Keyname	M2M_data Field	Storage	Format
Met	metric	String	Developer-defined string
Data	data	String	Developer-defined string
Lat	latitude	String	WGS84-recommended for online map compatibility
Long	longitude	String	WGS84-recommended for online map compatibility
Time	timestamp	ISO 8601 “YYYY-MM-DDThh:mm:ss.sss±TZ”	
Alt	altitude	String	Developer-defined value
Desc	description	String	Developer-defined string
Type	data_type	String	Data type of the data field String or Number
gen1	generic_1	String	Developer-defined string or value
gen2	generic_2	String	Developer-defined string or value

Note:

- All Operations Hub payload messages must contain the metric and data keyname value pairs. All other fields are optional.
- The order of the keyname value pairs in the payload is not compulsory.

- If included, Timestamps must be formatted according to the ISO 8601 format specified above.
- Data Type can be specified in cases where Operations Hub does not automatically identify the data type correctly. For example if you are sending a numeric ID, it should be treated as a String.

The keynames in the keyname value pairs define the field in the Operations Hub M2M_data entity where the value will be stored.

Note:
The latitude and longitude values are also combined and added to the M2M_data LatLong field.

Payloads with location and timestamp information

Some devices also have a built-in GPS (for example, a car). These devices can also send GPS latitude and longitude co-ordinates indicating the location of the reading. Many modern devices can also include the timestamp for the date and time the data was recorded. In this case, the payload is formatted as a set of keyname value pairs such as `met=Speed~data=120~lat=35.678~long=135.678~time=2014-12-23T07:14:30.546+09:00`

Payloads with multiple metrics

In order to reduce the number of calls required to send data from the device, a device that collects several metrics can send multiple metrics in a single payload. For example, a car device may send speed, odometer reading, and fuel level as one payload. This can be achieved by concatenating multiple metrics together in the payload using a semi-colon (;) as the delimiter.

A payload with three metrics appears as follows:
`met=Temperature~data=32;met=Pressure~data=12;met=Wind Speed~data=5`.

A payload for two metrics with GPS co-ordinates appears as follows:
`met=Speed~data=120~lat=35.678~long=135.678;met=Fuel~data=12~ lat=35.678~long=135.678`.

A payload including GPS and time details from a multi-sensor weather device appears as follows:

```
met=Temperature~data=36~lat=35.388628~long=139.673573~time=2014-12-23T07:14:30.546+09:00;
                met=Humidity~data=70~lat=35.388628~long=139.673573~time=2014-12-23T07:14:30.546+09:00;
                met=Pressure~data=1.2~lat=35.388628~long=139.673573~time=2014-12-23T07:14:30.546+09:00
```

Troubleshooting

Basic Troubleshooting

This topic contains information to help you troubleshoot issues.

To troubleshoot errors returned for OPC UA and Historian out-of-the-box (OOTB) queries, refer to Error Codes *(on page 616)* description.

To troubleshoot data source test connection errors, refer to Error Messages *(on page 635)* description.

Resolving Extension Query Error

If you do not have sufficient privileges to read or write operations, you may run into an error when attempting to execute the extension query in the end application. The error displays a generic message.

For example on a write failure, the console shows the following message:

```
{"status":{"success":false,"code":9998,"reason":"Data distributor response: Write request failed: Fail"}}
```

The Data Distributor log (`dataDistributor.log`) located at `C:\ProgramData\OphubLogs\DataDistributor` displays the following message:

```
Failed to write to NodeId ns=2;s=Channel1.testr.ss on server
 urn:CHEWY:Intellution.IntellutionGatewayOPCServer:UA%20Server with OPC UA error BadUserAccessDenied. Connection to
 server failed.
```

To resolve this issue, validate your data source connection, and the credentials to connect to the data source. In the above example, you would need to check the OPC UA server.

Tags are Not Displayed with an OPC UA Data Source

If tags are not getting displayed when you browse your correctly configured OPC UA data source, you may have to restart the GE Operations Hub OPC UA Browse Service in your Services console to resolve this issue.

Domain Redirect Error

DNS issue occurs while trying to access Operations Hub from different machines. To avoid the error, add `hostname` and `ip address` of the machine (where Operations Hub is installed) on to your host file located here: `windows/system32/drivers/etc/hosts`.

Importing App Creates Duplicate Data Sources

If you import the application on a clean install, duplicate data sources are created in Operations Hub. This occurs when Operations Hub does not have a model. When you import an application containing a model (in a .csv file) and some datasources (in the .xml file), all the data sources (containing details) that were exported during application export, are also imported. The model is also imported, which leads to the import of data sources again (without the details for the OPC UA data sources). This leads to some data sources appearing twice (once from the model, once from the app xml file).

Workaround: Configure the data source without the alias string for restoring application connectivity. Delete the duplicate (containing the alias string) if required.The model is associated with the data sources imported from the model file i.e the ones without the alias name.

Resolving SQL Connector EndApp Performance Issues

Implement these changes to achieve the best perfomance for your end applications using the SQL connection database.

1. Browse to the location directory on the machine where Operations Hub is installed: `..\ProgramData\GE\Operations Hub\iqp-config\IQP\app`
2. Open the `setting.conf` file in a text editor.
3. Enter `sqlconnector_runtime_simplejdbccall_lifetime=60000` in a new line at the end of the file.

   This means that the stored procedure meta data cache is refreshed every `60000` milliseconds (one minute). You can modify the refresh time to your requirement, but enter its value in milliseconds.
4. Search for `sqlconnector_maxConnectionPoolSize=10` and increase the pool size to your requirement.

