Operation Hub 2.0

Windows Documentation

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Chapter 1. Release Notes

Operations Hub Release Notes

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

Version: 2.0

Table 1. Enhancements and New Features

The following enhancements and new features have been added.

Description	Tracking IDs

This release of Operations Hub contains the following features:
 	
• Enabled OPC UA connectivity for Proficy iFIX, (read/write operations), Proficy CIMPLICITY (read/write operations), and IGS (read operations).
• Introduced a common browser for the Model Editor, Trend Chart, Query Editor, and Page Designer to browse the Asset Model, Historian, and OPC UA data sources.
• Implemented enhancements for the trend chart in the web application:
  ◦ Allows to configure color, line style, and width of trend lines
  ◦ Added Lab and Lab to Raw as additional sampling modes
  ◦ Allows plotting of multiple sampling modes for the same Historian tag
  ◦ Specify upper, lower, and target specification limits
  ◦ Increased sample count-up to 8K
  ◦ Re-fetch of data and tag statistics on zoom
• Allows trending of OPC UA data directly from configured OPC UA servers, in addition to the data from the Asset Model and Historian.
• Application and Page enhancements in terms of duplicating between applications, specifying a friendly name, etc.
• Improved and simplified approach towards binding Asset Model, OPC UA and Historian data to widgets.
• New Date Time picker available for date and time selection.
• Exposed Breadcrumb context selection to all widgets.
• Licensing enforcement - Trial version, Historian analysis tier and full version.
	• F49615
	• F49632
	• F49634
	• F49628
	• F51614
	• F49627
	• F53670
	• F49613
	• F54027

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

Description	Tracking ID
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 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
Some widgets, such as a table, do not work as expected when used with a REST query. In particular, features which require additional queries to fetch more data (such as pagination), as well as features limiting data (such as row limits) may not work.	DE118883
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
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

Description	Tracking ID
An import of an older app containing the Trend widget will not have the Scroll Percentage property available. As a workaround, when upgrading from Operation Hub 1.7 to 2.0, delete the Trend card and then re-add it to your app.	DE140521
When importing an application with plug-ins, if you choose to duplicate instead of replacing the application, some of the bindings may need to be recreated. See Import an Application *(page 104)*.	DE149914

If the OPC UA test connection fails with a *Certificate Uri is Invalid* error, it is possible that the URI specified in the UA SDK session call does not match with the URI in the certificate. To resolve this,
 	
• Modify the `ServerConfig.xml` file (found at `C:\Program Files\GE\Operations hub\BrowseService` if Operations Hub was installed with default location) to do the following:
 	
Replace
 	
`<ServerUri>urn:[NodeName]:proficy:webhmi:dataservices</ServerUri>`
 	
with
 	
`<ServerUri>urn:<machine name in capital`
`letters>:proficy:webhmi:dataservices</ServerUri>`
 	
wherein, the node name must be replaced with the Operations Hub server machine name in capital letters (even if the machine name is in small case or camel case).
• After modifying the XML file, restart GE Operations Hub UA Browse Service in your Services console.
	DE149878, DE149879

If there are several OPC UA data sources in Operations Hub pointing to the same URN, and if one among them is configured incorrectly (for example, an incorrect user name or password), then the data does not flow to the end application. The workaround is to eliminate the data sources with the bad configuration to allow the data to flow.	DE149674
When working with Operations hub, you can open a maximum of 5 browser tabs.	N/A

Table 3. Fixed Defects

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

Description	Tracking ID
Previously, errors occurred when duplicating a page several times from an application imported to the system. The error occurred sometimes on the fourth or fifth attempt to duplicate the page. This issue has been resolved.	DE132571
Previously with queries relation database, 'invalid number' occurred on passing a negative integer value to a stored procedure input parameter. This issue has been resolved.	DE141438
Error occurred when creating a new application page or modifying an existing one. To fix this issue, the default Tomcat POST max size has been updated.	DE143197 / SF 00890752
Previously, the properties tab for configuring plugins was not functioning as expected. This issue has been resolved.	DE141439 / SF 00878135
Previously for the input widget, there were issues with the properties display pane, which made it difficult to apply settings. This issue has been resolved.	DE141443 / SF 00878583

Description	Tracking ID
During export, an unusual file name was generated for an application that had a name with Japanese characters. This issue is fixed to generate the export file as `<AppName>_IQPPackage.zip`.	DE138649 / SF 00881458
The graph widget's data download icon was not displaying in the end application at runtime. This has been fixed.	DE141440 / SF 00880342
Previously, a live preview for Mobile and Tablet devices appeared at the bottom of the Model Editor when creating or deleting objects. This issue has been resolved.	DE121922
Previously, import or export of an application bundle with images failed if the image names contained spaces or non-English characters. This issue has been resolved.	DE105597
When not connected to the Internet, there are a couple of icons (the certificate lock icon and view password icon) in the UAA/LDAP tool which may not display. These icons require an Internet to display.	N/A

Table 4. Compatibility Matrix

The following products are compatible with Operations Hub.

Product	Required Version
Proficy Historian	• Historian 7.0 with the latest SP • Historian 7.1 with the latest SP • Historian 7.2 with the latest SIM • Historian 8.0 • Historian 8.1 📝 **Note:** • Operations Hub 2.0 and Historian on the same box is not supported. • 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	• Version 8.0, SIM3, for Integrated Process Apps • Version 8.1
User Authentication and Authorization (UAA) service	Version 2.0
Proficy iFIX	6.0 (read operations), 6.1 (read operations)
Proficy CIMPLICITY	10 (read operations), 11 (read operations)
GE Common Licensing	Version 19.2.1725.0

Chapter 2. Getting Started in Windows

Installing Operations Hub on Windows

System Requirements

When you install Operations Hub, all the required components are automatically installed. This topic provides the requirements for hardware components, browsers, and operating systems.

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 Server 2016
- Microsoft Windows Server 2019

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
- Chromium 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 7.0 with the latest SP • Historian 7.1 with the latest SP • Historian 7.2 with the latest SIM • Historian 8.0 • Historian 8.1 📒 **Note:** • While it is not recommended to install Historian and Operations Hub on the same computer, if you must install them together, the order of install matters for Historian 8.x. Install Historian 8.x prior to Operations Hub. • 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	• Version 8.0, SIM3, for Integrated Process Apps • Version 8.1
User Authentication and Authorization (UAA) service	Version 2.0
Proficy iFIX	6.0 (read operations), 6.1 (read operations)
Proficy CIMPLICITY	10 (read operations), 11 (read operations)
GE Common Licensing	Version 19.2.1725.0

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.
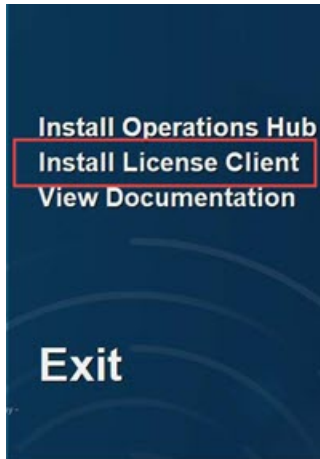
📝 **Note:** Previous licensing is replaced with Proficy licensing. For information on installing and configuring your license, refer to the [GE Support site](#).

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 *(page 15)* 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
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

- Ensure that the machine on which you want to install Operations Hub meets the System Requirements *(page 13)*.
- 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 perform step-by-step installation of Operations Hub. You can also install Operations Hub automatically *(page 30)*.

📋 **Note:** This topic describes how to install Operations Hub stand-alone (by downloading the installer from Salesforce). If, however, you want to use only the Historian analysis application in Operations Hub, you can choose to install just the Operations Hub add-on for Historian. If you do so, you will not be able to create, modify, or delete any applications or components of applications in Operations Hub.

1. Run the Operations Hub installation DVD, and then select **Install GE Operations Hub 2.0**. The **Welcome to GE Operations Hub** page appears.
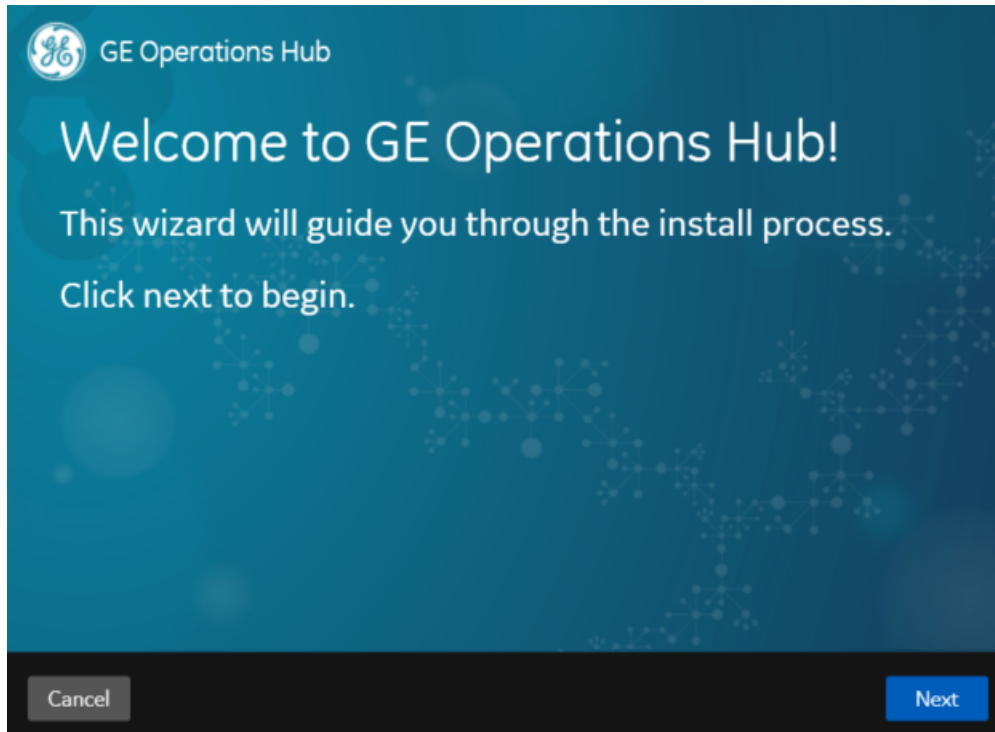
2. Select **Next**.
   The **Read and accept the license agreement to continue** page appears.
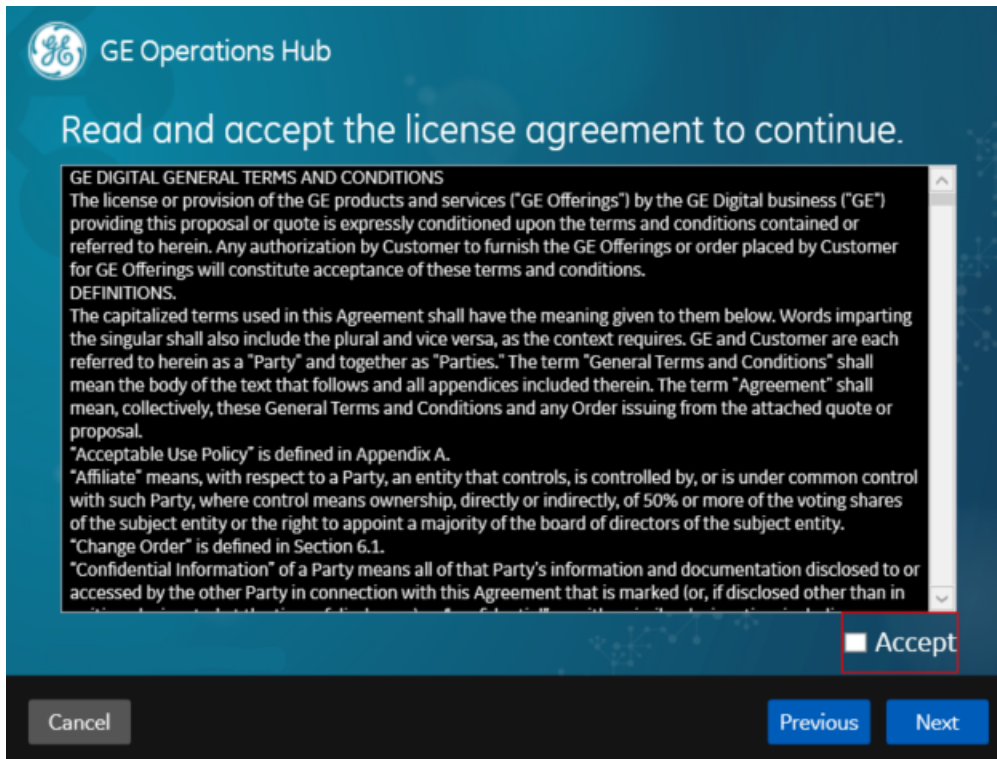
3. Select the **Accept** check box, and then select **Next**.
   The **TCP port check** page appears, specifying whether the ports chosen for Operations Hub are available.
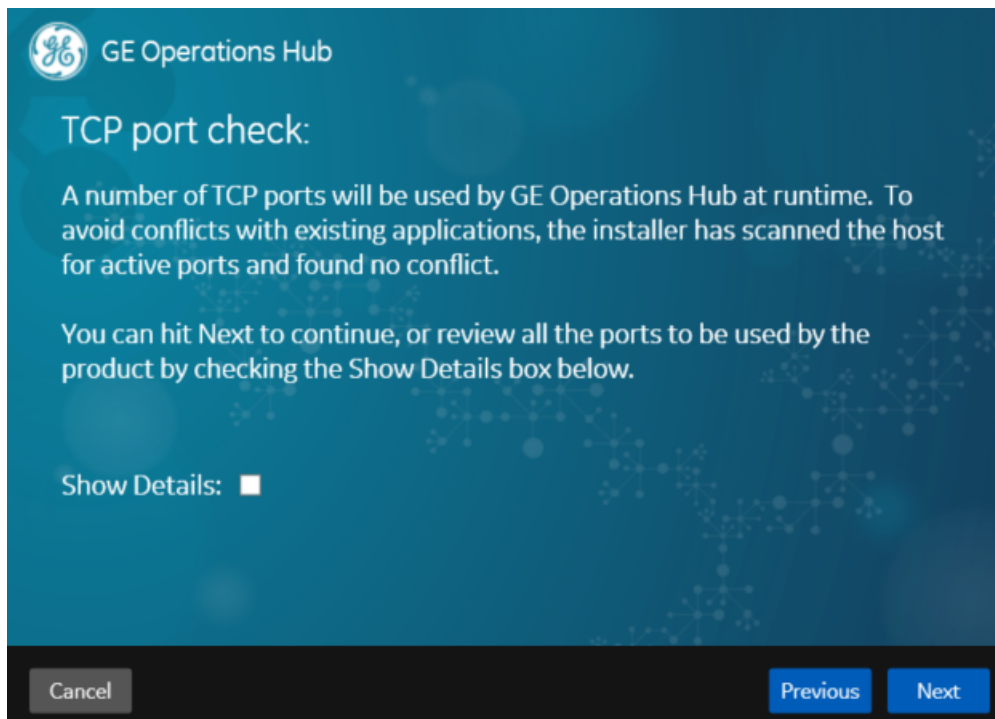
4. If you want to review or change the ports that will be used by Operations Hub, select the **Show Details** check box.
The **TCP port assignments** page appears, providing a list of ports that will be used by the various components in Operations Hub.

GE Operations Hub

TCP port assignments:

Public https port :	443	IQP database port :	5432
UAA http port :	9480	IQP Hazelcast port 1 :	5901
UAA IdP config service port :	7010	IQP Hazelcast port 2 :	5902
UAA security app port :	7011	IQP Hazelcast port 3 :	5903
UAA database port :	9432	IQP Endapp port :	3000
MQTT External port :	1883	IQP Endapp internal port :	8223
MQTT Internal port :	1884	WebHMI http port :	9482
Zookeeper port :	2181	WebHMI database port :	9434
Kafka port :	9092	Data distributor port :	9002
Redis port :	6379	OPC UA Browse port :	4856
IQP http port :	8080		

Review and remove or reconfigure any other programs that cause conflicts (indicated by ⚠ signs).

Cancel   Previous   Next

Note: Use care when changing port numbers so that there is a not a 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** page appears. By default, the **All Host Names** box contains a value, and the **Primary Host Name** box is disabled and populated with the first value in the **All Host Names** box.

6. In the **All Host Names** box, enter any of the following details of the machine for which you
   want to access Operations Hub following the install:
   • Fully qualified domain name
   • 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 safest way to apply the FQDN is to uninstall without purge, and then reinstall
     with the FQDN in the Host Names screen.

   The **Primary Host Name** box is updated with the first value in the **All Host Names** box.

7. Select **Next**.
   The **User Authentication and Authorization Service** page appears.

8. If you want to use the User Authentication and Authorization (UAA) service that is integrated with Operations Hub, enter a password in the **Admin Client Secret** and **Re-enter Secret** boxes. Otherwise, skip to the next step.

   📝 **Note:** The client secret password cannot contain the ampersand (&) or percent (%) special characters.

9. If you want to use an external UAA service, select the **Use External UAA** check box.
   When this check box is selected, the following information appears in the install screen.

10. For external UAA, provide values as specified in the following table.

Item	Description
UAA Base URL	Enter the URL of the UAA service. 📄 **Note:** • If referencing Historian 7.x UAA, then use a URL similar to this: https://Historian7x:8443; if referencing Historian 8.x then use a URL of https://Historian8x (no port number). • Historian 7.x requires a different port than Historian 8.x. For Historian 7.x, the default port to connect to UAA is 8443. For Historian 8.x, the default port to connect to UAA is 443. • If the ports were customized, then use the selected port.
Admin Client Id	Enter the ID of the administrator account of the UAA client.
Admin Client Secret	Enter the password of the administrator account.

Item	Description
UAA certificate file	Enter the path to the certificate file used by the UAA service. 📋 **Note:** • If provided, the certificate file must be a `.pem` file for the root issuer (not the UAA server certificate). • Export the root certificate from Historian 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 certificate store on client machines, to suppress warnings given by browsers such as Chrome.
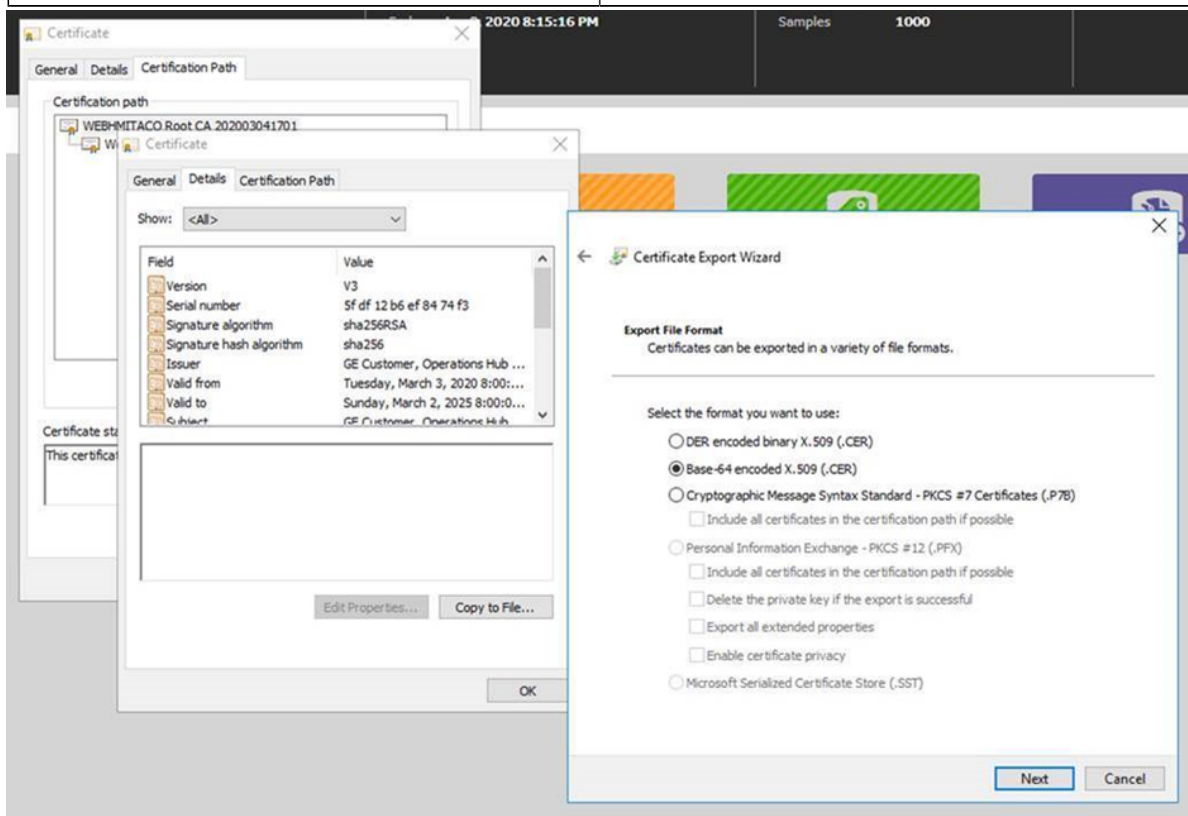
The **Test** button allows you to test the connection to the External UAA instance based on the information provided in the dialog box. Some of the possible messages encountered that a user may need to correct when the Test button is exercised are summarized in the table below:

Issue	Warning	Resolution
Invalid credentials	401 Unauthorized.	Check the admin client id and admin client secret provided to the External UAA URL.
No certificate	The test will pass, but the user is requested to provide the UAA root issuer's certificate.	Provide the UAA root issuer certificate file in the install.
Invalid certificate	Test succeeds but the certificate is not used- error reported if bad certificate used.	Provide the correct UAA 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 UAA server name resolution. • Actual mismatch with the "UAA base URL" and the issuer Uri in the "uaa.yml file.	Make sure the issuer Uri in the uaa.yml file and the UAA Base URL match exactly.
Error connecting to External UAA	External UAA server name resolution issue.	Check to make sure the External UAA is running. Check to make sure the issuer Uri in the uaa.yml file and the UAA 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 UAA base URL.	This error happens either while testing the user entered UAA 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 UAA 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 UAA 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://Hist80vm/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 Historian 8.x and Historian 7.x scenarios.