   Currently, the pool size indicates that you can configure 10 connections for your SQL end application.
5. Save and close the file.
6. Restart the Operations Hub machine for the changes to take effect.

Unable to Access Data Sources on Single Machine Install

If you installed Historian followed by Operations Hub on the same machine, you were not able to access DATASOURCES *(on page 285)* in Operations Hub. An error message appears stating, *Unable to load data sources*.

The error occurs only when the host name in the URL has mixed/upper-case letters, which get converted to lower case. To resolve this issue, modify the registry.

1. Run **regedit** to open the Registry Editor.
2. Navigate to `\HKEY_LOCAL_MACHINE\SOFTWARE\WOW6432Node\Apache Software Foundation\Procrun 2.0\WebhmiTomcat\Parameters\Java`.
3. In the right pane, double-click **Options**.

   The **Edit Multi-String** dialog appears.
4. Modify the property `-Dwebhmi.services.auth.fastTokenServices.trustedIssuers=https://pp-hist3/uaa/oauth/token` to append a new URL entry based on the mixed/upper-case host name.

   The property is a comma-separated list of multiple URLs. For example, a URL with upper-case `PP-HIST3` is appended to the list here: `-Dwebhmi.services.auth.fastTokenServices.trustedIssuers=https://pp-hist3/uaa/oauth/token,https://PP-HIST3/uaa/oauth/token)`.
5. Restart the GE Operations Hub WebHMI Tomcat Web Server service.

Invalid Token Fix

If upgrading from 2.0 to 2.1, restart the WebClient services to allow the Plant Applications Web Client to connect successfully to Operations Hub.

- If using Enterprise WebClient version, restart the Docker service.
- If using Standard WebClient version, restart the GE PlantApps WebClient Master Control service.

Services Not Starting After Reboot

If services do not start up on rebooting a machine, visit the link for steps to modify the registry and fix the issue:

https://docs.microsoft.com/en-US/troubleshoot/windows-server/system-management-components/service-not-start-events-7000-7011-time-out-error

The operating system related issue may vary from system to system depending on the resources being utilized at start up.

Error While Loading Data Sources

After installing Operations Hub 2.1, the error "Can't load DataSources" appears while trying to access the data sources screen. This issue may occur due to any of the following reasons:

- A Java class cache file may have been corrupted. This file once created, does not change until it is deleted.
    1. Stop the webhmi tomcat service.
    2. Delete the only file in this location folder `C:\ProgramData\GE\Operations Hub\webhmi-tomcat \j9aot`
    3. Start the webhmi tomcat service.
- There may be a mismatch of letter case in the UAA host name. The hostname should be ideally in lowercase. But, if UAA (standalone or as a part of Historian install) is installed with a mixed case or capital case, the mismatch can occur leading to the issue.
- IQP tomcat can start up much quicker than webhmi during system start up. It is possible that the delayed webhmi tomcat start up is interfering with accessing the web UI. A generous wait period usually resolves this issue.

Resolving Proficy Authentication Issue During Workflow Task Client Install

Proficy Authentication (UAA) server validation fails during installation of Workflow Task Client due to the change made to UAA for TLS 1.2.

Workaround: To successfully install Workflow Task Client with Operations Hub 2022, do the following:

1. Modify Registry for TLS 1.2 *(on page 640)*.
2. Install the Workflow Task Client plugin from the Workflow installer on your Operations Hub Server host.

Resolving External Proficy Authentication Issue During Operations Hub Install

The test button used to test connectivity to an external Proficy Authentication instance fails with a message `Could not create SSL/TLS secure channel`.

Workaround: To successfully test connectivity to an external Proficy Authentication instance, do the following:

1. Modify Registry for TLS 1.2 *(on page 640)*.
2. Install Operations Hub 2022 *(on page 24)* referencing the external Proficy Authentication instance.

Workflow Task Client is unable to connect to the Proficy Server

If user upgrades from an older version of Operations Hub (still using TLS 1.1) that has the Task Client widget, and then upgrades to version 2022 or greater (which supports only TLS 1.2), then Task Client is unable to connect to the Proficy Server.

Workaround: To resolve the connectivity issue, perform the steps provided in the topic Modify Registry for TLS 1.2 *(on page 640)*.

Resolving Operations Hub Blank Login Screen

If using an older version of Chrome or Firefox, you may be presented with a blank login page.

To resolve this issue, go to your browser's settings to download the latest version of your browser, or download and install the latest updates.

Resolving 2022.4.1 Uninstallation Fail

Uninstallation of Operations Hub 2022.4.1 fails due to error in kafka uninstallation.

Workaround: Stop `iqp-kafka` service, and proceed to uninstalling Operations Hub 2022.4.1 on your machine.

Error Codes

The following table outlines the error codes returned to Operations Hub from OPC UA and the Data Distributor. These codes are returned for OPC UA and Historian out-of-the-box (OOTB) queries as integers, and can be useful in troubleshooting.

Note:

- Make sure your Operations Hub logged in user matches with the user configured in the CIMPLICITY project or iFIX node.
- For inline writes to an iFIX or CIMPLICITY mimic with direct tag bindings, make sure that your data source matches with that of the CIMPLICITY project or iFIX node name.

Code	Integer	String	Description
0x80010000	2147549184	BadUnexpect-edError	An unexpected error occurred.
0x80020000	2147614720	BadInternal-Error	An internal error occurred as a result of a programming or configuration error.
0x80030000	2147680256	BadOutOf-Memory	Not enough memory to complete the operation.