For Historian 8.x: If the UAA URL in the Operations Hub install does NOT match the Historian 8.x UAA URL, then you will receive an "Issue not trusted" error when attempting to import a model. Examples of UAA 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 UAA's uaa.yml file so the issuer uri matches what's in the certificate. If Historian 8.x is installed with a Fully Qualified Domain Name (FQDN), then utilize the FQDN when specifying the external UAA URL. For example: http://HistFQDN/uaa.

If Historian 8.x is installed with a host name like "Historian8," then utilize the host name when specifying the external UAA URL. For example: http://Historian8/uaa

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

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

   a. Get the external UAA URL that you entered during install. For example, it might be something like: https://historian7:8443/uaa.
   b. Go to the Historian machine.
   c. Locate the uaa.yml file at this location: C:\Program Files\GE Digital\UAA\uaa.yml.
   d. At the end of the file, add the following lines:

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

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

11. Select **Next**.
    The **Create Tenant Admin Account** page appears.

12. Provide values as specified in the following table, and then select **Next**.

Item	Description
User Id	Enter the 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 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 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 UAA instance.
Password	Enter a password for the administrator account.
Re-enter Password	Re-enter the password for the administrator account.

The **Customize Log Files and Postgres Data Locations** page appears.

13. Provide values as specified in the following table, and then select **Next**.

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

Item	Description
WebHMI Database Folder	This box 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 box blank.

The **You are ready to install** page appears.
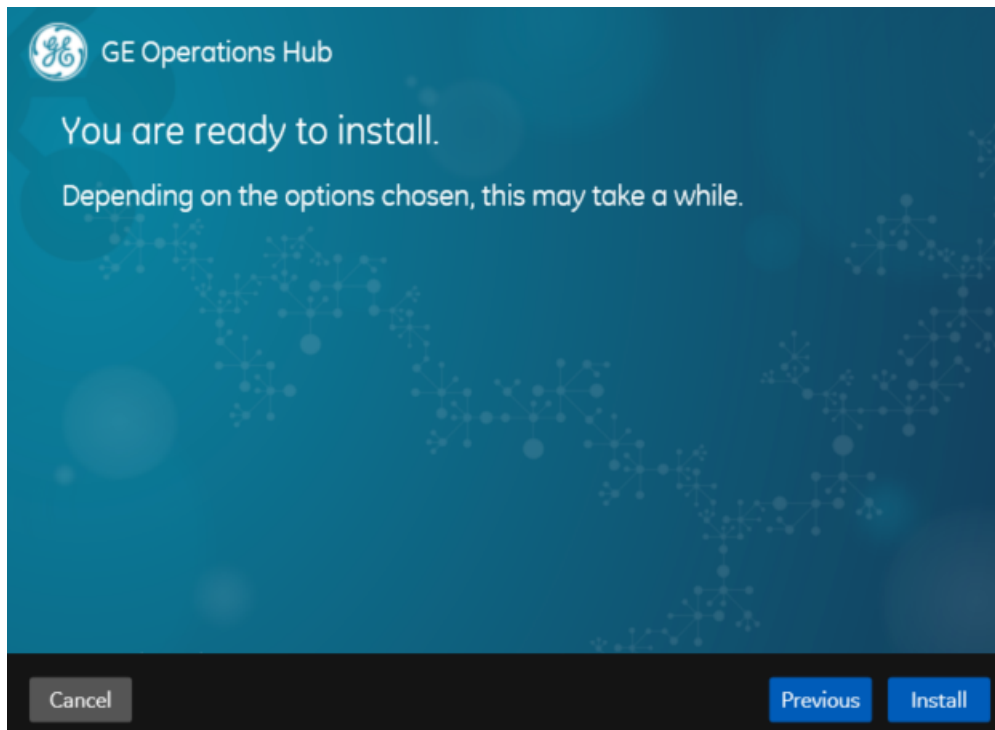
14. Select **Install**.

    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:**
    - 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.
    - After upgrading to Operations Hub 2.0, you will notice the IQP designer uses `app_name` instead of `app_id` in its URLs.

(on each client that you will use to access Operations Hub), and then .

Install Operations Hub Automatically

This topic describes how to install Operations Hub automatically. You can also install Operations Hub manually *(page 16)*.

1. In the Operations Hub installation folder, open the `windows.env` file in a text editor.

   📝 **Note:** We recommend that you back up the original `windows.env` file.

2. As needed, provide values for the parameters, and save the file.

3. Open Command Prompt, and run the following command: `<Operations Hub installation folder>\OpHub-Windows-Installer>ophub_bundle <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.
   - -norestart: Use this value if you do not want services to be restarted during the installation.
   - -promptrestart: Use this value if you want a message to appear, asking whether services must be restarted.

Operations Hub is installed.

To install to a different drive from the command line, refer to Non-System Drive Install *(page 30)*.

Log in to Operations Hub *(page 34)*.

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 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.
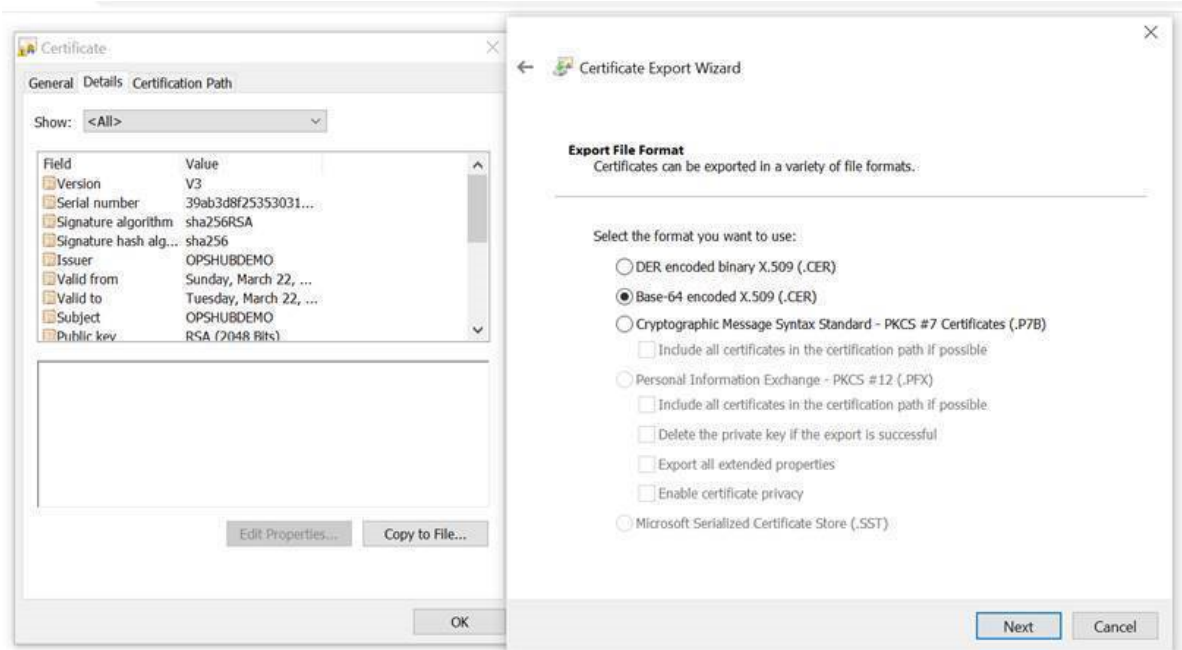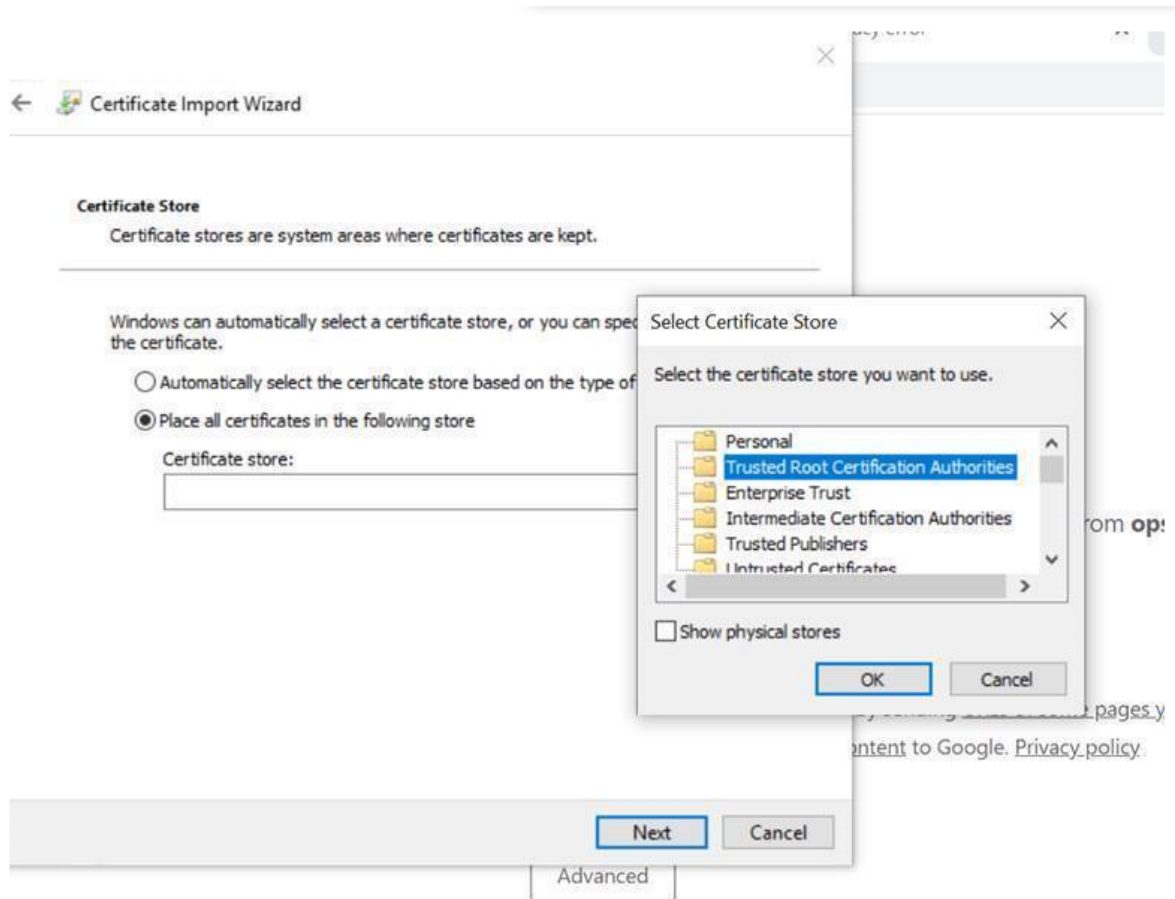
Post-Installation Tasks

Setting Up Operations Hub

Configure MQTT Broker Settings

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

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 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: • 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

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 `Config.js` file (`C:\Program Files\GE\Operations Hub\iqp-endapp \config`) to enter the code for google API key.

3. Open the `App.js` file (`C:\Program Files\GE\Operations Hub\iqp-endapp\public \scripts`) in Notepad ++ and search for `googleapi` to enter the key.

4. Enter map API key information as follows: For example, if the Google API version is 3.35, then enter `v=3.35&` before `key="+i+"`.

5. Save and close the file.

6. 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.

Log in to Operations Hub

Only a single user can log in to Operations Hub at a time. Therefore, if you want to log in as a different user, you must first log out of all the Operations Hub sessions (including 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 to access the Site Admin console, which is used to configure an MQTT server or an email server.

  📑 **Note:**
  ◦ Log out and close all the browser windows before you run the installer.
  ◦ Make a note of the Site Admin user account credentials. If, however, you have not made a note of the credentials (password) when running the installer package, reinstall `siteadmin_addon` and note down the credentials.
  ◦ In case you changed the password of the Site Admin user account, remember to enter the new password on the login page because 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 Site Admin 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:

1. Access the `uaa.yml` file. By default, this file is located in the following folder: `C:\Program Files\GE Digital\UAA`
2. 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.
3. Restart the Historian Embedded Tomcat Container service.

- 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.

Configure Timeout

After upgrading to a newer version of Operations Hub, configure these timeout settings.

Session Timeout

- Access the `web.xml` file at these locations, and update as follows:

`C:\Program Files\GE\Operations Hub\iqp-tomcat\conf`

`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>
```

Token Timeout

- Access the `web.xml` file located at `C:\ProgramFiles\GE\Operations Hub\uaa-tomcat\conf`, and update as follows:

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