Code	Integer	String	Description
0x80040000	2147745792	BadResource-Unavailable	An operating system resource is not available.
0x80050000	2147811328	BadCommu-nicationError	A low level communication error occurred.
0x80060000	2147876864	BadEncoding-Error	Encoding halted because of invalid data in the objects being serialized.
0x80070000	2147942400	BadDe-codingError	Decoding halted because of invalid data in the stream.
0x80080000	2148007936	BadEncod-ingLimitsEx-ceeded	The message encoding/decoding limits imposed by the stack have been exceeded.
0x80B80000	2159542272	BadRequest-TooLarge	The request message size exceeds limits set by the server.
0x80B90000	2159607808	BadRespon-seTooLarge	The response message size exceeds limits set by the client.
0x80090000	2148073472	BadUnknown-Response	An unrecognized response was received from the server.
0x800A0000	2148139008	BadTimeout	The operation timed out.
0x800B0000	2148204544	BadService-Unsupported	The server does not support the requested service.
0x800C0000	2148270080	BadShutdown	The operation was cancelled because the application is shutting down.
0x800D0000	2148335616	BadServer-NotConnect-ed	The operation could not complete because the client is not connected to the server.
0x800E0000	2148401152	BadServer-Halted	The server has stopped and cannot process any requests.
0x800F0000	2148466688	BadNothing-ToDo	There was nothing to do because the client passed a list of operations with no elements.

Code	Integer	String	Description
0x80100000	2148532224	BadTooMany-Operations	The request could not be processed because it specified too many operations.
0x80DB0000	2161836032	BadTooMany-Monitored-Items	The request could not be processed because there are too many monitored items in the subscription.
0x80110000	2148597760	BadData-TypeIdUn-known	The extension object cannot be (de)serialized because the data type id is not recognized.
0x80120000	2148663296	BadCertifi-cateInvalid	The certificate provided as a parameter is not valid.
0x80130000	2148728832	BadSecurity-ChecksFailed	An error occurred verifying security.
0x81140000	2165571584	BadCertifi-catePolicy-CheckFailed	The certificate does not meet the requirements of the secu-rity policy.
0x80140000	2148794368	BadCertifi-cateTimeIn-valid	The certificate has expired or is not yet valid.
0x80150000	2148859904	BadCertifi-cateIssuer-TimeInvalid	An issuer certificate has expired or is not yet valid.
0x80160000	2148925440	BadCertifi-cateHost-NameInvalid	The HostName used to connect to a server does not match a HostName in the certificate.
0x80170000	2148990976	BadCertifica-teUriInvalid	The URI specified in the ApplicationDescription does not match the URI in the certificate.
0x80180000	2149056512	BadCertifica-teUseNotAl-lowed	The certificate may not be used for the requested operation.
0x80190000	2149122048	BadCertifi-cateIssuer-	The issuer certificate may not be used for the requested op-eration.

Code	Integer	String	Description
		UseNotAllowed	
0x801A0000	2149187584	BadCertificateUntrusted	The certificate is not trusted.
0x801B0000	2149253120	BadCertificateRevocationUnknown	It was not possible to determine if the certificate has been revoked.
0x801C0000	2149318656	BadCertificateIssuerRevocationUnknown	It was not possible to determine if the issuer certificate has been revoked.
0x801D0000	2149384192	BadCertificateRevoked	The certificate has been revoked.
0x801E0000	2149449728	BadCertificateIssuerRevoked	The issuer certificate has been revoked.
0x810D0000	2165112832	BadCertificateChainIncomplete	The certificate chain is incomplete.
0x801F0000	2149515264	BadUserAccessDenied	User does not have permission to perform the requested operation.
0x80200000	2149580800	BadIdentityTokenInvalid	The user identity token is not valid.
0x80210000	2149646336	BadIdentityTokenRejected	The user identity token is valid but the server has rejected it.
0x80220000	2149711872	BadSecureChannelIdInvalid	The specified secure channel is no longer valid.
0x80230000	2149777408	BadInvalidTimestamp	The timestamp is outside the range allowed by the server.

Code	Integer	String	Description
0x80240000	2149842944	BadNonceInvalid	The nonce does appear to be not a random value or it is not the correct length.
0x80250000	2149908480	BadSessionIdInvalid	The session id is not valid.
0x80260000	2149974016	BadSessionClosed	The session was closed by the client.
0x80270000	2150039552	BadSessionNotActivated	The session cannot be used because ActivateSession has not been called.
0x80280000	2150105088	BadSubscriptionIdInvalid	The subscription id is not valid.
0x802A0000	2150236160	BadRequestHeaderInvalid	The header for the request is missing or invalid.
0x802B0000	2150301696	BadTimestampsToReturnInvalid	The timestamps to return parameter is invalid.
0x802C0000	2150367232	BadRequestCancelledByClient	The request was cancelled by the client.
0x80E50000	2162491392	BadTooManyArguments	Too many arguments were provided.
0x810E0000	2165178368	BadLicenseExpired	The server requires a license to operate in general or to perform a service or operation, but existing license is expired.
0x810F0000	2165243904	BadLicenseLimitsExceeded	The server has limits on number of allowed operations / objects, based on installed licenses, and these limits where exceeded.
0x81100000	2165309440	BadLicenseNotAvailable	The server does not have a license which is required to operate in general or to perform a service or operation.
0x002D0000	2949120	GoodSubscriptionTransferred	The subscription was transferred to another session.

Code	Integer	String	Description
0x002E0000	3014656	GoodCom-pletesAsyn-chronously	The processing will complete asynchronously.
0x002F0000	3080192	GoodOver-load	Sampling has slowed down due to resource limitations.
0x00300000	3145728	Good-Clamped	The value written was accepted but was clamped.
0x80310000	2150694912	BadNoCom-munication	Communication with the data source is defined, but not es-tablished, and there is no last known value available.
0x80320000	2150760448	BadWaiting-ForInitialData	Waiting for the server to obtain values from the underlying data source.
0x80330000	2150825984	BadNodeIdIn-valid	The syntax of the node id is not valid.
0x80340000	2150891520	BadNodeId-Unknown	The node id refers to a node that does not exist in the server address space.
0x80350000	2150957056	BadAttribute-IdInvalid	The attribute is not supported for the specified Node.
0x80360000	2151022592	BadIndex-RangeInvalid	The syntax of the index range parameter is invalid.
0x80370000	2151088128	BadIndex-RangeNoData	No data exists within the range of indexes specified.
0x80380000	2151153664	BadDataEn-codingInvalid	The data encoding is invalid.
0x80390000	2151219200	BadDataEn-codingUnsup-ported	The server does not support the requested data encoding for the node.
0x803A0000	2151284736	BadNotRead-able	The access level does not allow reading or subscribing to the Node.
0x803B0000	2151350272	BadNot-Writable	The access level does not allow writing to the Node.

Code	Integer	String	Description
0x803C0000	2151415808	BadOutOfRange	The value was out of range.
0x803D0000	2151481344	BadNotSupported	The requested operation is not supported.
0x803E0000	2151546880	BadNotFound	A requested item was not found or a search operation ended without success.
0x803F0000	2151612416	BadObjectDeleted	The object cannot be used because it has been deleted.
0x80400000	2151677952	BadNotImplemented	Requested operation is not implemented.
0x80410000	2151743488	BadMonitoringModeInvalid	The monitoring mode is invalid.
0x80420000	2151809024	BadMonitoredItemIdInvalid	The monitoring item id does not refer to a valid monitored item.
0x80430000	2151874560	BadMonitoredItemFilterInvalid	The monitored item filter parameter is not valid.
0x80440000	2151940096	BadMonitoredItemFilterUnsupported	The server does not support the requested monitored item filter.
0x80450000	2152005632	BadFilterNotAllowed	A monitoring filter cannot be used in combination with the attribute specified.
0x80460000	2152071168	BadStructureMissing	A mandatory structured parameter was missing or null.
0x80470000	2152136704	BadEventFilterInvalid	The event filter is not valid.
0x80480000	2152202240	BadContentFilterInvalid	The content filter is not valid.

Code	Integer	String	Description
0x80C10000	2160132096	BadFilterOperatorInvalid	An unrecognized operator was provided in a filter.
0x80C20000	2160197632	BadFilterOperatorUnsupported	A valid operator was provided, but the server does not provide support for this filter operator.
0x80C30000	2160263168	BadFilterOperandCountMismatch	The number of operands provided for the filter operator was less then expected for the operand provided.
0x80490000	2152267776	BadFilterOperandInvalid	The operand used in a content filter is not valid.
0x80C40000	2160328704	BadFilterElementInvalid	The referenced element is not a valid element in the content filter.
0x80C50000	2160394240	BadFilterLiteralInvalid	The referenced literal is not a valid value.
0x804A0000	2152333312	BadContinuationPointInvalid	The continuation point provide is longer valid.
0x804B0000	2152398848	BadNoContinuationPoints	The operation could not be processed because all continuation points have been allocated.
0x804C0000	2152464384	BadReferenceTypeIdInvalid	The reference type id does not refer to a valid reference type node.
0x804D0000	2152529920	BadBrowseDirectionInvalid	The browse direction is not valid.
0x804E0000	2152595456	BadNodeNotInView	The node is not part of the view.
0x81120000	2165440512	BadNumericOverflow	The number was not accepted because of a numeric overflow.

Code	Integer	String	Description
0x804F0000	2152660992	BadServerUriInvalid	The ServerUri is not a valid URI.
0x80500000	2152726528	BadServerNameMissing	No ServerName was specified.
0x80510000	2152792064	BadDiscoveryUrlMissing	No DiscoveryUrl was specified.
0x80520000	2152857600	BadSempahoreFileMissing	The semaphore file specified by the client is not valid.
0x80530000	2152923136	BadRequestTypeInvalid	The security token request type is not valid.
0x80540000	2152988672	BadSecurityModeRejected	The security mode does not meet the requirements set by the server.
0x80550000	2153054208	BadSecurityPolicyRejected	The security policy does not meet the requirements set by the server.
0x80560000	2153119744	BadTooManySessions	The server has reached its maximum number of sessions.
0x80570000	2153185280	BadUserSignatureInvalid	The user token signature is missing or invalid.
0x80580000	2153250816	BadApplicationSignatureInvalid	The signature generated with the client certificate is missing or invalid.
0x80590000	2153316352	BadNoValidCertificates	The client did not provide at least one software certificate that is valid and meets the profile requirements for the server.
0x80C60000	2160459776	BadIdentityChangeNotSupported	The server does not support changing the user identity assigned to the session.

Code	Integer	String	Description
0x805A0000	2153381888	BadRequest-CancelledBy-Request	The request was cancelled by the client with the Cancel service.
0x805B0000	2153447424	BadParentN-odeIdInvalid	The parent node id does not to refer to a valid node.
0x805C0000	2153512960	BadRefer-enceNotAl-lowed	The reference could not be created because it violates constraints imposed by the data model.
0x805D0000	2153578496	BadNodeId-Rejected	The requested node id was reject because it was either invalid or server does not allow node ids to be specified by the client.
0x805E0000	2153644032	BadNodeId-Exists	The requested node id is already used by another node.
0x805F0000	2153709568	BadNode-ClassInvalid	The node class is not valid.
0x80600000	2153775104	BadBrowse-NameInvalid	The browse name is invalid.
0x80610000	2153840640	BadBrowse-NameDupli-cated	The browse name is not unique among nodes that share the same relationship with the parent.
0x80620000	2153906176	BadNodeAt-tributesIn-valid	The node attributes are not valid for the node class.
0x80630000	2153971712	BadTypeDefi-nitionInvalid	The type definition node id does not reference an appropriate type node.
0x80640000	2154037248	BadSource-NodeIdInvalid	The source node id does not reference a valid node.
0x80650000	2154102784	BadTargetN-odeIdInvalid	The target node id does not reference a valid node.