```
<session-config>
     <session-timeout>2</session-timeout>
     <cookie-config> <max-age>120</max-age> </cookie-config>
  </session-config>
```

📄 **Note:**

1. `session-timeout` and `cookie max-age` must be in sync.
2. `session-timeout` is measured in minutes, whereas `cookie-config` is measured in seconds.
3. Any manual configuration changes, including changes for timeouts, are overwritten on upgrade.

Mapping UAA Groups

About User Groups

A user group is created for a specific type of users who will likely perform the same type of activities.

Typically, the following types of users use 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.

⚠️ **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 User Account and Authentication (UAA)

In Operations Hub, user authentication is handled using Proficy UAA (User Account and Authentication). Proficy UAA 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 UAA, 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 UAA to perform basic user management, except when additional configuration is required.

Several Proficy products use Proficy UAA, including Historian, Plant Applications, and Operations Hub. To use Proficy UAA, 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 UAA, this is called a shared or common UAA.

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

Proficy UAA 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 UAA with an external identity provider, you can provide the users and groups from that identity provider with access to Proficy products and their features.

Proficy UAA Install and Components

To use Proficy UAA, you must install one of the products which bundles Proficy UAA, 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 UAA 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 UAA.

⚠️ **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 UAA supports UAA version 4.30.0 or later.

Map Existing UAA Groups With Proficy UAA

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

1. Double-click .

   i **Tip:** By default, this icon appears on the desktop after you install Proficy UAA.

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 in the while installing your Proficy product. These values are required to connect to Proficy UAA.

Box	Description
URL	Enter the authorization server URL of the Proficy UAA server that you specified in the **UAA Base URL** box during installation (for example, https://localhost).
	If referencing Historian 7.x UAA, then use a url of https://Historian7x:8443; if referencing Historian 8.x then use a URL of https://Historian8x (no port number). The port numbers reflect the default port numbers for Historian. If ports were customized, then use the selected port.
Client ID	Enter the client ID of the Proficy UAA server that you specified in the **Admin Client ID** box during installation.
Client Secret	Enter the client secret configured for the OAuth client that you specified in the **Admin Client Secret** box 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 UAA. In the **Filter** box, a list of groups in the existing UAA instance appear.

7. In the drop-down list box, select the Proficy UAA 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 UAA group that you have selected, the check box is already selected.

   ℹ️ **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 UAA group is mapped to the existing UAA groups that you have selected.

10. Repeat steps 7 through 9 for all the Proficy UAA groups that you want to map.

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

Map LDAP Groups With Proficy UAA

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

1. Double-click ![IDP Connectivity tool].

   ⓘ **Tip:** By default, this icon appears on the desktop after you install Proficy UAA.

2. Select the **Identity Providers** tab.
   The **UAA/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 in the while installing your Proficy product. These values are required to connect to the Proficy UAA. Proficy UAA works only with a single instance of UAA, which is specified during Proficy UAA installation. After installation, you cannot change the instance of UAA that Proficy UAA will use.

Box	Description
URL	Enter the authorization server URL of the Proficy UAA server that you specified in the **UAA Base URL** box during installation (for example, https://localhost).
	If referencing Historian 7.x UAA, then use a url of https://Historian7x:8443; if referencing Historian 8.x then use a URL of https://Historian8x (no port number). The port numbers reflect the default port numbers for Historian. If ports were customized, then use the selected port.
Client ID	Enter the client ID of the Proficy UAA server that you specified in the **Admin Client ID** box during installation.
Client Secret	Enter the client secret configured for the OAuth client that you specified in the **Admin Client Secret** box during installation.

5. Select **Test**.
   If connection to the UAA 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.

Item	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 (UAA restart required)	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	Enter the subdirectories to include in the search (for example, cn={0}).
User Search Base	Enter the starting point for the LDAP user search in the directory tree (for example, dc=developers,dc=com).
Group Search Base	Enter the starting point for the LDAP group search in the directory tree (for example, ou=scopes,dc=developers,dc=com).
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}).

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 UAA.

9. In the drop-down list box, select the Proficy UAA 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 UAA 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 UAA group.

11. Repeat steps 8 through 10 for all the Proficy UAA groups that you want to map.

The LDAP groups are mapped with the Proficy UAA groups.

⚠️ **Warning:** Any change in the configured details for LDAP impacts its connectivity. Make sure to update the connectivity screens to reflect the changes.

Map SAML Groups With Proficy UAA

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

1. Double-click [IDP Connectivity tool icon].

   ℹ️ **Tip:** By default, this icon appears on the desktop after you install Proficy UAA.