Code	Integer	String	Description
0x80660000	2154168320	BadDuplicateReferenceNotAllowed	The reference type between the nodes is already defined.
0x80670000	2154233856	BadInvalidSelfReference	The server does not allow this type of self reference on this node.
0x80680000	2154299392	BadReferenceLocalOnly	The reference type is not valid for a reference to a remote server.
0x80690000	2154364928	BadNoDeleteRights	The server will not allow the node to be deleted.
0x40BC0000	1086062592	UncertainReferenceNotDeleted	The server was not able to delete all target references.
0x806A0000	2154430464	BadServerIndexInvalid	The server index is not valid.
0x806B0000	2154496000	BadViewIdUnknown	The view id does not refer to a valid view node.
0x80C90000	2160656384	BadViewTimestampInvalid	The view timestamp is not available or not supported.
0x80CA0000	2160721920	BadViewParameterMismatch	The view parameters are not consistent with each other.
0x80CB0000	2160787456	BadViewVersionInvalid	The view version is not available or not supported.
0x40C00000	1086324736	UncertainNotAllNodesAvailable	The list of references may not be complete because the underlying system is not available.

Code	Integer	String	Description
0x00BA0000	12189696	GoodResults-MayBeIncom-plete	The server should have followed a reference to a node in a remote server but did not. The result set may be incomplete.
0x80C80000	2160590848	BadNotType-Definition	The provided Nodeid was not a type definition nodeid.
0x406C0000	1080819712	UncertainRef-erenceOutOf-Server	One of the references to follow in the relative path refer-ences to a node in the address space in another server.
0x806D0000	2154627072	BadTooMany-Matches	The requested operation has too many matches to return.
0x806E0000	2154692608	BadQuery-TooComplex	The requested operation requires too many resources in the server.
0x806F0000	2154758144	BadNoMatch	The requested operation has no match to return.
0x80700000	2154823680	BadMaxAge-Invalid	The max age parameter is invalid.
0x80E60000	2162556928	BadSecurity-ModeInsuffi-cient	The operation is not permitted over the current secure chan-nel.
0x80710000	2154889216	BadHistory-OperationIn-valid	The history details parameter is not valid.
0x80720000	2154954752	BadHistory-OperationUn-supported	The server does not support the requested operation.
0x80BD0000	2159869952	BadInvalid-Timestamp-Argument	The defined timestamp to return was invalid.
0x80730000	2155020288	BadWriteNot-Supported	The server does not support writing the combination of val-ue, status and timestamps provided.
0x80740000	2155085824	BadTypeMis-match	The value supplied for the attribute is not of the same type as the attribute's value.

Code	Integer	String	Description
0x80750000	2155151360	BadMethod-Invalid	The method id does not refer to a method for the specified object.
0x80760000	2155216896	BadArgu-mentsMiss-ing	The client did not specify all of the input arguments for the method.
0x81110000	2165374976	BadNotExe-cutable	The executable attribute does not allow the execution of the method.
0x80770000	2155282432	BadTooMany-Subscriptions	The server has reached its maximum number of subscrip-tions.
0x80780000	2155347968	BadTooMany-PublishRe-quests	The server has reached the maximum number of queued publish requests.
0x80790000	2155413504	BadNoSub-scription	There is no subscription available for this session.
0x807A0000	2155479040	BadSequen-ceNumberUn-known	The sequence number is unknown to the server.
0x807B0000	2155544576	BadMessage-NotAvailable	The requested notification message is no longer available.
0x807C0000	2155610112	BadInsuffi-cientClient-Profile	The client of the current session does not support one or more Profiles that are necessary for the subscription.
0x80BF0000	2160001024	BadStateNot-Active	The sub-state machine is not currently active.
0x81150000	2165637120	BadAlready-Exists	An equivalent rule already exists.
0x807D0000	2155675648	BadTcp-ServerToo-Busy	The server cannot process the request because it is too busy.

Code	Integer	String	Description
0x807E0000	2155741184	BadTcpMessageTypeInvalid	The type of the message specified in the header invalid.
0x807F0000	2155806720	BadTcpSecureChannelUnknown	The SecureChannelId and/or TokenId are not currently in use.
0x80800000	2155872256	BadTcpMessageTooLarge	The size of the message specified in the header is too large.
0x80810000	2155937792	BadTcpNotEnoughResources	There are not enough resources to process the request.
0x80820000	2156003328	BadTcpInternalError	An internal error occurred.
0x80830000	2156068864	BadTcpEndpointUrlInvalid	The server does not recognize the QueryString specified.
0x80840000	2156134400	BadRequestInterrupted	The request could not be sent because of a network interruption.
0x80850000	2156199936	BadRequestTimeout	Timeout occurred while processing the request.
0x80860000	2156265472	BadSecureChannelClosed	The secure channel has been closed.
0x80870000	2156331008	BadSecureChannelTokenUnknown	The token has expired or is not recognized.
0x80880000	2156396544	BadSequenceNumberInvalid	The sequence number is not valid.

Code	Integer	String	Description
0x80BE0000	2159935488	BadProtocolVersionUnsupported	The applications do not have compatible protocol versions.
0x80890000	2156462080	BadConfigurationError	There is a problem with the configuration that affects the usefulness of the value.
0x808A0000	2156527616	BadNotConnected	The variable should receive its value from another variable, but has never been configured to do so.
0x808B0000	2156593152	BadDeviceFailure	There has been a failure in the device/data source that generates the value that has affected the value.
0x808C0000	2156658688	BadSensorFailure	There has been a failure in the sensor from which the value is derived by the device/data source.
0x808D0000	2156724224	BadOutOfService	The source of the data is not operational.
0x808E0000	2156789760	BadDeadbandFilterInvalid	The deadband filter is not valid.
0x408F0000	1083113472	UncertainNoCommunicationLastUsableValue	Communication to the data source has failed. The variable value is the last value that had a good quality.
0x40900000	1083179008	UncertainLastUsableValue	Whatever was updating this value has stopped doing so.
0x40910000	1083244544	UncertainSubstituteValue	The value is an operational value that was manually overwritten.
0x40920000	1083310080	UncertainInitialValue	The value is an initial value for a variable that normally receives its value from another variable.
0x40930000	1083375616	UncertainSensorNotAccurate	The value is at one of the sensor limits.

Code	Integer	String	Description
0x40940000	1083441152	Uncertain-EngineeringUnitsExceeded	The value is outside of the range of values defined for this parameter.
0x40950000	1083506688	Uncertain-SubNormal	The value is derived from multiple sources and has less than the required number of Good sources.
0x00960000	9830400	GoodLocal-Override	The value has been overridden.
0x80970000	2157379584	BadRefresh-InProgress	This Condition refresh failed, a Condition refresh operation is already in progress.
0x80980000	2157445120	BadConditionAlready-Disabled	This condition has already been disabled.
0x80CC0000	2160852992	BadConditionAlready-Enabled	This condition has already been enabled.
0x80990000	2157510656	BadConditionDisabled	Property not available, this condition is disabled.
0x809A0000	2157576192	BadEventId-Unknown	The specified event id is not recognized.
0x80BB0000	2159738880	BadEvent-NotAcknowledgeable	The event cannot be acknowledged.
0x80CD0000	2160918528	BadDialogNotActive	The dialog condition is not active.
0x80CE0000	2160984064	BadDialogResponseInvalid	The response is not valid for the dialog.
0x80CF0000	2161049600	BadConditionBranchAlreadyAcked	The condition branch has already been acknowledged.
0x80D00000	2161115136	BadConditionBranch-	The condition branch has already been confirmed.

Code	Integer	String	Description
		AlreadyConfirmed	
0x80D10000	2161180672	BadConditionAlreadyShelved	The condition has already been shelved.
0x80D20000	2161246208	BadConditionNotShelved	The condition is not currently shelved.
0x80D30000	2161311744	BadShelvingTimeOutOfRange	The shelving time not within an acceptable range.
0x809B0000	2157641728	BadNoData	No data exists for the requested time range or event filter.
0x80D70000	2161573888	BadBoundNotFound	No data found to provide upper or lower bound value.
0x80D80000	2161639424	BadBoundNotSupported	The server cannot retrieve a bound for the variable.
0x809D0000	2157772800	BadDataLost	Data is missing due to collection started/stopped/lost.
0x809E0000	2157838336	BadDataUnavailable	Expected data is unavailable for the requested time range due to an un-mounted volume, an off-line archive or tape, or similar reason for temporary unavailability.
0x809F0000	2157903872	BadEntryExists	The data or event was not successfully inserted because a matching entry exists.
0x80A00000	2157969408	BadNoEntryExists	The data or event was not successfully updated because no matching entry exists.
0x80A10000	2158034944	BadTimestampNotSupported	The client requested history using a timestamp format the server does not support (i.e requested ServerTimestamp when server only supports SourceTimestamp).
0x00A20000	10616832	GoodEntryInserted	The data or event was successfully inserted into the historical database.

Code	Integer	String	Description
0x00A30000	10682368	GoodEntryReplaced	The data or event field was successfully replaced in the historical database.
0x40A40000	1084489728	UncertainDataSubNormal	The value is derived from multiple values and has less than the required number of Good values.
0x00A50000	10813440	GoodNoData	No data exists for the requested time range or event filter.
0x00A60000	10878976	GoodMoreData	The data or event field was successfully replaced in the historical database.
0x80D40000	2161377280	BadAggregateListMismatch	The requested number of Aggregates does not match the requested number of NodeIds.
0x80D50000	2161442816	BadAggregateNotSupported	The requested Aggregate is not support by the server.
0x80D60000	2161508352	BadAggregateInvalidInputs	The aggregate value could not be derived due to invalid data inputs.
0x80DA0000	2161770496	BadAggregateConfigurationRejected	The aggregate configuration is not valid for specified node.
0x00D90000	14221312	GoodDataIgnored	The request specifies fields which are not valid for the EventType or cannot be saved by the historian.
0x80E40000	2162425856	BadRequestNotAllowed	The request was rejected by the server because it did not meet the criteria set by the server.
0x81130000	2165506048	BadRequestNotComplete	The request has not been processed by the server yet.
0x00DC0000	14417920	GoodEdited	The value does not come from the real source and has been edited by the server.
0x00DD0000	14483456	GoodPostActionFailed	There was an error in execution of these post-actions.