2. Select the **Identity Providers** tab.
   The **UAA/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 in the while installing your Proficy product. These values are required to connect to the Proficy UAA. Proficy UAA works only with a single instance of UAA, which is specified during installation. After installation, you cannot change the instance of UAA that Proficy UAA will use.

Box	Description
URL	Enter the authorization server URL of the Proficy UAA server that you specified in the **UAA Base URL** box during installation (for example, https://localhost). If referencing Historian 7.x UAA, then use a url of https://Historian7x:8443; if referencing Historian 8.x then use a URL of https://Historian8x (no port number). The port numbers reflect the default port numbers for Historian. If ports were customized, then use the selected port.
Client ID	Enter the client ID of the Proficy UAA server that you specified in the **Admin Client ID** box during installation.
Client Secret	Enter the client secret configured for the OAuth client that you specified in the **Admin Client Secret** box during installation.

5. Select **Test**.

If connection to the UAA 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.

Item	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.
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.

   ℹ️ **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 UAA 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 UAA group.

Certificate Management

About the Certificate Management Tool

The Certificate Management tool allows you to manage external certificates and renew expired certificates. It 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 *(page 48)*.
- Renew a local certificate *(page 49)*.
- Import a server certificate or an issuer certificate *(page 48)*.
- Remove a server certificate or an issuer certificate *(page 49)*.
- View log messages *(page 50)* 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 .

   ⓘ **Tip:** By default, this icon appears on the desktop after you install 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 .

   ⓘ **Tip:** By default, this icon appears on the desktop after you install 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 .

   ⓘ Tip: By default, this icon appears on the desktop after you install 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 .

   ⓘ Tip: By default, this icon appears on the desktop after you install 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 .

   > **Tip:** By default, this icon appears on the desktop after you install 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.

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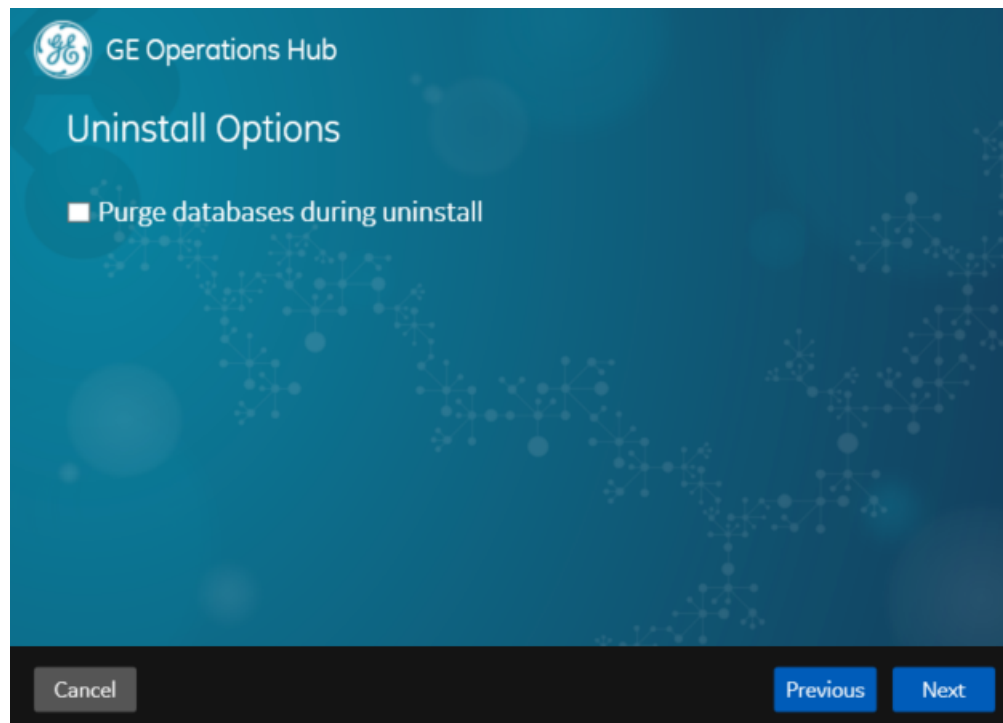
c. In addition to uninstalling Operations Hub, if you want to delete all the related data and applications, select the **Purge databases during uninstall** check box.

d. Select **Next**.
The You are ready to uninstall page appears.
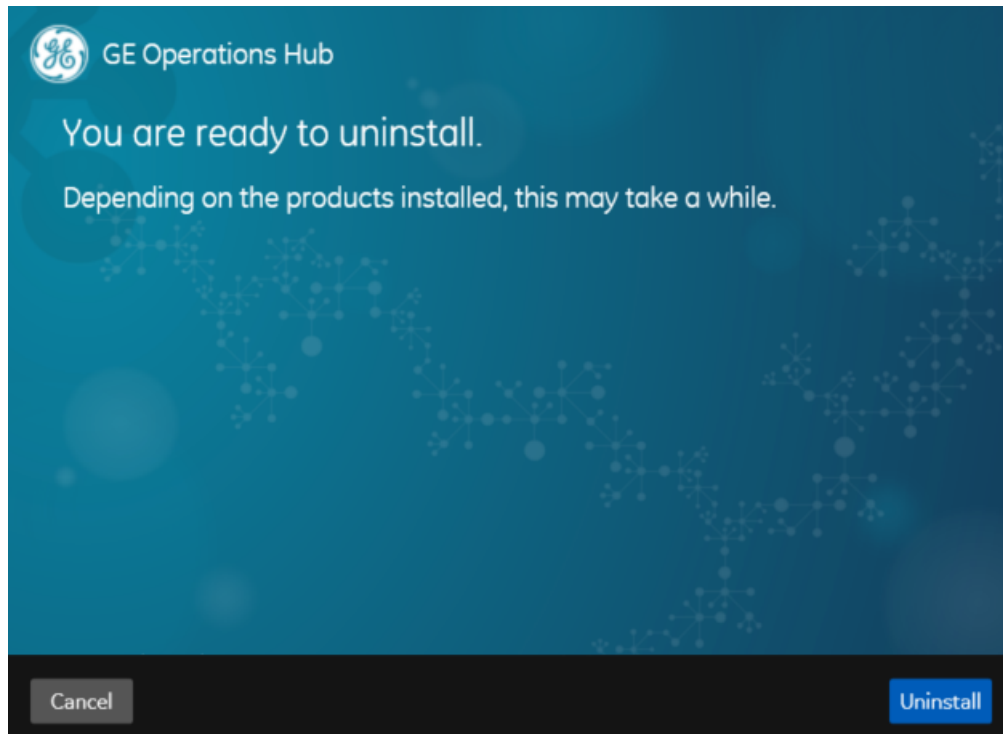
      e. Select **Uninstall**.

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:

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 *(page 223)*.

Configuring Historian 7.x in Operations Hub

Name: Hist7.0

Product: Proficy Historian   ▼

Description:

☑ **Enable System Connection** - This connection is used for trending.

Hostname: Ex: HISTORIANSERVER01

☑ Authentication Required

Username :   admin

Password: ●●●●●●●●●●   👁

⟳ Test

☑ **Enable REST Connection** - This connection is used for queries.

Base URL: https://hist7server:8443/

☐ REST Authentication Required

☐ Ignore TLS/SSL

☐ Certificate Required

Cancel   Save

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 *(page 207)*](#) and [Define Objects *(page 207)*](#).

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 *(page 223)*.

2. Import the model from the **Admin** > **Import/Export** option.
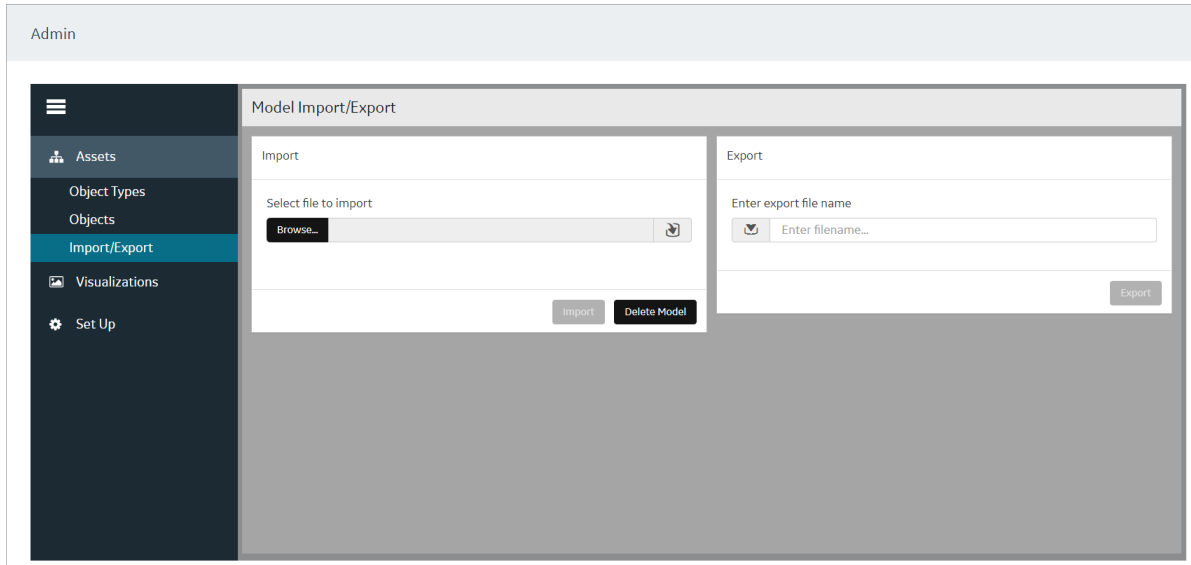
3. While in the **Admin**, make sure the Historian server is also setup via the **Setup** area.
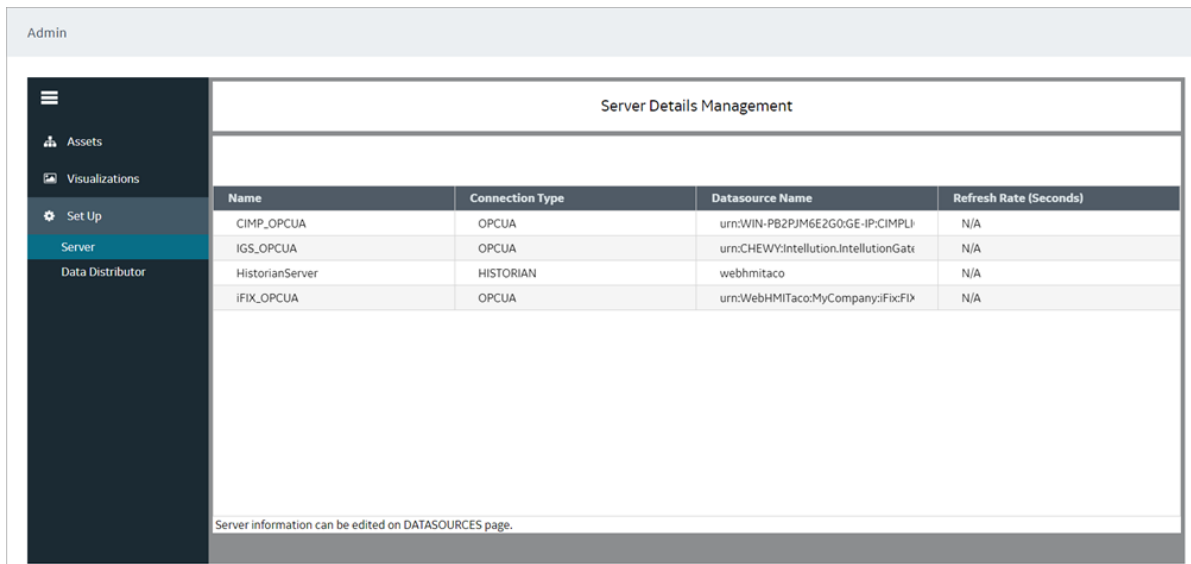
4. After the model is successfully imported, go the **Visualizations > Designer** section and enable the Trendable properties and save.
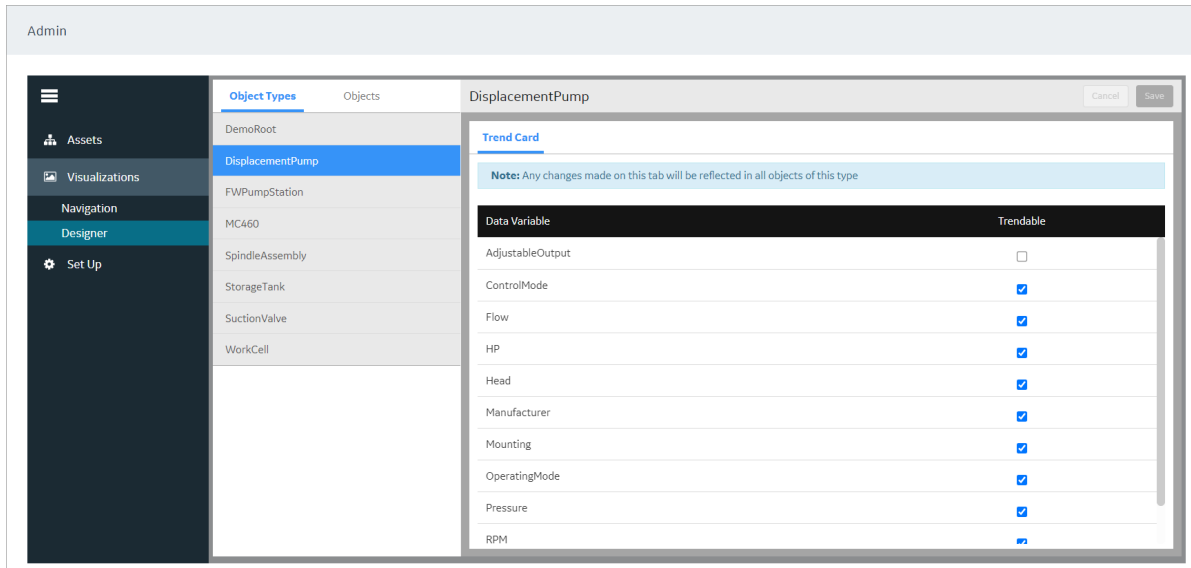
5. Switch to the **Apps** section.

6. Choose the **Historian Analysis** app.

7. Select the button to open the app.
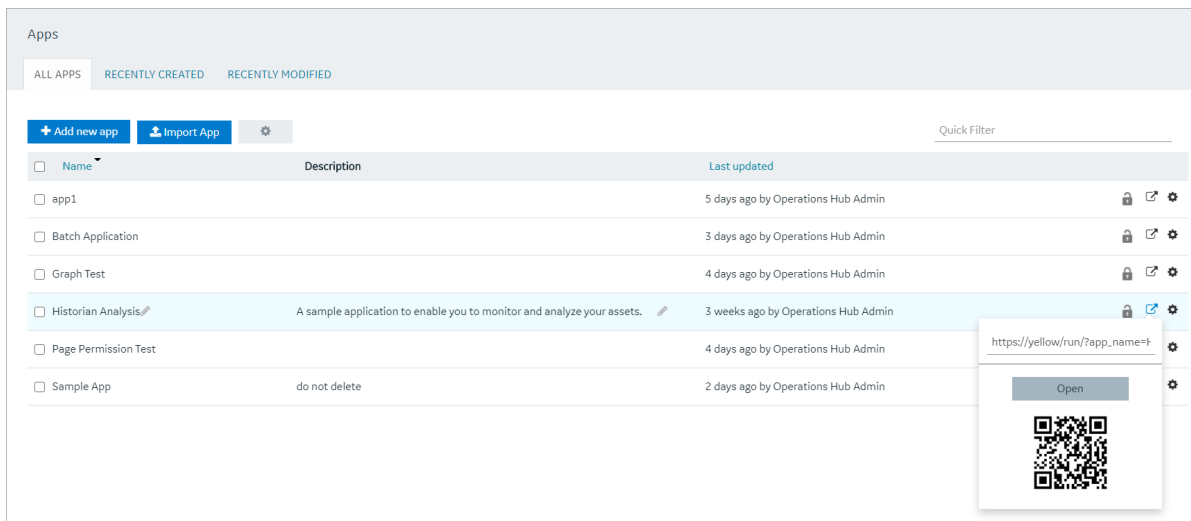
8. At run time, navigate through the model and the Trend chart will display data based on the context selected.
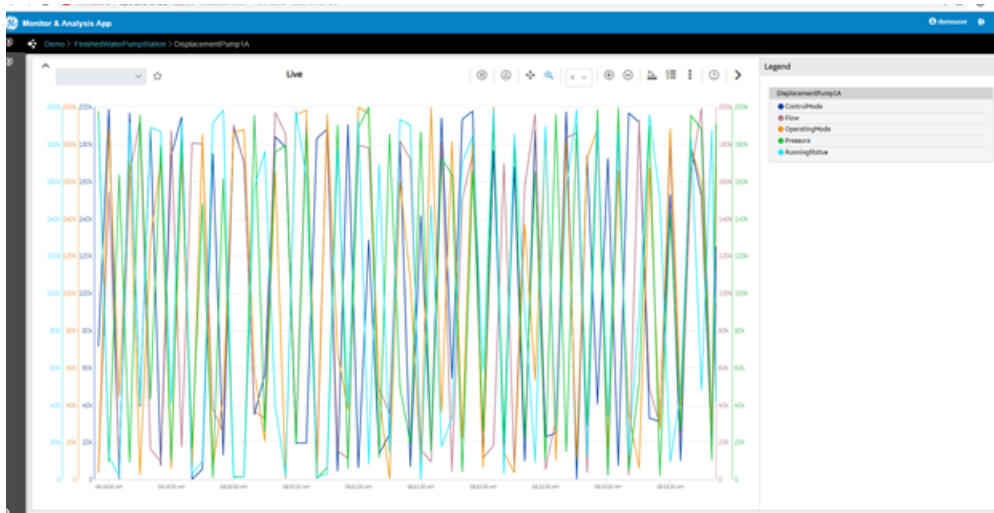
Use the Trend Widget without an Asset Model (Browsing Data Source Directly for Trend Widget)

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.
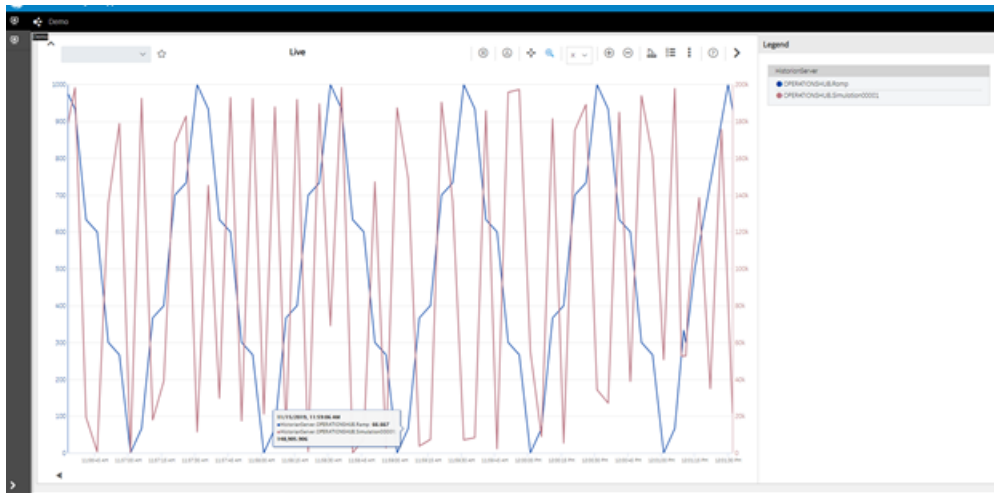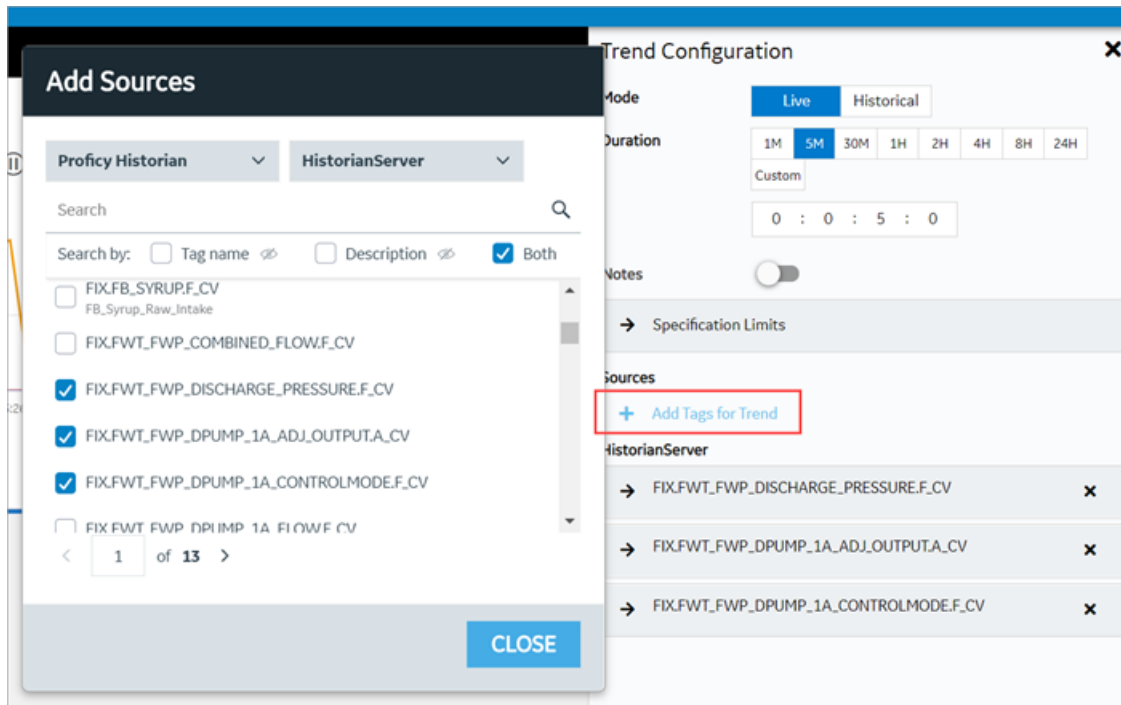
Create Historian REST Query for Operations Hub

1. Make sure the data source for Historian REST API is configured as described in the Configure Historian Data Sources for Operations Hub *(page 54)* section.

2. Create a query for Current value.

   Refer to Create a REST Query .

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.
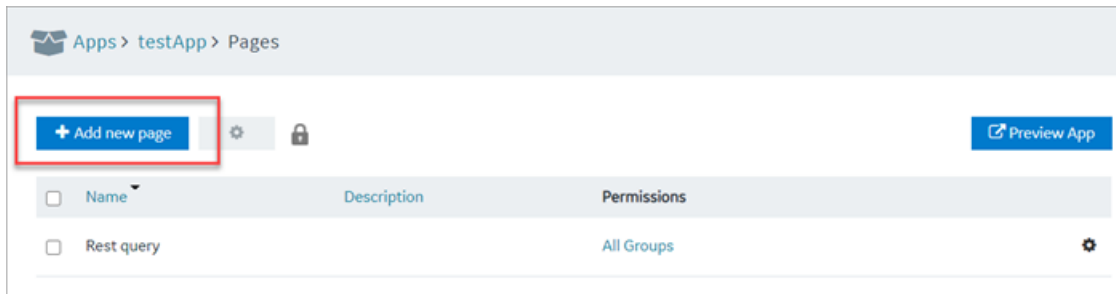
2. Within Page > Page Data, select Query > REST, next to **Get Current Value**, click Add to add the "Current Value Query" to Page.
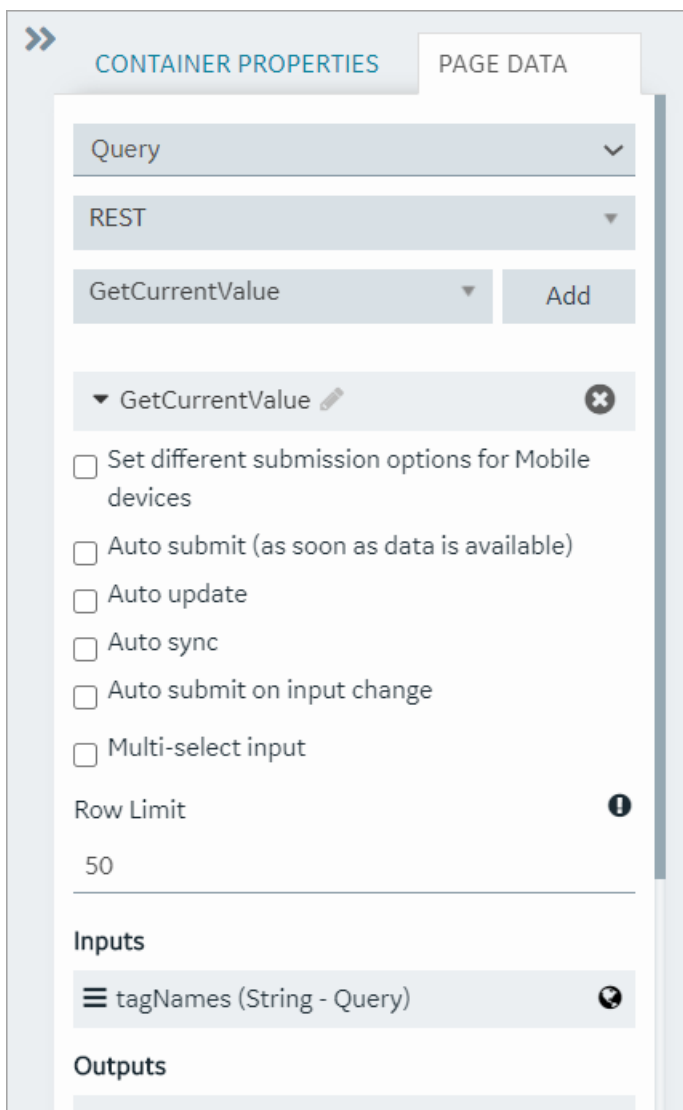
3. Add widgets to the Page, by first adding three containers to the page. From Layouts, select and drag Containers.
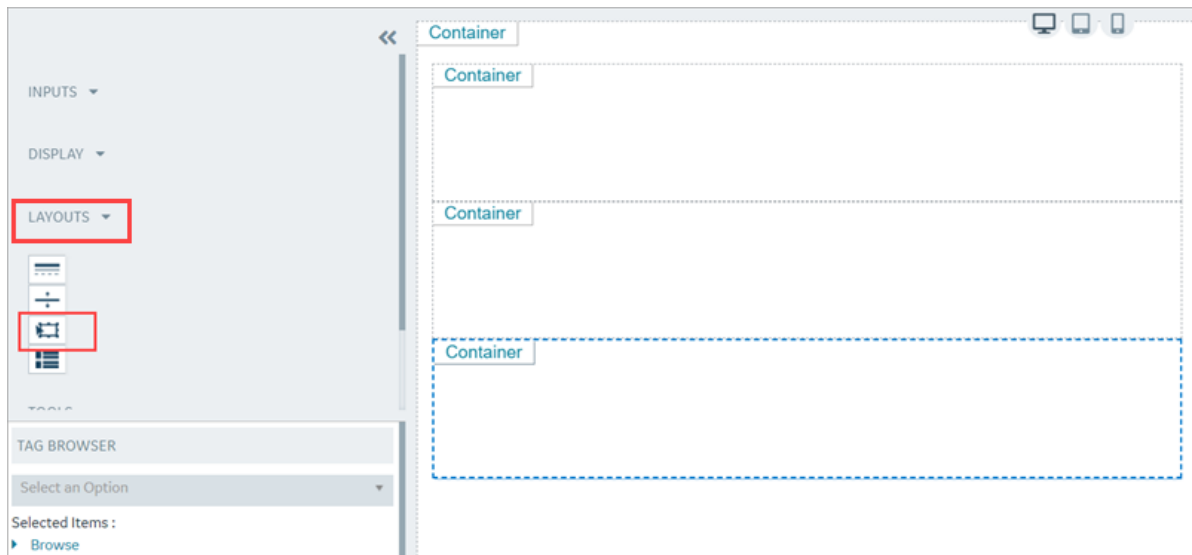
4. Add an Input > Input widget and a button into the first container, Display > Gauge into the second container, and Display > Table into the third container.
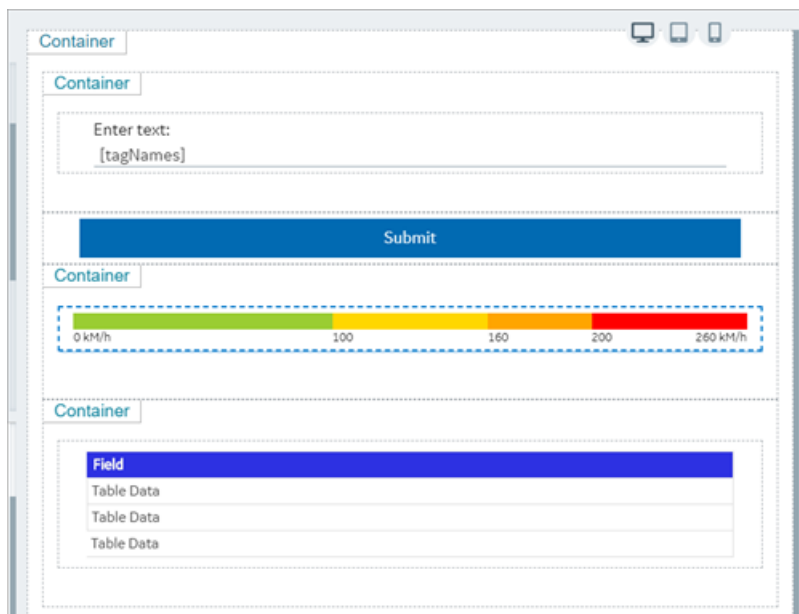
5. Now we need to bind the query parameters to each of the widgets: For the Input widget set the target data to the "GetCurrentValue" > TagNames. For the Source you can put in a manual entry of a known Historian tag name.

6. For the Gauge widget, set the style to "Arc Meter" and set the Data > Source > Get Current Value > historian_data.Data.Samples.Value.
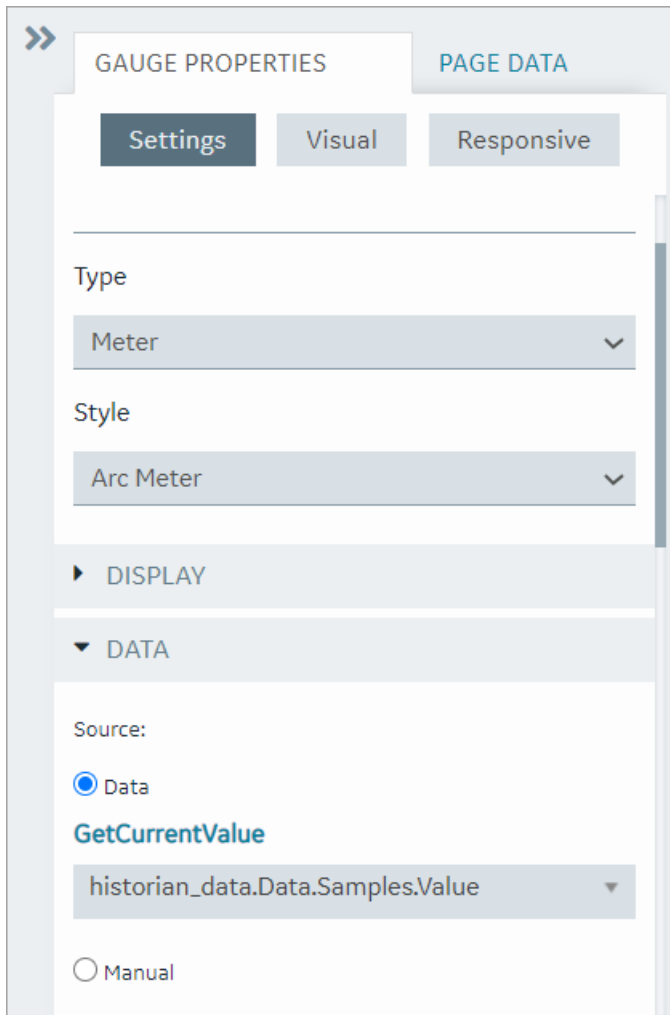
7. Set the color and start position numbers based on the data source High and Low as shown in the following figure.

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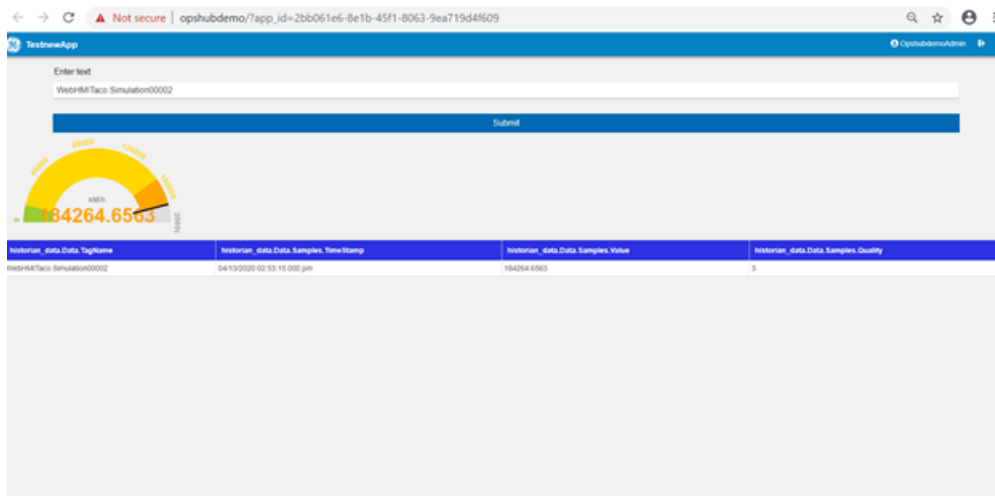