Code	Integer	String	Description
0x40DE0000	1088290816	Uncertain-DominantVal-ueChanged	The related EngineeringUnit has been changed but the Vari-able Value is still provided based on the previous unit.
0x00E00000	14680064	GoodDepen-dentValue-Changed	A dependent value has been changed but the change has not been applied to the device.
0x80E10000	2162229248	BadDomi-nantValue-Changed	The related EngineeringUnit has been changed but this change has not been applied to the device. The Variable Val-ue is still dependent on the previous unit but its status is currently Bad.
0x40E20000	1088552960	UncertainDe-pendentVal-ueChanged	A dependent value has been changed but the change has not been applied to the device. The quality of the dominant variable is uncertain.
0x80E30000	2162360320	BadDepen-dentValue-Changed	A dependent value has been changed but the change has not been applied to the device. The quality of the dominant variable is Bad.
0x00A70000	10944512	GoodCommu-nicationEvent	The communication layer has raised an event.
0x00A80000	11010048	GoodShut-downEvent	The system is shutting down.
0x00A90000	11075584	GoodCallA-gain	The operation is not finished and needs to be called again.
0x00AA0000	11141120	GoodNonCrit-icalTimeout	A non-critical timeout occurred.
0x80AB0000	2158690304	BadInvalidAr-gument	One or more arguments are invalid.
0x80AC0000	2158755840	BadConnec-tionRejected	Could not establish a network connection to remote server.
0x80AD0000	2158821376	BadDiscon-nect	The server has disconnected from the client.

Code	Integer	String	Description
0x80AE0000	2158886912	BadConnectionClosed	The network connection has been closed.
0x80AF0000	2158952448	BadInvalidState	The operation cannot be completed because the object is closed, uninitialized or in some other invalid state.
0x80B00000	2159017984	BadEndOfStream	Cannot move beyond end of the stream.
0x80B10000	2159083520	BadNoDataAvailable	No data is currently available for reading from a non-blocking stream.
0x80B20000	2159149056	BadWaitingForResponse	The asynchronous operation is waiting for a response.
0x80B30000	2159214592	BadOperationAbandoned	The asynchronous operation was abandoned by the caller.
0x80B40000	2159280128	BadExpectedStreamToBlock	The stream did not return all data requested (possibly because it is a non-blocking stream).
0x80B50000	2159345664	BadWouldBlock	Non blocking behaviour is required and the operation would block.
0x80B60000	2159411200	BadSyntaxError	A value had an invalid syntax.
0x80B70000	2159476736	BadMaxConnectionsReached	The operation could not be finished because all available connections are in use.

Error Messages

A list of connection errors, their cause, and action to be taken.

These are some of the errors you may encounter when testing a data source connection:

Note:

- Make sure your Operations Hub logged in user matches with the user configured in the CIMPLICITY project or iFIX node.
- For inline writes to an iFIX or CIMPLICITY mimic with direct tag bindings, make sure that your data source matches with that of the CIMPLICITY project or iFIX node name.

Error Message	Description
Test Connection Failed - Server not reachable.	**Cause:** The hostname or the IP address of the server is incorrect. **Action:** Enter the correct hostname or the IP address.
Test Connection Failed - Security mode or policy not supported.	**Cause:** The selected security policy is not supported by the server. **Action:** Select a security policy supported by the server.
Test Connection Failed - Authentication Failed.	**Cause:** The user name or password to login to the sever is incorrect. **Action:** Enter the correct user name or password.
Test Connection Failed - Server not trusted.	**Cause:** The server certificate is not trusted by the Operations Hub client. **Action:** To trust, access the untrusted server certificate, then select **Trust**. The server certificate gets copied to the Operations Hub trusted folder.
Test Connection Failed - Server doesn't trust this client.	**Cause:** Operations Hub client certificate is not trusted by the server. **Action:** Log in to the server, and add the Operations Hub client certificate to their trusted list.
Test Connection Failed - Certificate Uri is Invalid.	**Cause:** If upgrading from Operations Hub 2.0 to 2.1, you need to revert the changes made to the `ServerConfig.xml` file.

Error Message	Description
	Action: Follow these steps: 1. Go to `C:\Program Files\GE\Operations hub \BrowseService`. 2. Open `ServerConfig.xml` and search for: `<ServerUri>urn:<machine name in capital letters>:proficy:webhmi:dataservices</ServerUri>` Replace `<machine name in capital letters>` with `[NodeName]`. 3. Save and close the XML file. 4. Go to Operations Hub trusted store `C:\ProgramData\GE\Operations Hub\pki\trusted\certs` and delete the existing certificate. 5. Visit your data sources and trust them all over again to reissue the certificate.
Test Connection Failed - Connection limit on OPC UA server exceeded.	**Cause:** You have exceeded the license limitation of clients on this server. **Action:** Get a license issued for this client.
Test Connection Failed to connect the opcua endpoint.	**Cause:** The endpoint url could be incorrect. **Action:** Enter the correct endpoint URL in this format: `opc.tcp://hostname:port`.
Test Connection Failed - Fields are not filled properly.	**Cause:** The information to establish a connection is either missing, or invalid. **Action:** Enter the correct information.

Configure Logs to Troubleshoot Licensing Issue

With Operations Hub licensing enforcement, you may be asked to purchase a license even when you have a valid license activated on your license client.

In the event of a licensing issue, follow these steps to enable logging and reveal potential problems before contacting GE Support.

1. Open the `logback.xml` file located here:

   `<Directory where Operations Hub is installed>\iqp-tomcat\webapps\<site/app/eventengine>\WEB-INF\classes\logback.xml`
2. Find the following line of code and change `"ERROR"` to `"DEBUG"`.

   ```
   <Logger name="com.iqp" level="ERROR">
   ```
3. Save and close the `logback.xml` file.
4. Replicate the licensing error to log messages in the `app.log/site.log` or `eventengine.log` file located here:

   `C:\ProgramData\OphubLogs\iqp-tomcat`
5. Look for log entries similar to the following:

   ```
   "2021-3-2 13:24:11  - Project65.isLicenseVersionValid() : lc_license_ophub = 20
   2021-03-02 14:37:41,720 [pool-6-thread-1] DEBUG com.iqp.common.utils.other.lc -
    LicenseClient.getLicenseValue(): isLicenseDateValid() = 1 isLicenseVersionValid() = 1 isLicenseVersionValid()
    = 4"
   ```

   > **Tip:**
   > Look for keywords such as Project65, LicenseClient, and LicenseService to investigate licensing related issues.
6. Provide the log file details to the Support team.

Configuration of Logging for Services

You can find log configuration for every service at the following location.

- **WebHMI Services**: `<Directory where Operations Hub is installed>\webhmi-tomcat\webapps\<Service>\WEB-INF\classes\logback.xml`
- **IQP Apps**: `<<Directory where Operations Hub is installed>\iqp-tomcat\webapps\<site/app/eventengine>\WEB-INF\classes\ logback.xml`

Important Configurations

MaxHistory: https://logback.qos.ch/manual/appenders.html#tbrpMaxHistory. For more information, refer to https://logback.qos.ch/manual/appenders.html#SizeAndTimeBasedRollingPolicy.

To configure package level logging or any changes on the logging configuration that do not require restart of the tomcat container.

```
<configuration scan="true" scanPeriod="30 seconds" >
  ...
</configuration>
```

(http://logback.qos.ch/manual/configuration.html#autoScan scan=true) which detects runtime changes on log level without need to restart the service. But currently it is kept disabled, as it has runtime impact.

You can configure package level logger highlighted as below:

https://logback.qos.ch/manual/configuration.html#loggerElement

```
<configuration>

  <appender name="STDOUT" class="ch.qos.logback.core.ConsoleAppender">
    <!-- encoders are assigned the type
         ch.qos.logback.classic.encoder.PatternLayoutEncoder by default -->
    <encoder>
      <pattern>%d{HH:mm:ss.SSS} [%thread] %-5level %logger{36} - %msg%n</pattern>
    </encoder>
  </appender>

  <logger name="chapters.configuration" level="INFO"/>

  <!-- Strictly speaking, the level attribute is not necessary since -->
  <!-- the level of the root level is set to DEBUG by default.       -->
  <root level="DEBUG">
    <appender-ref ref="STDOUT" />
  </root>

</configuration>
```

```
<?xml version="1.0"?>
<configuration>

    <appender name="FILE" class="ch.qos.logback.core.rolling.RollingFileAppender">
        <append>true</append>
        <file>${logging.path:-logs}/alarmService.log</file>
        <rollingPolicy class="ch.qos.logback.core.rolling.TimeBasedRollingPolicy">
            <fileNamePattern>${logging.path:-logs}\alarmService.%d{yyyy-MM-dd}.%i.log.gz</fileNamePattern>
            <!-- Max number of Log Files
            <minIndex>1</minIndex>
            <maxIndex>20</maxIndex>-->

            <!-- keep 7 days' worth of history -->
            <MaxHistory>7</MaxHistory>
            <timeBasedFileNamingAndTriggeringPolicy class="ch.qos.logback.core.rolling.SizeAndTimeBasedFNATP">
                <maxFileSize>100MB</maxFileSize>
            </timeBasedFileNamingAndTriggeringPolicy>
        </rollingPolicy>
        <encoder>
            <pattern>%d{yyyy-MM-dd HH:mm:ss.SS} %-5level --- [%thread] %-40.40logger{39} : %msg%n</pattern>
        </encoder>
    </appender>

    <!-- additivity=false ensures analytics data only goes to the analytics log -->
    <root level="INFO">
        <appender-ref ref="FILE"/>
    </root>
```

UAA Services

`<Directory where Operations Hub is installed>\uaa-tomcat\webapps\uaa\WEB-INF\classes\log4j2.properties`

```
appender.rolling.policies.type = Policies
appender.rolling.policies.size.type = SizeBasedTriggeringPolicy
appender.rolling.policies.size.size=100MB
appender.rolling.strategy.type = DefaultRolloverStrategy
appender.rolling.strategy.max = 10

appender.rolling.strategy.action.type = Delete
appender.rolling.strategy.action.basepath=${sys:logging.path}
appender.rolling.strategy.action.maxDepth = 1
appender.rolling.strategy.action.condition.type = IfFileName
appender.rolling.strategy.action.condition.glob = uaa-backup-*.log.gz
appender.rolling.strategy.action.ifAny.type = IfAny
appender.rolling.strategy.action.ifAny.ifLastModified.type = IfLastModified
appender.rolling.strategy.action.ifAny.ifLastModified.age = 7d
```

Modify Registry for TLS 1.2

This topic describes how to modify the registry setting on the Operations Hub server to allow for TLS 1.2.

The following steps serve as a workaround to troubleshoot these issues:

- Resolving Proficy Authentication Issue During Workflow Task Client Install *(on page 615)*
- Resolving External Proficy Authentication Issue During Operations Hub Install *(on page 615)*
- Workflow Task Client is unable to connect to the Proficy Server *(on page 615)*

1. Access the following registry paths and modify the `DWORD` value name `SchUseStrongCrypto` with the value data as `1`.
   - `HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\.NETFramework\v4.0.30319`
   - `HKEY_LOCAL_MACHINE\SOFTWARE\WOW6432Node\Microsoft\.NETFramework\v4.0.30319`
2. If the registry value does not exist, then create a new one with the same value name and value data.

> **Note:**
> For more information, refer to Microsoft suggested actions.