10. Bind the **Submit Action** on button to the query as shown in the following figure:
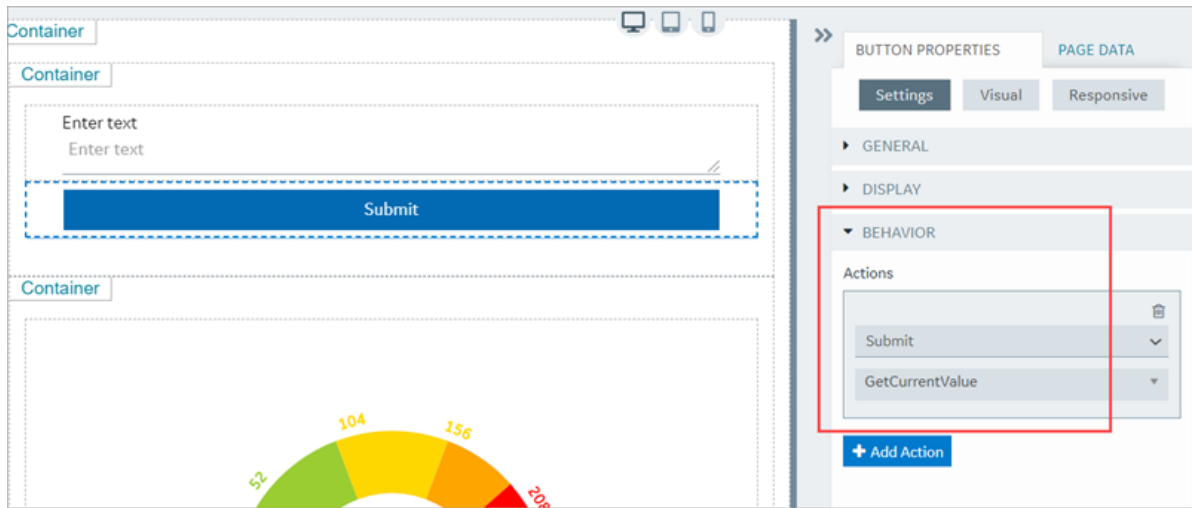
11. Save the App.

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 *(page 222)* section.
2. Provide the details to the external database. Refer to the Create a Query to a Relational Database *(page 70)* 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 *(page 70)* 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 *(page 74)* section.
5. View the page in the end app. For an example, see Example of Adding Relational Database Queries to a Page *(page 77)*.

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 *(page 232)*.

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:

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

Use the Relational Database Query in the Designer

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.

Apps > Asset Management > Pages

+ Add new page   ⚙   🔒   ⧉ Preview App

☐	Name ▾	Description	
☐	1 Dashboard	Homepage	⚙
☐	2 Supported Devices Types	Manage device types	⚙
☐	3 Manage Devices	Manage devices	⚙
☐	4 Device Type Metrics	Manage metrics	⚙
☐	5 Device Type Groups	Manage groups	⚙
☐	Template	A template for new pages	⚙

3. Select **Add new page**.
   The **Create Page** window appears.

Create Page   ✕

Page name: _____

Page description: _____

Include in app navigation: ☑

Create   Cancel

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:
   - Select the flow type as Query
   - Select the Data source type as Relational Database
   - Select the required data source
   - Select the required Query
   - Select a result set
   - Click Add

The Query with sub-selected result set will be added to the page. The naming convention will be QueryName - ResultSetName.

Assigning Inputs and Outputs to components will be exactly like that of REST and Entity pages.

📝 **Note:**
   - If a stored procedure has multiple result sets configured, the user must add each result set as an independent query in the page designer by choosing the result set.
   - If a stored procedure contains output parameters, then all the output parameters are treated as an additional result set.
   - In the case when there are multiple result sets for the query, and when the user adds them to the page, then the inputs and query execution option check boxes will be shown for the first result set, but internally they will be reflected to all the result sets for a query.
   - If the query has single result set, the user can add it multiple times in the page builder. But, if the same query output is changed to contain multiple result sets at a later point, then the user has to remove the second instance of the query before adding the new result set.

- 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.
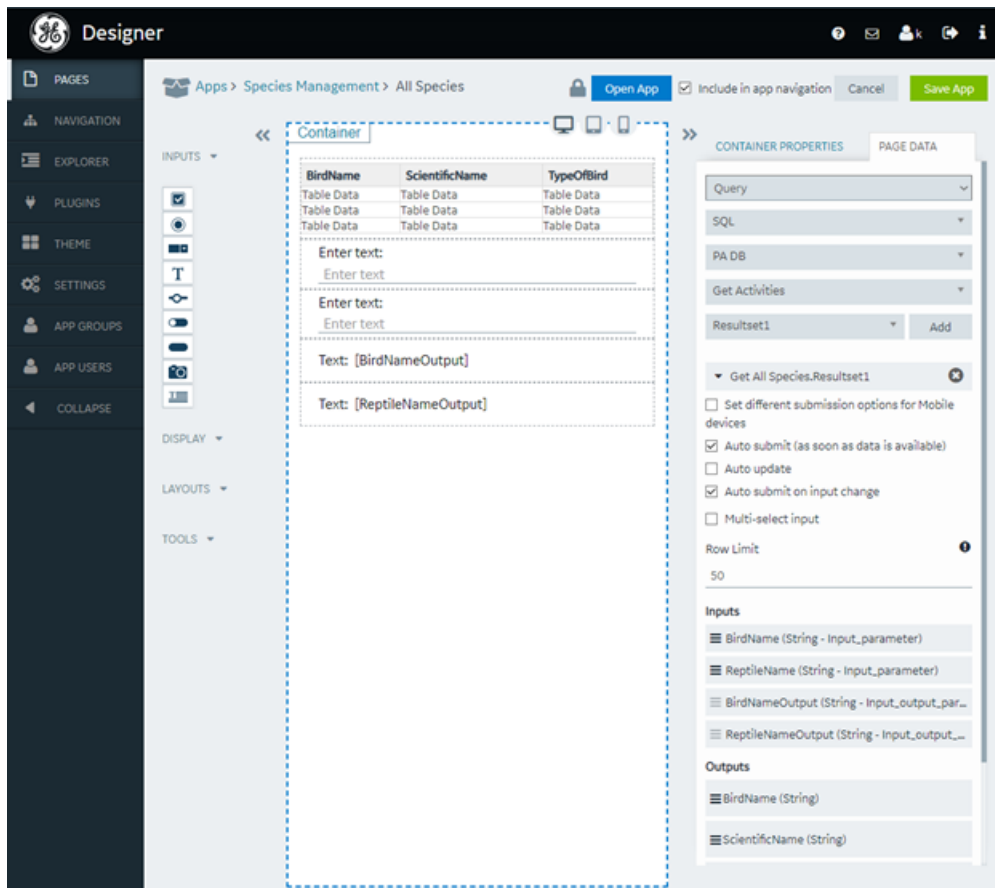
The changes made to the page are saved.
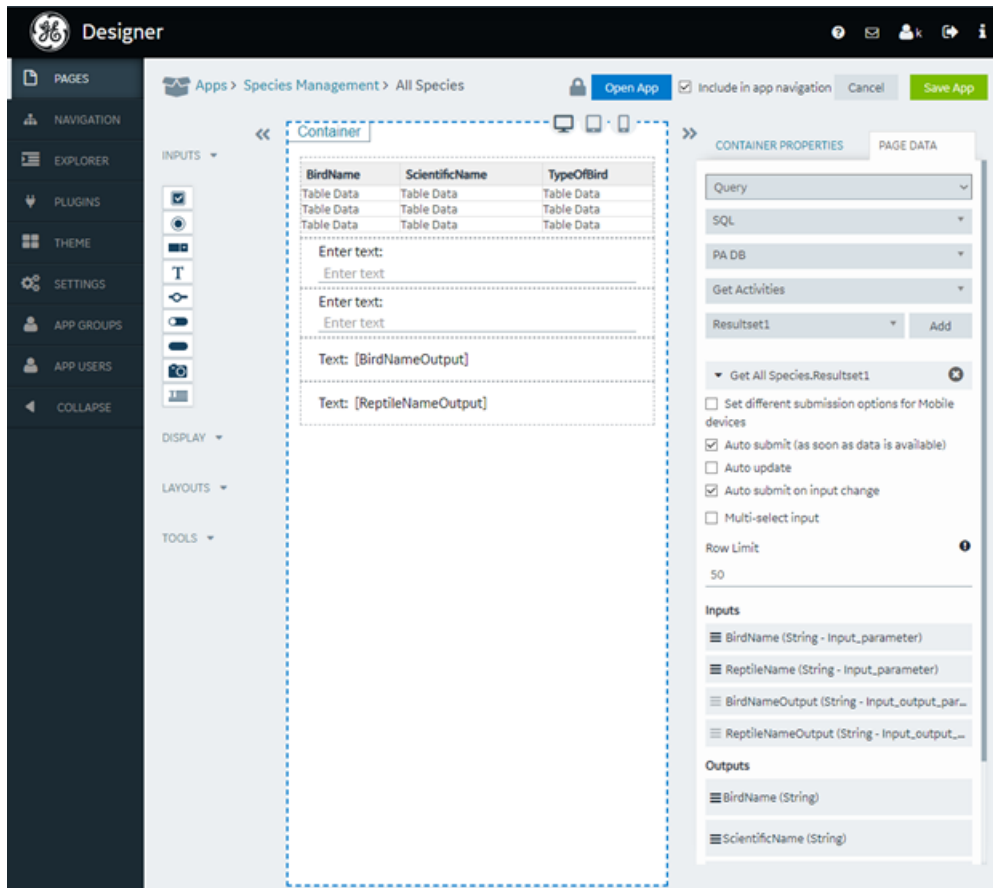
📝 **Note:** View the Page in the End app, by clicking **Open App** button.

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. The steps that follow describe how this page was created.

1. Add two buttons and two input boxes to the page as shown in the following figure, and make the input controls disabled.

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 show in the screenshot (+ for next, - for previous).
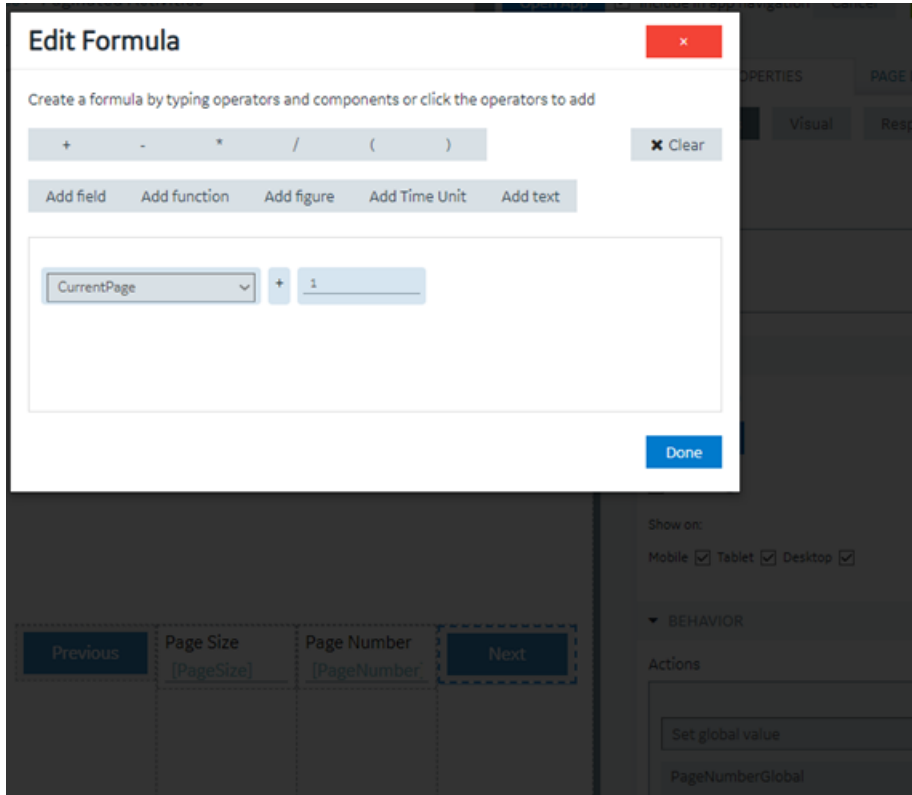
5. Select each button and set the display condition as shown in the following figures.
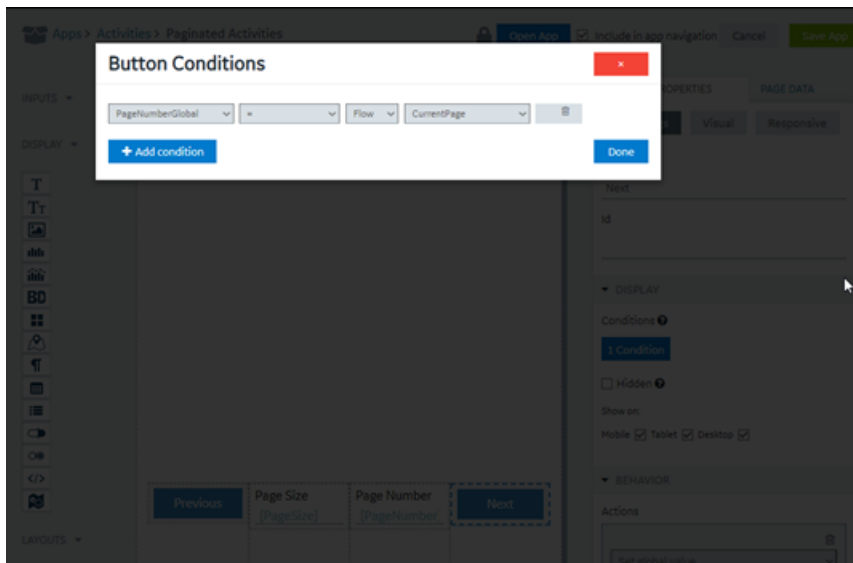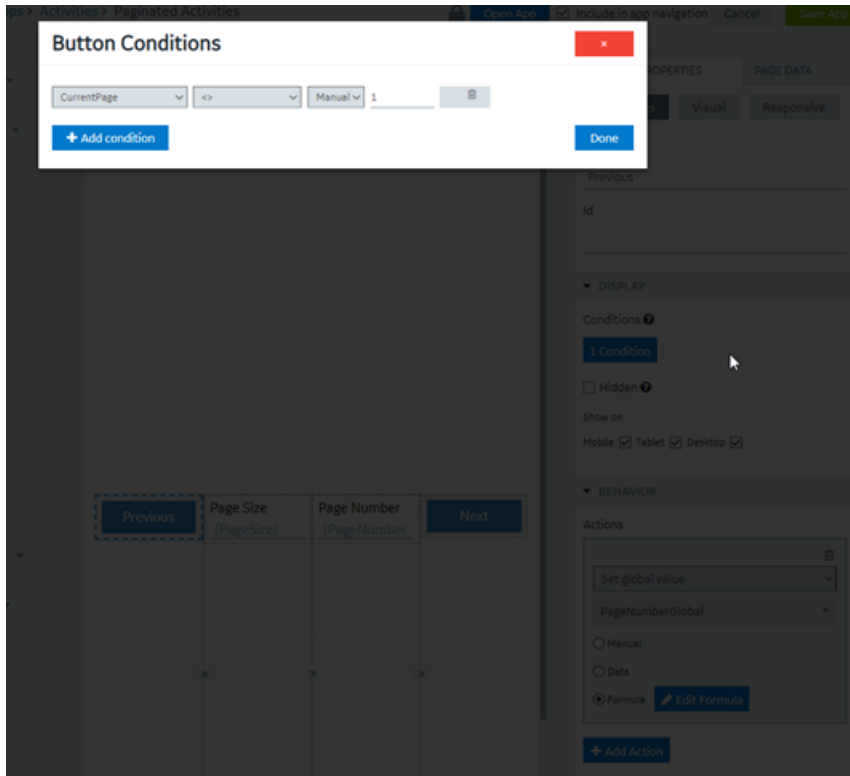
6. Select **Save App**.

   The final page displays as shown in the first figure.

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 *(page 227)*.
2. Build an asset model for OPC UA data sources in this order:
   - Create object types *(page 207)* with Proficy iFIX, Proficy CIMPLICITY, and IGS data variables.
   - For the object types, create object instances *(page 207)*.
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 *(page 210)*.

4. Use the Trend Widget for OPC UA Data Sources *(page 82)*.
5. To enable write operations in Proficy CIMPLICITY for Operations Hub, refer to Configure Proficy CIMPLICITY for Writes *(page 84)*.
6. To enable write operations in Proficy iFIX for Operations Hub, refer to Configure Proficy iFIX for Writes *(page 86)*.

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 Configure Trend Chart Settings *(page 339)*.

Use the Trend Widget with an Asset Model

- Create a data source with OPC UA configuration in Operations Hub *(page 227)*.
- 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.
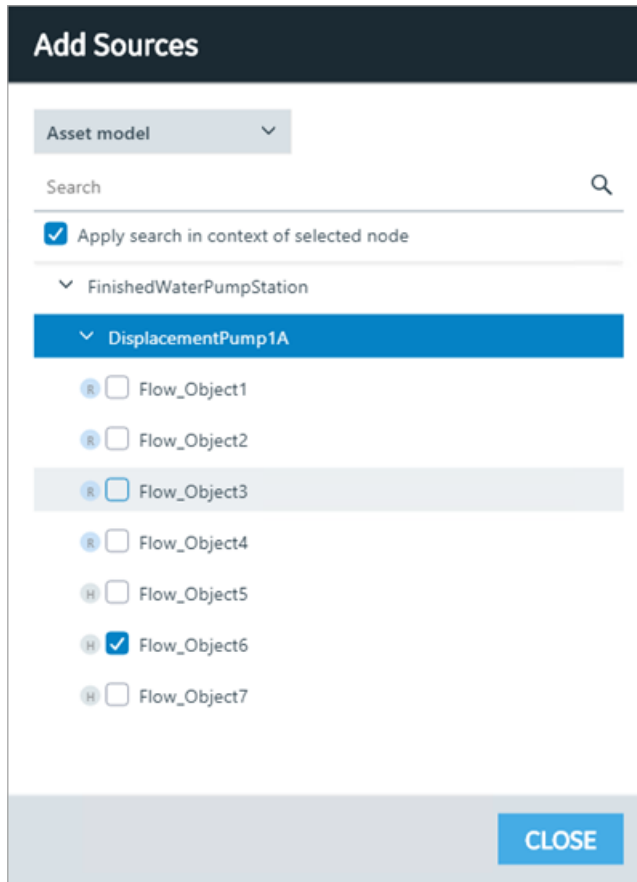
5. Select **Asset Model** from the drop-down.
   A list of assets appear.

6. Browse and select the check box for the properties you want to add to the trend chart.
   Refer to Browse Data Sources *(page 232)*.
   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 *(page 227)*.

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.
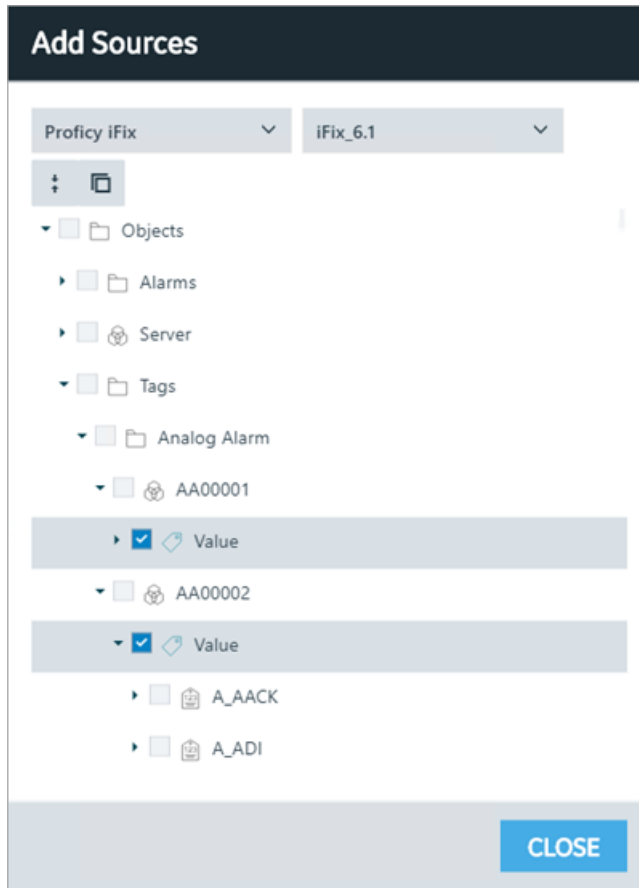
5. Select iFIX, CIMPLICITY, or OPC UA from the drop-down, then select the server.
   The address space for the selected data source appears in a tree structure.

6. Browse and select the check box for the tags you want to add to the trend chart.
   Refer to Browse Data Sources *(page 232)*.
   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
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 and <u>set up an extension query *(page 153)*</u> for CIMPLICITY with these details:

Method	WRITE

Tag Source	OPC UA
Tag inputs and outputs	As required

6. Create an application page and bind the extension query with widgets.

7. Log in to the end application, and perform the write operations in runtime.
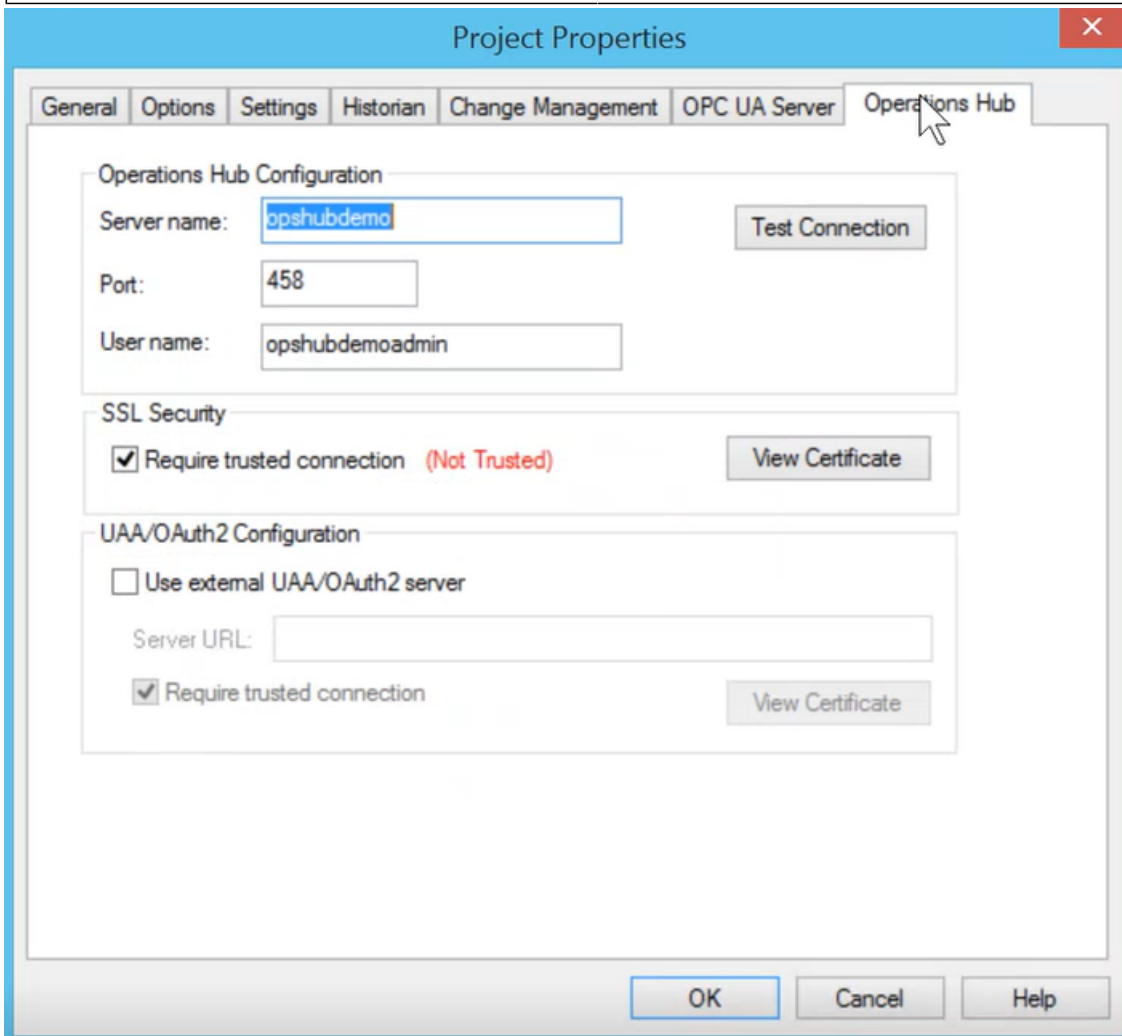
Configure Proficy iFIX for Writes

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

1. Log in to Proficy iFIX.

2. Go to your **C: drive > Program Files (x86) > GE > iFIX** and search for the `secmgr.clr.dll.config` file. to modify.

3. Update and save your `secmgr.clr.dll.config` file modified with these details:
   - Ensure that `uaa_oauthHost` points to the UAA server that is providing authentication services.
   - If the UAA server is the default one installed with Operations Hub, this will generally be the hostname (short or FQDN) used when you installed Operations Hub.

```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>
```

4. To verify the write operations, log in to Operations Hub and set up an extension query *(page 153)* for iFIX with these details:

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

5. Create an application page and bind the extension query with widgets.

6. Log in to the end application, and perform the write operations in runtime.

Data Binding to Widgets

Use these options to provide input values to your queries in a quick and simple manner.

⚠️ **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 will have to browse and select all over again to build input queries.

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 *(page 232)*.
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.

Refer to:

- Create an Extension Query *(page 153)*
- About Queries *(page 129)*

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.
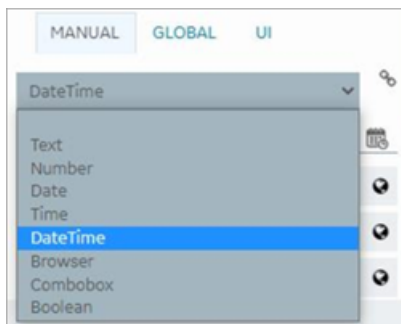

- Global
- UI

📝 **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 the widget properties. Select the link to directly jump to the query on the **PAGE DATA** tab.
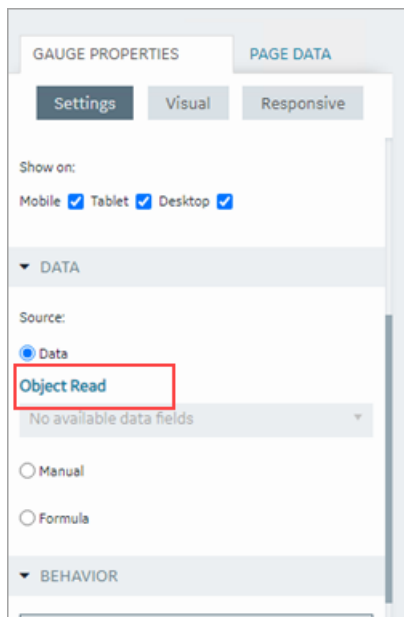
Drag and Drop Data

You can drag and drop the data from selected tags or properties onto the widgets. You can also select **Add** to add the query to the page.

Refer to <u>Sample Page with Historical Data</u> *(page 355)*.

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 *(page 129)*, database tables *(page 107)* (called entities), events *(page 167)*, email templates *(page 176)*, users *(page 186)*, 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.

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 *(page 91)*

📄 **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.
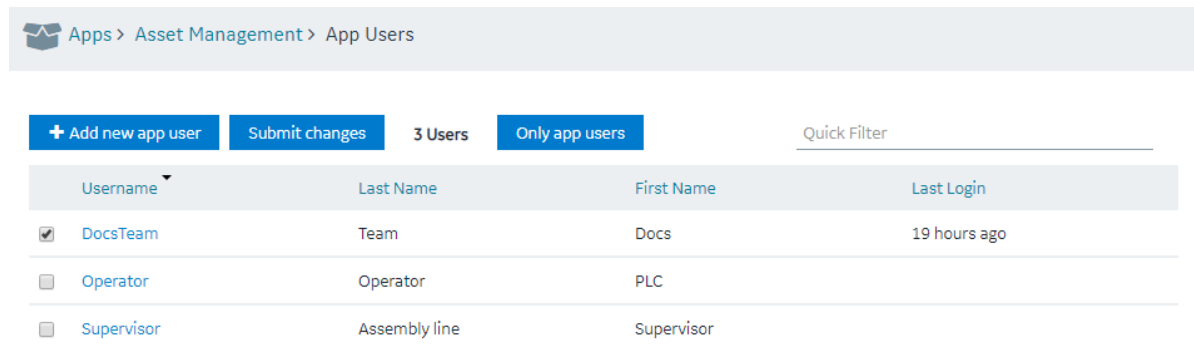   The **PAGES** workspace appears.

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.

Apps

ALL APPS   RECENTLY CREATED

☐ Name ▾	Description	Last updated			
☐ Asset Management	Manage Devices	3 months ago by Docs Team	🔒	⬈	⚙
☐ Asset Testing	Test Devices	3 months ago by Docs Team	🔒	⬈	⚙
☐ Building Monitor_Step1	Simple Sample App	3 months ago by Docs Team	🔒	⬈	⚙
☐ Building Monitor_Step2	Step 1 with History	3 months ago by Docs Team	🔒	⬈	⚙
☐ Building Monitor_Step3	Step 2 with Repeater	3 months ago by Docs Team	🔒	⬈	⚙
☐ Building Monitor_Step4	Step 3 and gauges	3 months ago by Docs Team	🔒	⬈	⚙
☐ Building Monitor_Step5	Step 4 with data from Pivot Entity	3 months ago by Docs Team	🔒	⬈	⚙
☐ ES Event Map View	Monitor Tags and Events with Map	3 months ago by Docs Team	🔒	⬈	⚙
☐ ES_M2MvsPivot	M2M vs Pivot Comparison	3 months ago by Docs Team	🔒	⬈	⚙
☐ Store Temp App	temp	2 months ago by Docs Team	🔒	⬈	⚙

2. Select **RECENTLY CREATED**.
   A list of the ten most recently created applications appears.

Apps

ALL APPS   RECENTLY CREATED   RECENTLY MODIFIED

+ Add new app   **⬆ Import App**   ⚙   Quick Filter

☐	Name	Description	Last updated			
☐	Widget font testing 2		18 hours ago by Docs Team	🔓	⬈	⚙
☐	ES Event Map View	Monitor Tags and Events with Map	Yesterday by Docs Team	🔓	⬈	⚙
☐	Building Monitor_Step1	Simple Sample App	Yesterday by Docs Team	🔓	⬈	⚙
☐	Building Monitor_Step2	Step 1 with History	Yesterday by Docs Team	🔓	⬈	⚙
☐	Building Monitor_Step3	Step 2 with Repeater	Yesterday by Docs Team	🔓	⬈	⚙
☐	Building Monitor_Step4	Step 3 and gauges	Yesterday by Docs Team	🔓	⬈	⚙
☐	Building Monitor_Step5	Step 4 with data from Pivot Entity	Yesterday by Docs Team	🔓	⬈	⚙
☐	ES_M2MvsPivot	M2M vs Pivot Comparison	Yesterday by Docs Team	🔓	⬈	⚙
☐	Asset Management	Manage Devices	Yesterday by Docs Team	🔓	⬈	⚙
☐	Asset Testing	Test Devices	Yesterday by Docs Team	🔓	⬈	⚙

Access a Recently Modified Application

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

Apps

ALL APPS   RECENTLY CREATED

	Name ▾	Description	Last updated			
☐	Asset Management	Manage Devices	3 months ago by Docs Team	🔒	⬈	⚙
☐	Asset Testing	Test Devices	3 months ago by Docs Team	🔒	⬈	⚙
☐	Building Monitor_Step1	Simple Sample App	3 months ago by Docs Team	🔒	⬈	⚙
☐	Building Monitor_Step2	Step 1 with History	3 months ago by Docs Team	🔒	⬈	⚙
☐	Building Monitor_Step3	Step 2 with Repeater	3 months ago by Docs Team	🔒	⬈	⚙
☐	Building Monitor_Step4	Step 3 and gauges	3 months ago by Docs Team	🔒	⬈	⚙
☐	Building Monitor_Step5	Step 4 with data from Pivot Entity	3 months ago by Docs Team	🔒	⬈	⚙
☐	ES Event Map View	Monitor Tags and Events with Map	3 months ago by Docs Team	🔒	⬈	⚙
☐	ES_M2MvsPivot	M2M vs Pivot Comparison	3 months ago by Docs Team	🔒	⬈	⚙
☐	Store Temp App	temp	2 months ago by Docs Team	🔒	⬈	⚙

2. Select **RECENTLY MODIFIED**.

A list of the ten most recently modified applications appears.

Apps

ALL APPS   RECENTLY CREATED   RECENTLY MODIFIED

+ Add new app   **⬆ Import App**   ⚙   Quick Filter

☐	Name	Description	Last updated ▼			
☐	Asset Management	Manage Devices	Yesterday by Docs Team	🔒	⧉	⚙
☐	Asset Testing	Test Devices	Yesterday by Docs Team	🔒	⧉	⚙
☐	Building Monitor_Step1 ✎	Simple Sample App ✎	Yesterday by Docs Team	🔒	⧉	⚙
☐	Building Monitor_Step2	Step 1 with History	Yesterday by Docs Team	🔒	⧉	⚙
☐	Building Monitor_Step3	Step 2 with Repeater	Yesterday by Docs Team	🔒	⧉	⚙
☐	Building Monitor_Step4	Step 3 and gauges	Yesterday by Docs Team	🔒	⧉	⚙
☐	Building Monitor_Step5	Step 4 with data from Pivot Entity	Yesterday by Docs Team	🔒	⧉	⚙
☐	ES_M2MvsPivot	M2M vs Pivot Comparison	Yesterday by Docs Team	🔒	⧉	⚙
☐	ES Event Map View	Monitor Tags and Events with Map	Yesterday by Docs Team	🔒	⧉	⚙
☐	Widget font testing 2		18 hours ago by Docs Team	🔒	⧉	⚙

Create an Application

This topic describes how to create an application. You can also <u>copy an application</u> <i>(page 101)</i>.

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

Apps

ALL APPS   RECENTLY CREATED

+ Add new app   **⬆ Import App**   ⚙   ⏮ ◀ 1 ▶ ⏭   Quick Filter

☐ Name ▼	Description	Last updated			
☐ Asset Management	Manage Devices	3 months ago by Docs Team	🔒	⬏	⚙
☐ Asset Testing	Test Devices	3 months ago by Docs Team	🔒	⬏	⚙
☐ Building Monitor_Step1	Simple Sample App	3 months ago by Docs Team	🔒	⬏	⚙
☐ Building Monitor_Step2	Step 1 with History	3 months ago by Docs Team	🔒	⬏	⚙
☐ Building Monitor_Step3	Step 2 with Repeater	3 months ago by Docs Team	🔒	⬏	⚙
☐ Building Monitor_Step4	Step 3 and gauges	3 months ago by Docs Team	🔒	⬏	⚙
☐ Building Monitor_Step5	Step 4 with data from Pivot Entity	3 months ago by Docs Team	🔒	⬏	⚙
☐ ES Event Map View	Monitor Tags and Events with Map	3 months ago by Docs Team	🔒	⬏	⚙
☐ ES_M2MvsPivot	M2M vs Pivot Comparison	3 months ago by Docs Team	🔒	⬏	⚙
☐ Store Temp App	temp	2 months ago by Docs Team	🔒	⬏	⚙

2. Select **Add new app**.
The **Create App** window

Create App   ×

App name:

Description:

Cancel   **Create**

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.

Copy an Application

This topic describes how to copy an application. You can also create an application *(page 99)*.

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 *(page 102)*, and then import *(page 104)* it.

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

Apps			
ALL APPS	**RECENTLY CREATED**		

Name	Description	Last updated	
Asset Management	Manage Devices	3 months ago by Docs Team	🔒 ⬈ ⚙
Asset Testing	Test Devices	3 months ago by Docs Team	🔒 ⬈ ⚙
Building Monitor_Step1	Simple Sample App	3 months ago by Docs Team	🔒 ⬈ ⚙
Building Monitor_Step2	Step 1 with History	3 months ago by Docs Team	🔒 ⬈ ⚙
Building Monitor_Step3	Step 2 with Repeater	3 months ago by Docs Team	🔒 ⬈ ⚙
Building Monitor_Step4	Step 3 and gauges	3 months ago by Docs Team	🔒 ⬈ ⚙
Building Monitor_Step5	Step 4 with data from Pivot Entity	3 months ago by Docs Team	🔒 ⬈ ⚙
ES Event Map View	Monitor Tags and Events with Map	3 months ago by Docs Team	🔒 ⬈ ⚙
ES_M2MvsPivot	M2M vs Pivot Comparison	3 months ago by Docs Team	🔒 ⬈ ⚙
Store Temp App	temp	2 months ago by Docs Team	🔒 ⬈ ⚙

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.

Create App

App name:	Building Monitor_Step2_1524484067911
Description:	Step 1 with History

Cancel   Create

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

If you want to use or copy an application that was created using a different site, you must export the
application, and then import *(page 104)* it.

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

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.

   ℹ **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.

Import an Application

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.

📝 **Note:** For these applications to perform as expected, ensure that you resave them after importing to your system:

- Applications containing the trend card and the breadcrumb plug-ins
- Historian Analysis application, if imported as a duplicate (and renamed)

that you want to import.

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**.

Option	Description
Duplicate	In case of conflict, you can choose to make a duplicate copy of the application, and import to your system.
Replace	In case of conflict, you can choose to replace the existing application with the one being imported.

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

Delete an Application

- When you delete an application, only the application is deleted; the components used by the application are not deleted.
- You cannot delete an application if it is locked.

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.

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 *(page 115)* 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 *(page 117)* or import data from a Microsoft Excel workbook *(page 119)*.

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 .

- ⬚ : 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
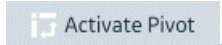
  Activate Pivot .

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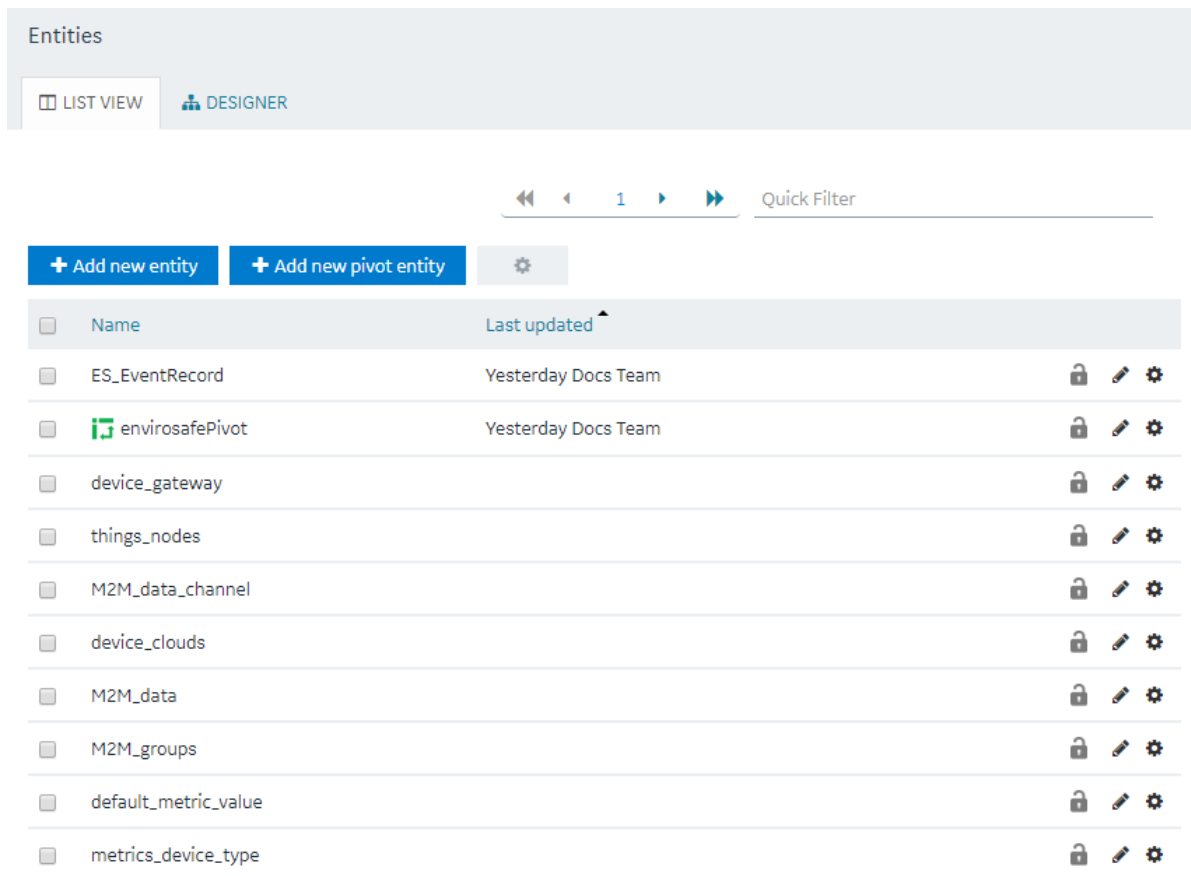
> ⓘ **Tip:** You can modify values in the available fields, and then select **Save** or **Save and Exit** to save your changes.

Create an Entity

This topic describes how to create an entity. You can also .

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

Entities		
⊞ LIST VIEW ⛢ DESIGNER		

	Name	Last updated ▲		
☐	ES_EventRecord	Yesterday Docs Team	🔒	✏ ⚙
☐	envirosafePivot	Yesterday Docs Team	🔒	✏ ⚙
☐	device_gateway		🔒	✏ ⚙
☐	things_nodes		🔒	✏ ⚙
☐	M2M_data_channel		🔒	✏ ⚙
☐	device_clouds		🔒	✏ ⚙
☐	M2M_data		🔒	✏ ⚙
☐	M2M_groups		🔒	✏ ⚙
☐	default_metric_value		🔒	✏ ⚙
☐	metrics_device_type		🔒	✏ ⚙

+ Add new entity   **+ Add new pivot entity**   ⚙

⏮ ◀ 1 ▶ ⏭   Quick Filter

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.

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 *(page 115)* 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 Activate Pivot 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 *(page 110)*.

   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.

> ℹ️ **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 *(page 117)* or import data in to the entity *(page 119)*.

Add a Row to an Entity

As needed, add fields to the entity *(page 115)*.

This topic describes how to add a row and enter data manually in an entity. You can also import data *(page 119)* 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.
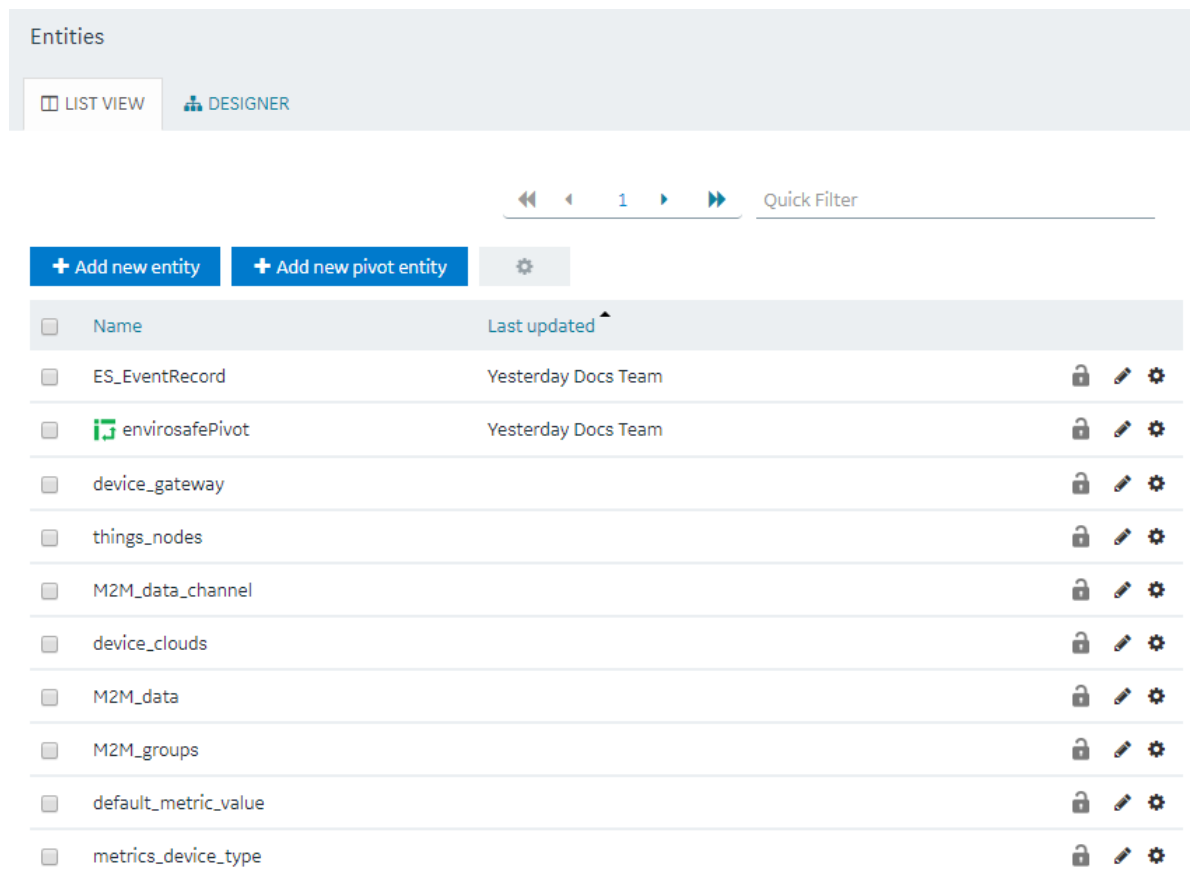
4. Enter values in the blank row, and then select **Save Changes**.
   The values that you have entered in the row are saved.

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 *(page 117)*.

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.

Set Column Mapping

Select Data ⟩ Specify Column Mappings ⟩

Spreadsheet Data

☐ Use Header Row Names

Import data from row ____ to row ____

Entity Data

◉ Append to existing data

○ Overwrite existing data

Cancel Next

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.

Entities		
▥ LIST VIEW	⚙ DESIGNER	

	⏮ ◀ 1 ▶ ⏭	Quick Filter

➕ Add new entity	➕ Add new pivot entity	⚙

☐	Name	Last updated ▲			
☐	ES_EventRecord	Yesterday Docs Team	🔒	✎	⚙
☐	envirosafePivot	Yesterday Docs Team	🔒	✎	⚙
☐	device_gateway		🔒	✎	⚙
☐	things_nodes		🔒	✎	⚙
☐	M2M_data_channel		🔒	✎	⚙
☐	device_clouds		🔒	✎	⚙
☐	M2M_data		🔒	✎	⚙
☐	M2M_groups		🔒	✎	⚙
☐	default_metric_value		🔒	✎	⚙
☐	metrics_device_type		🔒	✎	⚙

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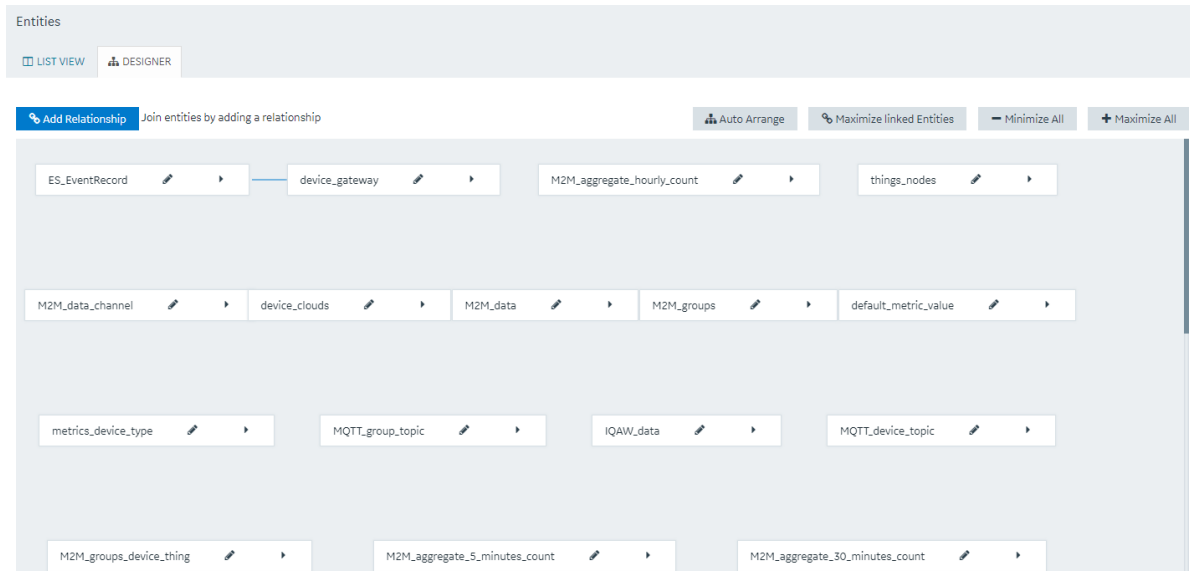
> ⓘ **Tip:** You can arrange the entities in an order, minimize all entities, maximize all entities, or maximize only the entities in a relationship by selecting **Auto Arrange**, **Minimize All**, **Maximize All**, or **Maximize linked Entities** respectively.

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.

Entities

LIST VIEW   **DESIGNER**

	Name	Last updated ▲			
☐	ES_EventRecord	Yesterday Docs Team	🔒	✏	⚙
☐	🔲 envirosafePivot	Yesterday Docs Team	🔒	✏	⚙
☐	device_gateway		🔒	✏	⚙
☐	things_nodes		🔒	✏	⚙
☐	M2M_data_channel		🔒	✏	⚙
☐	device_clouds		🔒	✏	⚙
☐	M2M_data		🔒	✏	⚙
☐	M2M_groups		🔒	✏	⚙
☐	default_metric_value		🔒	✏	⚙
☐	metrics_device_type		🔒	✏	⚙

+ Add new entity   **+ Add new pivot entity**   ⚙

◀◀ ◀ 1 ▶ ▶▶   Quick Filter

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.
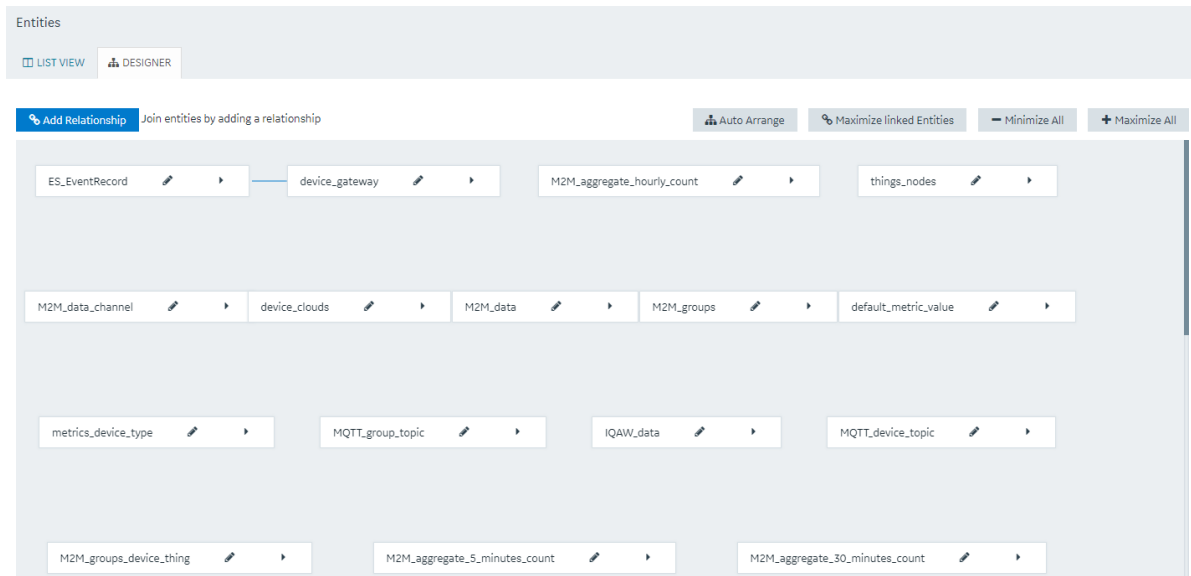
3. On the line connecting the two entities whose relationship you want to delete, select ✖.
   A message appears, asking you to confirm that you want to delete the relationship.

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 *(page 131)*, Update *(page 136)*, Insert *(page 140)*, and Delete *(page 142)*.
- SQL *(page 145)* Queries: Used to view and modify data stored in an external SQL database by executing existing stored procedures for that database.
- REST *(page 148)* Queries: Used to view and modify data stored in external sources by accessing their exposed REST APIs, such as Historian.
- Extension *(page 153)* 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 *(page 156)* to modify and use them.

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

Name	Type	Description	Origin	Permissions
Current Value	Extension		System	All Groups
Historical By Count	Extension		System	All Groups
Historical By Interval	Extension		System	All Groups
Historian Write Comment	Extension		System	All Groups
Historian Read Comment	Extension		System	All Groups
OPC UA Write	Extension		System	All Groups
Historical By Interval-Calculated Mode	Extension		System	All Groups

- 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.

To troubleshoot errors returned for OOTB queries, refer to <u>Error Codes</u> *(page 375)*.

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 a Get Query

This topic describes how to create a Get query. You can also .

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 **Get**.

6. In the **Entity** box, select an entity from which you want to get results.
The **Output Data**, **Conditions**, **Role Conditions**, and **Advanced** sections appear.

7. In the **Output Data** section, select **Add field**.
   The **FIELD**, **FUNCTION**, and **ACCESS** boxes appear.

   i **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. *i* **Tip:** If the entity that you have specified in the **Entity** box is a source entity in a relationship, 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 account 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.

Field	Description

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.
	
	 • **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. • **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: ◦ 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	Select the entity field that contains the value that you want to compare with the value in the **In user's role tree** box. This box appears only if the value in the **Row visibility** box is **Filter rows**.
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.

Field	Description
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. In the **Order By** box, select the entity field that stores the user name, and then select **Asc**.

    b. In the **Group By** box, select the entity field that stores the country.

12. Select **Save** or **Save And Exit**.
The query is created.
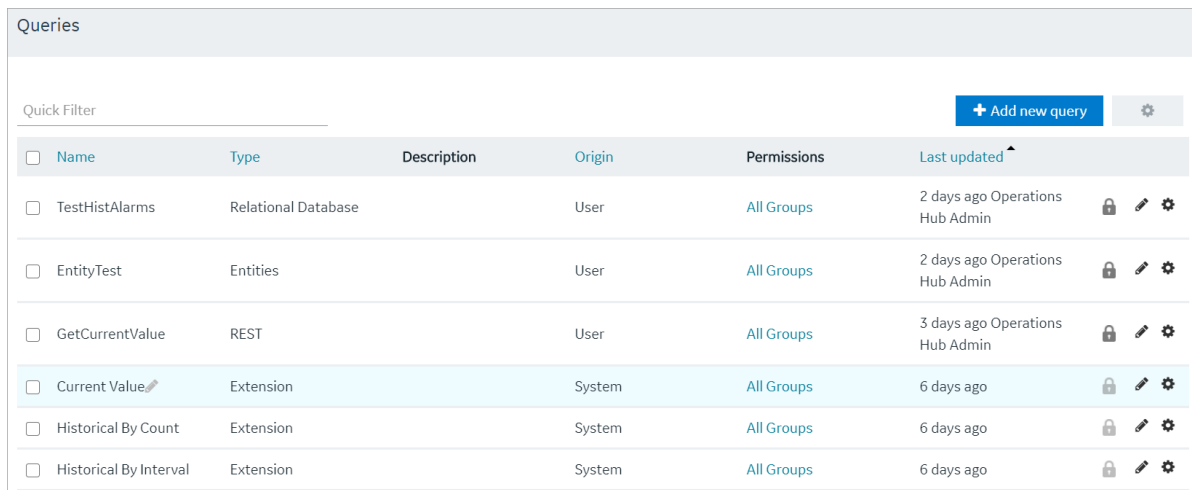
Create an Update Query

This topic describes how to create an Update query. You can also copy a query *(page 156)*.

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

	Name	Type	Description	Origin	Permissions	Last updated ▲			
☐	TestHistAlarms	Relational Database		User	All Groups	2 days ago Operations Hub Admin	🔒	✏	⚙
☐	EntityTest	Entities		User	All Groups	2 days ago Operations Hub Admin	🔒	✏	⚙
☐	GetCurrentValue	REST		User	All Groups	3 days ago Operations Hub Admin	🔒	✏	⚙
☐	Current Value ✏	Extension		System	All Groups	6 days ago	🔒	✏	⚙
☐	Historical By Count	Extension		System	All Groups	6 days ago	🔒	✏	⚙
☐	Historical By Interval	Extension		System	All Groups	6 days ago	🔒	✏	⚙

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

Create Query

Query name: _____

Create Cancel

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.

Queries > DeviceList

Description: _____

Query Type:
- ○ Get
- ● Update
- ○ Insert
- ○ Delete

Entity: device_clouds ▾

Conditions

+ Add

Set Data

device_clouds -> cloud_id ▾   Source: Input field ▾   Input Name: _____   🗑

+ Add   **+ Add all fields**

Cancel   **Save**   **Save As New**   **Save And Exit**

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 account 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.

Field	Description
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 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 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.

Field	Description
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 an Insert Query

This topic describes how to create an Insert query. You can also copy a query *(page 156)*.

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.

Field	Description
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 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.
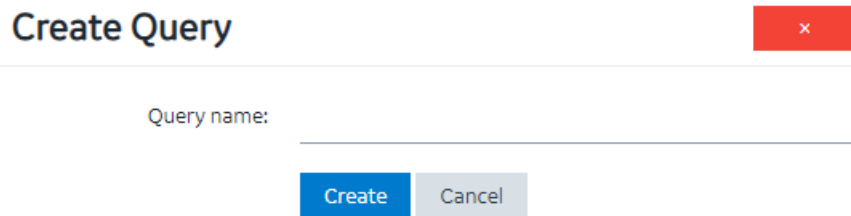
Create a Delete Query

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

Queries						
Quick Filter					**＋ Add new query**	⚙
☐ Name	Type	Description	Origin	Permissions	Last updated ▲	
☐ TestHistAlarms	Relational Database		User	All Groups	2 days ago Operations Hub Admin	🔒 ✏ ⚙
☐ EntityTest	Entities		User	All Groups	2 days ago Operations Hub Admin	🔒 ✏ ⚙
☐ GetCurrentValue	REST		User	All Groups	3 days ago Operations Hub Admin	🔒 ✏ ⚙
☐ Current Value✏	Extension		System	All Groups	6 days ago	🔒 ✏ ⚙
☐ Historical By Count	Extension		System	All Groups	6 days ago	🔒 ✏ ⚙
☐ Historical By Interval	Extension		System	All Groups	6 days ago	🔒 ✏ ⚙

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, 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.

Field	Description

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 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 a SQL Query

This topic describes how to create a SQL query. To use a relational database in an Operations Hub application, you must:

- Create a Data Source *(page 221)* 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 *(page 74)*.

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.

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, 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.

10. Add the required fields.

The following figure displays an example:

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

Create a REST Query

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

- Create the data source *(page 221)* that you want to use in the query.
- Create an entity *(page 110)* 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.
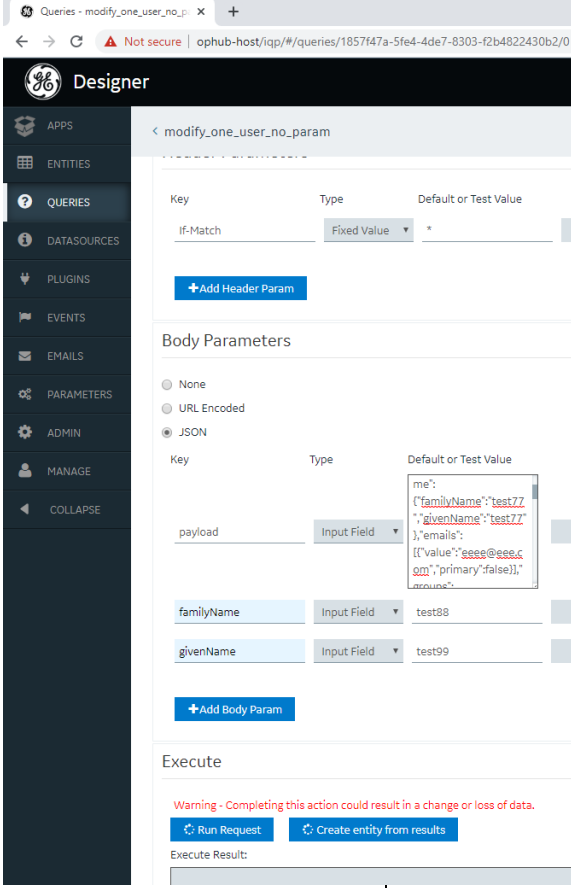
Box	Description
Description	Enter a description for the query.
Type	Select **REST**.
Method	Select the method of the API you want to use in the query. Supported methods are GET, PUT, POST, and DELETE.
Entity	Select the entity that will specify the query response fields. 📝 **Note:** When using a Historian 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.

Box	Description
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 appear before the query string if query parameters are present.	For the endpoint `https://jsonplaceholder.typicode.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.	

Type of Parameter	Description	Example
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 either a URL encoded format, or JSON. In the case JSON 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.	

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 > Sampled Data
- Post > Calculated Data
- Post > Interpolated Data

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

Box	Description
Raw JSON	Select this check box if you want the entire JSON 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 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.

Box	Description
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 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.
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 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.

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

v1.5 API Name	v1.6 API Name
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 *(page 131)*.

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 *(page 163)*.

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

In the main navigation menu, select **PLUGINS**.
The **PLUGINS** workspace appears, displaying a list of plug-ins that are imported.

Plugins Management					
+ Import					
Name ▾	**Category**	**Version**			
Boilerplate	Visualization		i	🗑	📥
LiquidGauge	Visualization	1.0.0	i	🗑	📥
Neon Gauge	Visualization	0.0.2	i	🗑	📥

ⓘ **Tip:** You can access the information related to a plug-in by selecting **i** in the corresponding row.

Import a Plug-in

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

Plugins Management

+ Import

Name ▾	Category	Version			
Boilerplate	Visualization		i	🗑	⬇
LiquidGauge	Visualization	1.0.0	i	🗑	⬇
Neon Gauge	Visualization	0.0.2	i	🗑	⬇

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.

In the page designer of an application, the imported plug-in appears in the **CUSTOM** section.

[Use the plug-in in an application](#) *(page 159)*.

Use a Plug-in in an Application

[Import the plug-in](#) *(page 158)* that you want to use in an application.

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

Apps

ALL APPS   RECENTLY CREATED

+ Add new app   **⬆ Import App**   ⚙   ⏮ ◂ 1 ▸ ⏭   Quick Filter

☐	Name ▾	Description	Last updated			
☐	Asset Management	Manage Devices	3 months ago by Docs Team	🔒	⬈	⚙
☐	Asset Testing	Test Devices	3 months ago by Docs Team	🔒	⬈	⚙
☐	Building Monitor_Step1	Simple Sample App	3 months ago by Docs Team	🔒	⬈	⚙
☐	Building Monitor_Step2	Step 1 with History	3 months ago by Docs Team	🔒	⬈	⚙
☐	Building Monitor_Step3	Step 2 with Repeater	3 months ago by Docs Team	🔒	⬈	⚙
☐	Building Monitor_Step4	Step 3 and gauges	3 months ago by Docs Team	🔒	⬈	⚙
☐	Building Monitor_Step5	Step 4 with data from Pivot Entity	3 months ago by Docs Team	🔒	⬈	⚙
☐	ES Event Map View	Monitor Tags and Events with Map	3 months ago by Docs Team	🔒	⬈	⚙
☐	ES_M2MvsPivot	M2M vs Pivot Comparison	3 months ago by Docs Team	🔒	⬈	⚙
☐	Store Temp App	temp	2 months ago by Docs Team	🔒	⬈	⚙

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.

⬢ Apps > Asset Management > Pages

+ Add new page   ⚙ 🔓   **⬈ Preview App**

☐	Name ▾	Description	
☐	1 Dashboard	Homepage	⚙
☐	2 Supported Devices Types	Manage device types	⚙
☐	3 Manage Devices	Manage devices	⚙
☐	4 Device Type Metrics	Manage metrics	⚙
☐	5 Device Type Groups	Manage groups	⚙
☐	Template	A template for new pages	⚙

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.
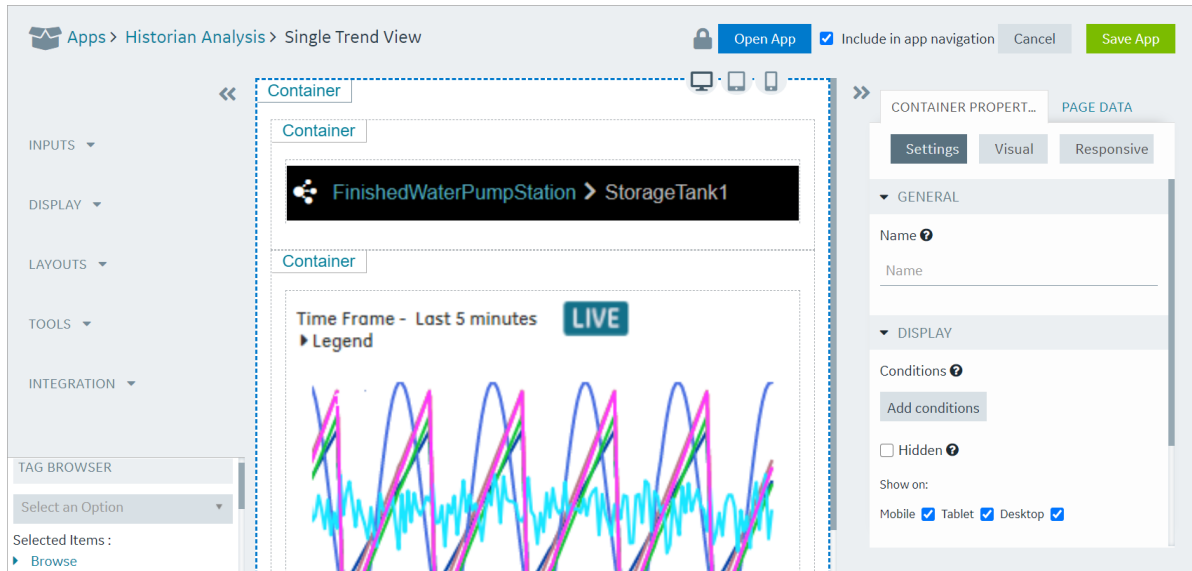
4. From the list of plug-ins in the **CUSTOM** section, drag the plug-in to the container in which you want to include the plug-in.

5. Select **Save App**.
The plug-in is used in the application.

Download a Plug-In

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

Plugins Management

+ Import

Name ▾	Category	Version			
Boilerplate	Visualization		i	🗑	⤓
LiquidGauge	Visualization	1.0.0	i	🗑	⤓
Neon Gauge	Visualization	0.0.2	i	🗑	⤓

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

1. In the main navigation menu, select **PLUGINS**.
   The **PLUGINS** workspace appears, displaying a list of plug-ins that are imported.

Plugins Management

+ Import

Name ▾	Category	Version			
Boilerplate	Visualization		i	🗑	⤓
LiquidGauge	Visualization	1.0.0	i	🗑	⤓
Neon Gauge	Visualization	0.0.2	i	🗑	⤓

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

A plug-in must contain the following components:

- index.html: Contains the plug-in html code.
- main.js: Contains the plug-in javascript code.
- manifest.json: Contains the plug-in configuration details.
- style.css: Contains the plug-in stylesheet details.
- The scripts folder: Contains external scripts.

This topic describes the content to include in each of these components to create 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.
pluginId [String]	The unique ID of the plug-in. The value for this parameter must be a long, random one.

Parameter	Description
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
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 • 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. callback - 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 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.

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.

Events

+ Add new event   ⚙

Quick Filter _____

☐ Name ▼   Last updated

☐ ES_HighHumidity   Yesterday by Docs Team   ⚙

☐ ES_HighTemp   Yesterday by Docs Team   ⚙

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 *(page 168)*.

1. Access the event *(page 167)* for which you want to create a trigger.

2. Select **Add Entity Condition**.
   The **Entity** and **Condition** sections

   Trigger
   ───────────────────────────────

                      Entity Name

   1. Entity   Select   ▾   🗑

                      Entity Field   Operator   Value

   Condition: Select   ▾   =   ▾   _____   ☐ Allow End User to set value

   ───────────────────────────────

   + Add Entity Condition   + Add Device Condition

   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 *(page 168)*.

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 *(page 168)*.

1. Access the event *(page 167)* 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
MyDeviceType	Any	Any	All devices of the type MyDeviceType.
MyDeviceType	MyGroup	Any	All devices in the group MyGroup.
MyDeviceType	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 .

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 *(page 172)*
- Send a command to a device *(page 174)*

Create a trigger based on an entity condition *(page 168)* or a device condition *(page 169)*.

1. Access the event *(page 167)* for which you want to create an action.

2. Select **Send e-mail**.
   The **Send an E-mail** section

   Send an E-mail

	Default E-mails (separate addresses by ,)	
Recipient's address:	[ ]	☐ Allow End User to set e-mail address

   + Add Query Recipients

   Email template: [Select Email Template... ▾]   **+ Create Email Template**

   Scheduler   ◉ Take action only on initial trigger   ○ Take action on every trigger

   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.

Field	Description
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 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 *(page 177)*](#), 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 *(page 171)*](#)
- [Send a command to a device *(page 174)*](#)

Create a trigger based on an or a .

1. for which you want to create an action.

2. Select **Run a Query**.
   The **Run a Query** section appears.

   Run a Query

	Query Name
Query:	Select ▼

   Scheduler   ⦿ Take action only on initial trigger   ○ Take action on every trigger

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 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 *(page 172)*
- Send an email *(page 171)*

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 *(page 168)* or a device condition *(page 169)*.

1. Access the event *(page 167)* 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.

Option	Description
Scheduler	Select one of the following options: • **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.

Events

+ Add new event   ⚙   Quick Filter

☐ Name ▾   Last updated

☐ ES_HighHumidity   Yesterday by Docs Team   ⚙

☐ ES_HighTemp   Yesterday by Docs Team   ⚙
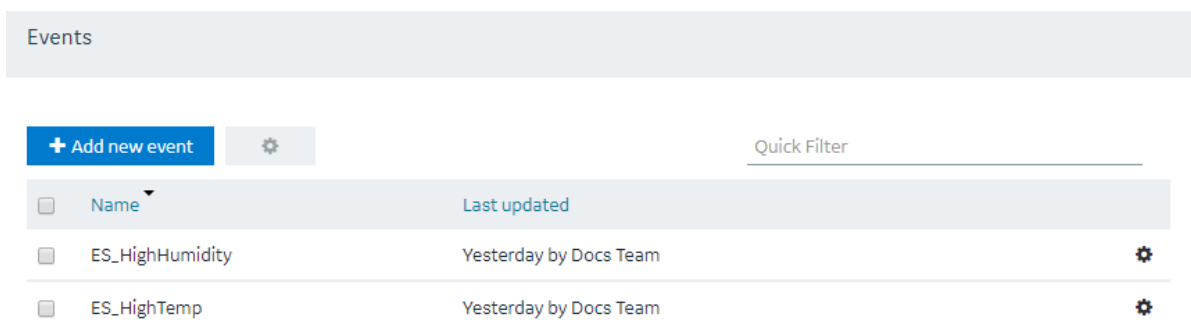
2. In the rows containing the events that you want to delete, select the check boxes.

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.

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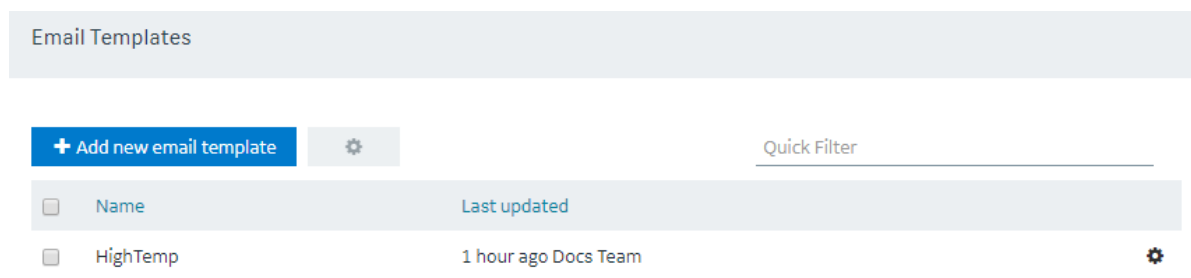
1. In the main navigation menu, select **EMAILS**.
   The **EMAILS** workspace appears.

   Email Templates

+ Add new email template	⚙		Quick Filter
☐ Name		Last updated	
☐ HighTemp		1 hour ago Docs Team	⚙

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.

Email Templates > HighTemp

Subject

Add text   Add Parameter

Body

Add text   Add Parameter   Add Paragraph   Add Newline

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 *(page 178)*.

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

Email Templates

+ Add new email template   ⚙   Quick Filter

☐   Name   Last updated

☐   HighTemp   1 hour ago Docs Team   ⚙

2. Select **Add new email template**.
   The **Create Email Template** window appears.

Create Email Template

×

Email Template Name:

_____

Create   Cancel

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 *(page 180)* allow you to add dynamic content to the email based on values 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 *(page 177)*.

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

Email Templates

+ Add new email template ⚙   Quick Filter

	Name	Last updated
☐	HighTemp	1 hour ago Docs Team	⚙

2. In the row containing the email template that you want to copy, select the link.
   The email template appears.

Email Templates > HighTemp

Subject

Add text   Add Parameter

[Alert]: High tempe

Body

Add text   Add Parameter   Add Paragraph   Add Newline

Temperature in the

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.

Email Templates

+ Add new email template ⚙   Quick Filter

☐ Name   Last updated
☐ HighTemp   1 hour ago Docs Team   ⚙
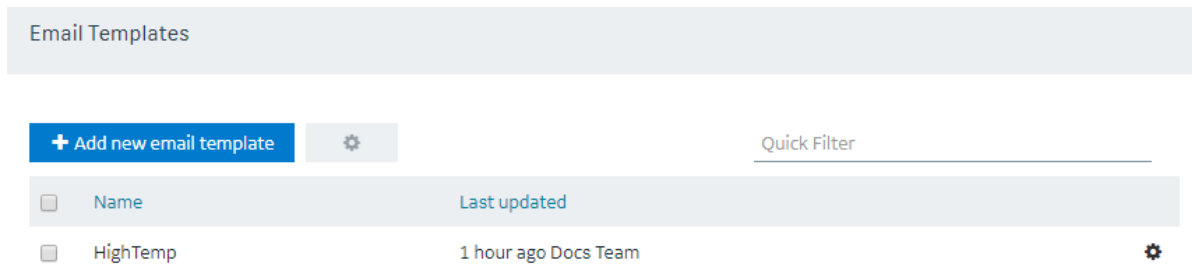
2. In the workspace heading, select ⚙, and then select **Delete email templates**.
   A message appears, asking you to confirm that you want to delete the email templates.

   ⓘ **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.

Parameters		
+ Add new parameter ⚙		Quick Filter
☐ Name	Last updated	
☐ Temperature	Yesterday Docs Team	⚙
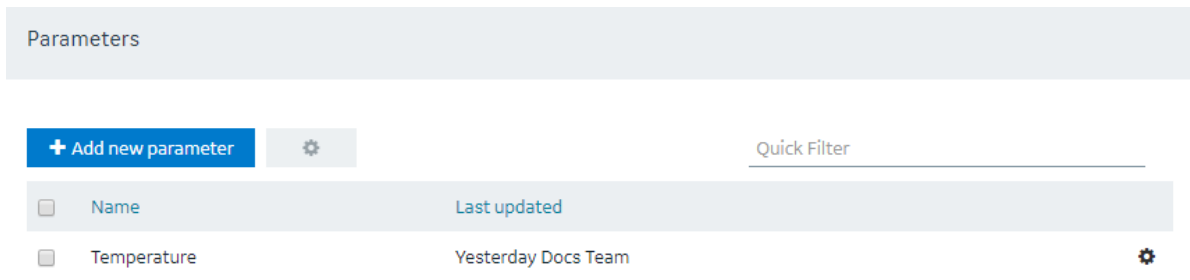
2. In the row containing the parameter that you want to access, in the **Name** column, select the link.
   The parameter appears.

Parameters > Temperature

Select Existing Parameter ▾

Value Source

○ Fixed 24

○ Event Variable

○ From Query

Cancel   Save   Save As New   Save And Exit

ⓘ **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 .

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

Parameters

+ Add new parameter   ⚙   Quick Filter

☐	Name	Last updated	
☐	Temperature	Yesterday Docs Team	⚙

2. Select **Add new parameter**.
   The **Create Parameter** window appears.

Create Parameter

Parameter name:

Create   Cancel

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.

Parameters > Temperature

Select Existing Parameter ▼

Value Source

⦿ Fixed 24

○ Event Variable

○ From Query

Cancel   Save   Save As New   Save And Exit

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.

Option	Description
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. • **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 *(page 184)*.

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

Parameters

+ Add new parameter   ⚙   Quick Filter

	Name	Last updated	
☐	Temperature	Yesterday Docs Team	⚙
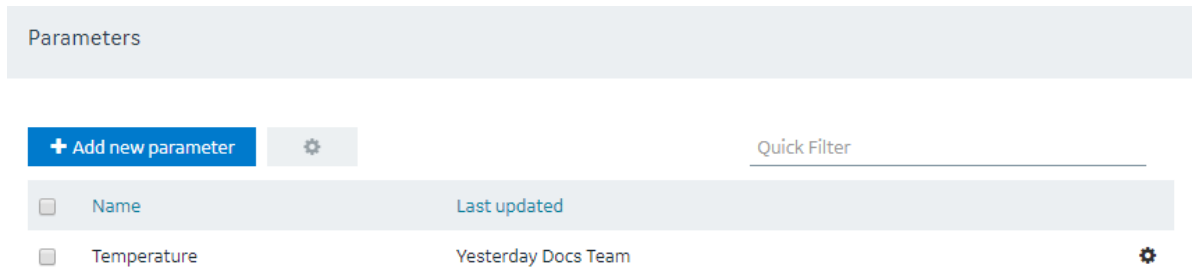
2. In the row containing the parameter that you want to copy, select the link.
   The workspace for the parameter appears.

Parameters > Temperature

Select Existing Parameter ▼

Value Source

◉ Fixed 24

◯ Event Variable

◯ From Query

Cancel   Save   Save As New   Save And Exit
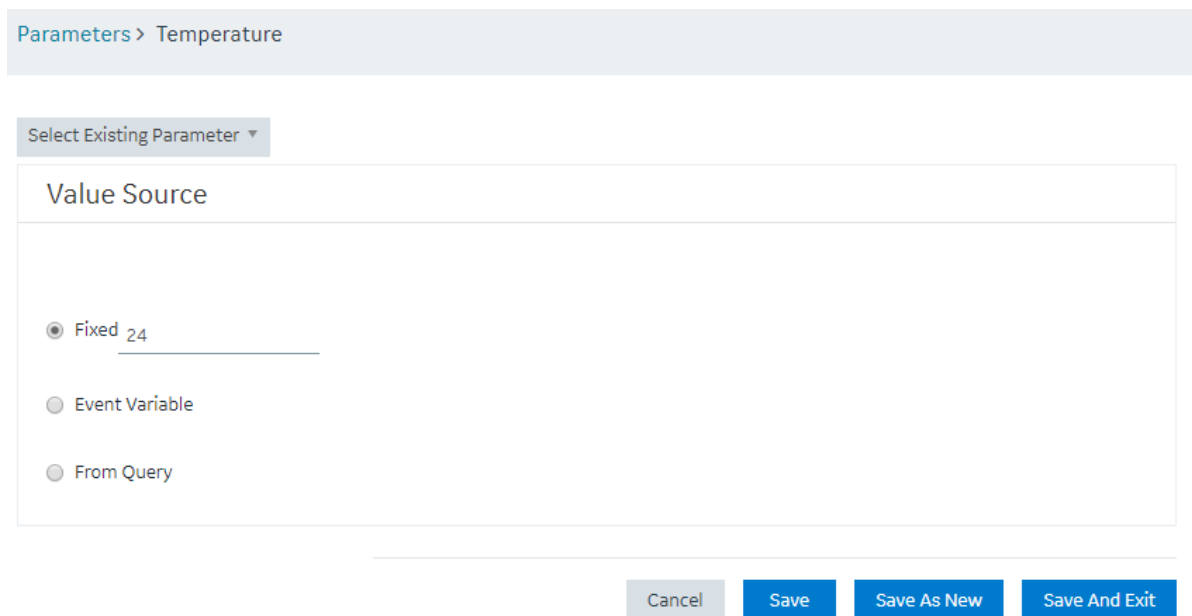
3. As needed, modify values in the available fields, and then select **Save As New**.
   A window appears, asking you to enter a name for the parameter. By default, the name contains the name of the original parameter, appended with a system-generated value.

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.
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 .

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.
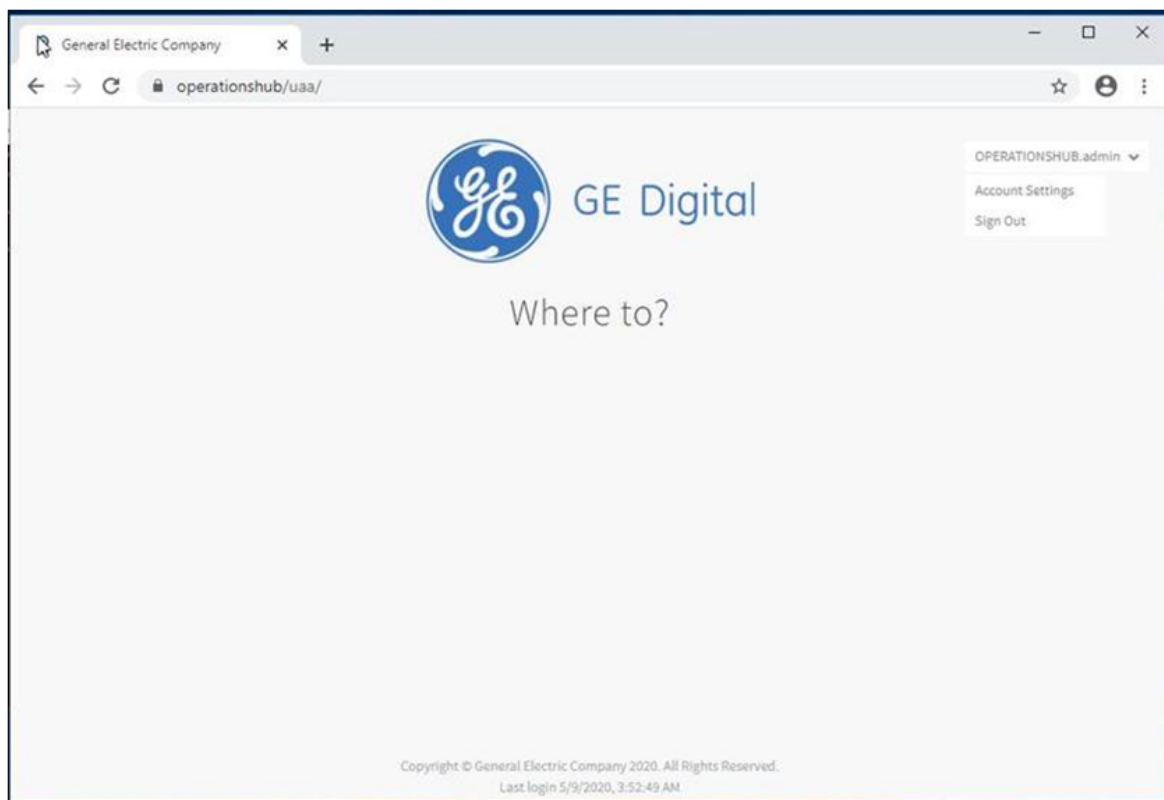
3. In the upper right-hand corner of the screen, click **Account Settings.**

The following screen appears.
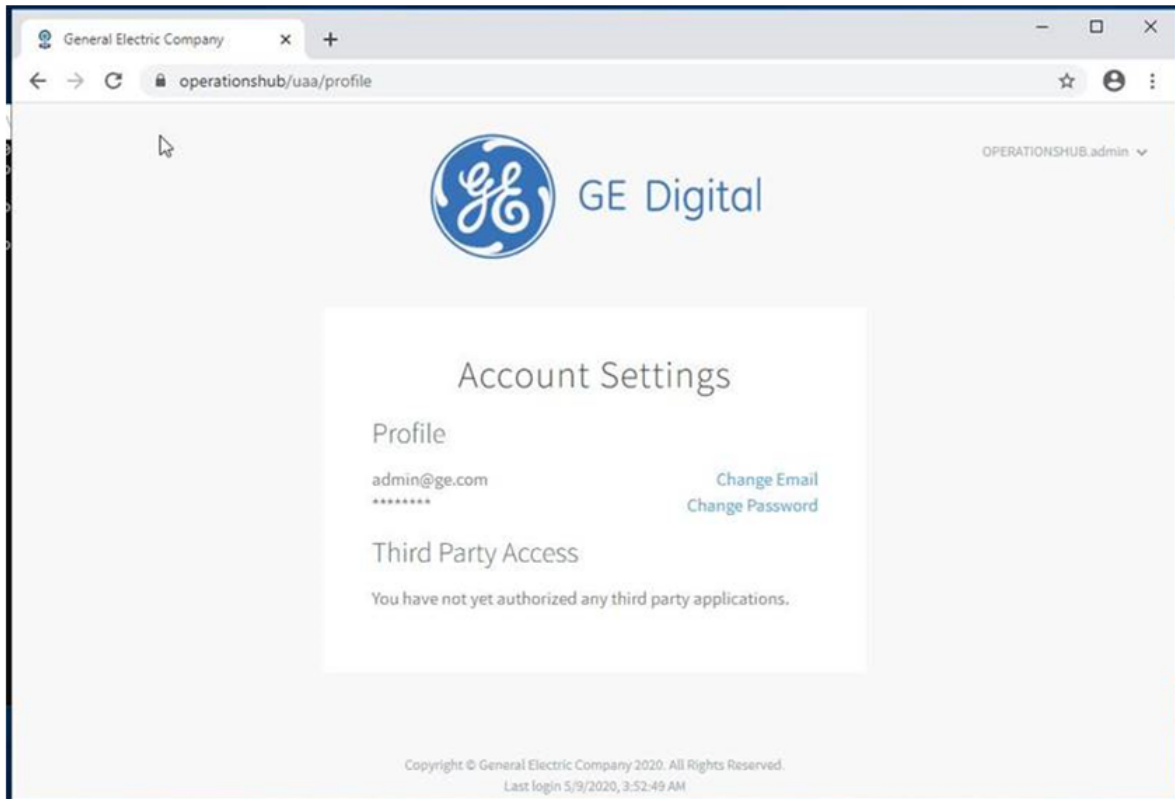
4. Select the **Change Password** link.

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.

   (i) 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.

   (i) 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 *(page 199)*.

Create a Group
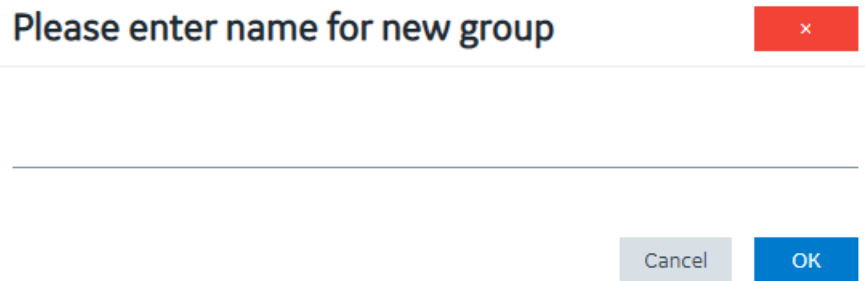
1. In the main navigation menu, select **Roles**.
   The **Roles** workspace appears, displaying a list of categories.

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.

Please enter name for new group   ×

Cancel   OK

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

You create a model to build the runtime structure and content. You 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 for supplying data.

The Model Editor user interface helps you create and modify your model. You can also use the model template to manually build and modify your model structure and then import it. For information about the template, see Model Template Description *(page 215)*.

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 *(page 221)*
- Configure Data Distributor Settings *(page 206)*
- Set Up the Data Model Structure *(page 207)*
- Define Objects *(page 207)*
- Set Up Runtime Navigation *(page 210)*

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

Character	Description
!	Exclamation Point
@	At sign
^	Caret
$	Dollar Sign
()	Parentheses
|	Pipe
.	Period
`	Grave Accent
~	Tilde
-	Hyphen
_	Underscore

📝 **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
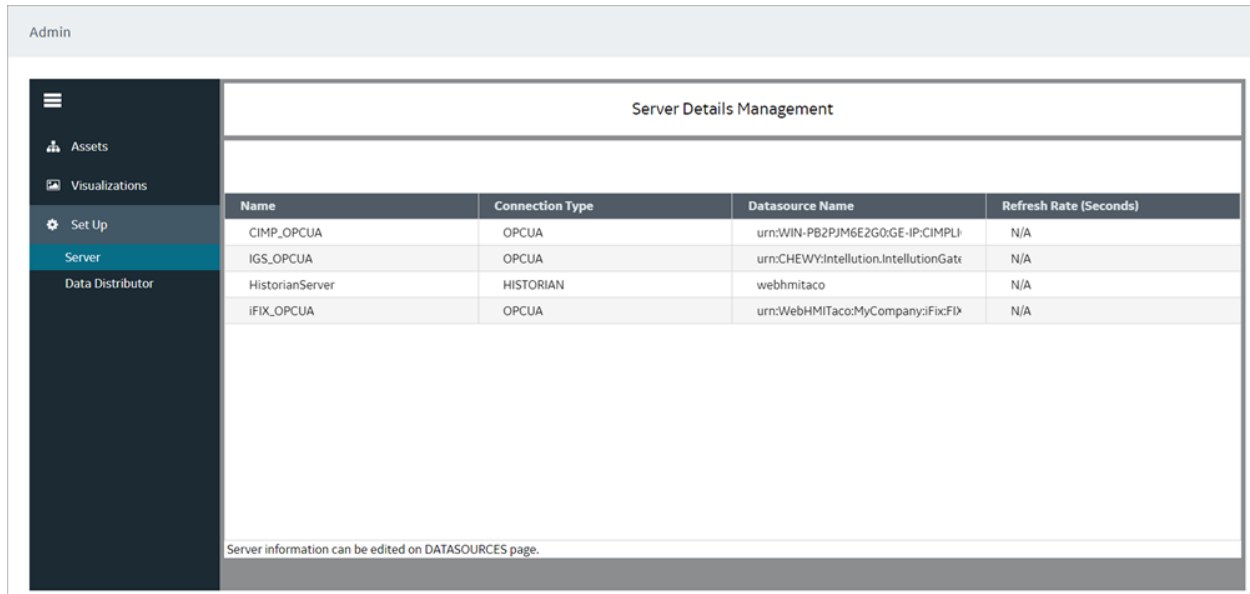
Access the details for the data source servers that are used to populate data in your model.

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 *(page 221)*.

Configure Data Distributor Settings

Create a Data Source *(page 221)*.

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.
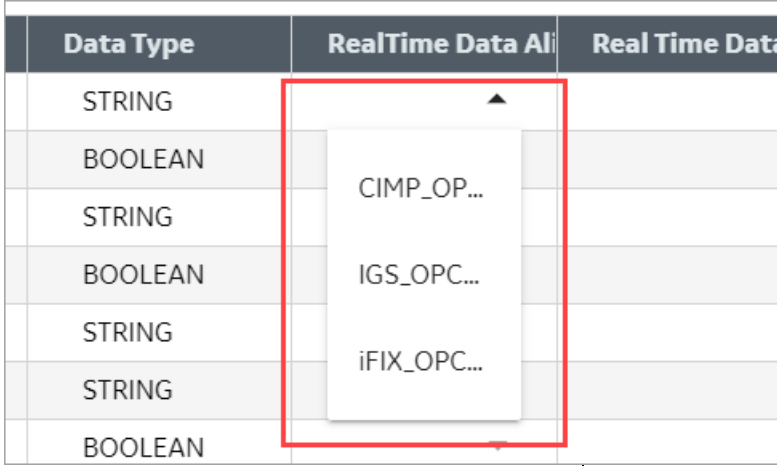
1. In the Administration environment, navigate to **Assets > Object Types > New**.
   The **Object Type Information** screen appears.

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**.
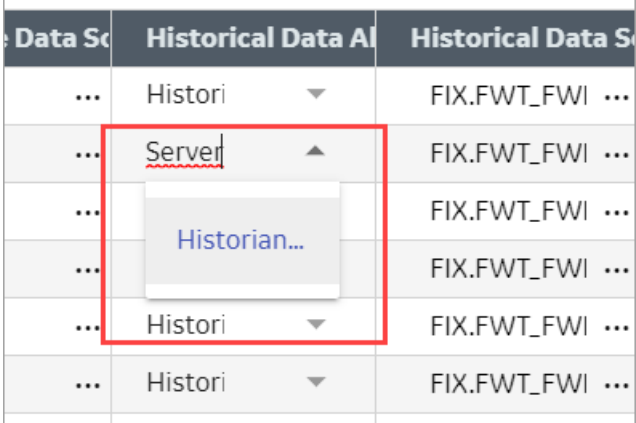
Define Objects

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.
RealTime Data Source	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 *(page 232)*.

Column	Description
Historical Data Alias	You receive historical data from the Historian data source. Select ▼ to choose a data source from the list of available Historian data sources.
Historical Data Source	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. Refer to Browse Data Sources *(page 232)*.

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.

   ○ FinishedWaterPumpStation

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.
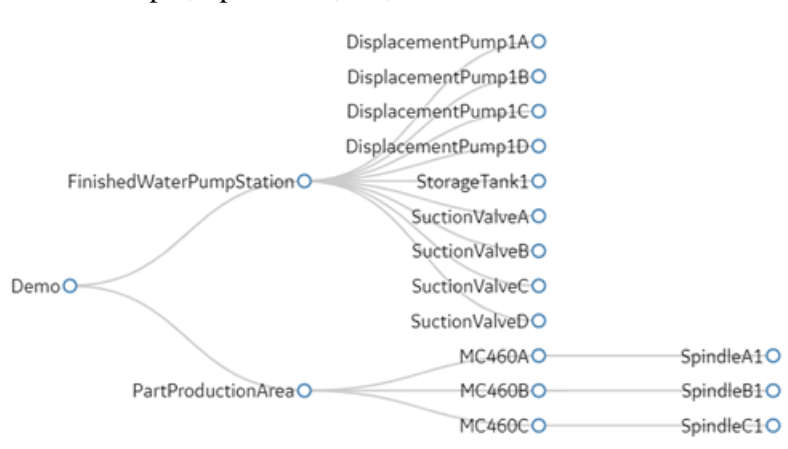
6. You can also drag and drop objects within the hierarchy to change their order, as shown in this example. SunctionValveA is now a child of FinishedWaterPumpStation.

DisplacementPump1B

DisplacementPump1C

DisplacementPump1D

FinishedWaterPumpStation

SuctionValveA

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:
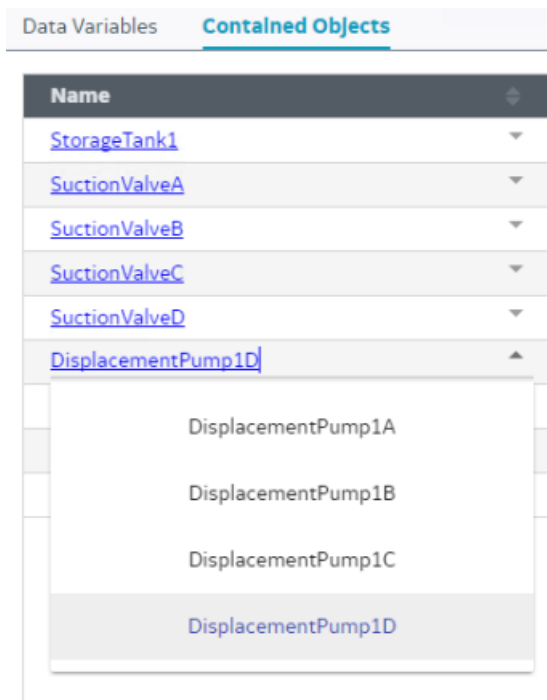
5. Select the object to replace the contained object. This selected object is now a contained object for the object type.

6. **Optional:** To view the details of a contained object, such as its data variables, select its hyper-linked 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 *(page 102)*.

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 *(page 220)* 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**.

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.

Access the Model Template

The model template, `ModelStarterTemplateSteps.xlsm`, provides a structure to help you create your model.

1. Navigate to `\Program Files\Proficy\ProficyWebServer\Tools \ModelStarterTemplateSteps.xlsm`.
2. Follow the instructions in `ModelStarterTemplateSteps.xlsm`.
3. When done, select **Save Model to CSV** to save the model to a CSV file, which you can then import.

Model Template Description

The model template provides sections to help you build the runtime model structure for trending historical data.

Model Concepts

Review this illustration before creating your runtime model.

📝 **Note:** Although this model describes HMI/SCADA data sources, such as iFIX, this release only pertains to data from Historian data sources. A later release will include these data sources.
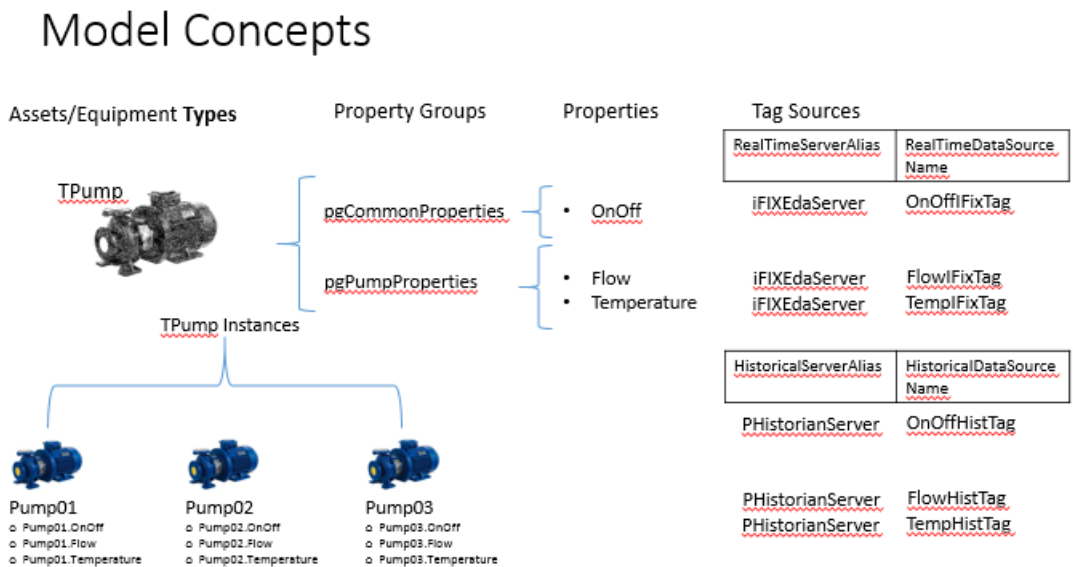
Concept Terminology Differences

The model template and Model Editor user interface use different concept terminology, as shown in the following table.

Model Template	Model Editor
Asset type	Object type
Asset	Object
Property	Data variable

Hierarchy

You must 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.

📝 **Note:** Since only one root node is allowed in this hierarchy, do not define more than one asset to a root parent.

Property	Description
HierarchyFlagsHeader	Header column with the keyword `HierarchyFlags`.
HierarchyFlags	Specifies whether to update or overwrite the asset hierarchy when importing the model file.
OverwriteHierarchy	• `True` creates a new hierarchy based on the exact content of the imported model file. • `False` updates any existing imported hierarchical relationships.
OverwriteAssetChildren	• `True` replaces existing child assets with child assets in the model template file. • `False` adds child assets from the model template file to the existing child assets.

Asset Types

Asset types define the structure of the equipment pieces within your model. For each asset type, such as a StorageTank, you set up all the property names, such as TankLevel, that any asset instance associated with this type can reuse in its own definition.

Property	Description
AssetTypeHeader	Header column with the keyword `AssetType`.
Asset Type Name	Name of the asset type.
Description	Description of the asset type.
Property Groups of the Asset Type	Collection of properties associated with the asset type. Assets assigned to this asset type inherit these properties. An asset type can contain more than one property group.

Property Groups

Property groups assemble a set of properties for a piece of equipment. This enables you to create a common set of properties to reuse across multiple asset types.

Property	Description
PropertyGroupHeader	Header column with the keyword `PropertyGroup`.
Property Group Name	Name of the property group.

Property	Description
Description	Description of the property group.

Assets

Assets are the instances of equipment, such as StorageTank1, in the model. When you assign an asset to an asset type, it inherits all the properties created for that asset type.

You must arrange assets in to hierarchical relationships in the Hierarchy section to appear in the Runtime context selection. Each asset has a parent in the hierarchy.

Property	Description
AssetHeader	Header column with the keyword `Asset`.
Asset Name	Name of the asset instance.
Description	Description of the asset instance.
Asset Type Name	Name of its associated asset type.
Parent Asset Name	Name of the parent asset. One asset in the list must have a parent asset set to `\` (root).
Parent Property Name	Ties this asset instance to an asset property definition in the `Parent Asset Name` type definition. For example, the TPumpStation type contains the InletTank and OutletTank as properties of type `Asset`. When you create instances of the TPumpStation (for example, PumpStation01, PumpStation02), you must also create instances for InletTank (for example, InletTank01, InletTank02) and OutletTank (for example, OutletTank01, OutletTank02) and point them to the InletTank and OutletTank properties of the TPumpstation type using this `Parent Property Name` column, as shown in the following example.

#AssetTypeHeader	Asset Type Name	Description	Property Groups of the Asset Type		
AssetType	TEnterpriseStation		TEnterpriseStationGroup		
AssetType	TPumpStation		TPumpStationPropertyGroup		
AssetType	TStorageTank		StorageTankShape	AssetType	
#PropertyDefinitionHeader	Property Group Name	Property Name	Property Type	AssetType (if the property type is Asset)	
PropertyDefinition	TPumpStationPropertyGroup	InletTank	Asset	StorageTank	
PropertyDefinition	TPumpStationPropertyGroup	OutletTank	Asset	StorageTank	
#AssetHeader	Asset Name	Description	Asset Type Name	Parent Asset Name (\ - root)	Parent Property Name
Asset	EnterpriseStation		TEnterpriseStation	\	
Asset	PumpStation01		TPumpStation	EnterpriseStation	
Asset	InletTank01		TStorageTank	PumpStation01	InletTank
Asset	OutletTank01		TStorageTank	PumpStation01	OutletTank
Asset	PumpStation02		TPumpStation	EnterpriseStation	
Asset	InletTank02		TStorageTank	PumpStation02	InletTank
Asset	OutletTank02		TStorageTank	PumpStation02	OutletTank

Property Definitions

Property definitions describe the actual pieces of data that come from a data source. Among other things, it defines how to use a property in views. For example, you can define a property to appear as a trend line on Trend views. Properties comprise a property group.

Property	Description
PropertyDefinitionHeader	Header column with the keyword `PropertyDefinition`.
Property Group Name	Property group name in which to associate this property.
Property Name	Name of the property.
Property Type	Property type: `Boolean`, `number`, `string`, or `asset`. Property definitions of an asset type can be contained types or child asset references. You must define the child asset type in the `AssetType` column.
AssetType	When the property type is `asset`, use this property definition. To assign an asset to a property, you must define this asset type. It allows you to nest child assets in the asset type.
Trendable	Property displays as a trend line on Trend views.
ControlGroupId	Unique ID of the control group, allowing you to group properties that can be modified. Any properties with a control group ID are grouped together in an auto-generated Control Card. If the control group has an associated Control Point, an operator can change its value on the Control View at runtime.
ControlPoint	Setpoint for the current HMI/SCADA property value. Both the current property and its control point must be in the same control group. A property can be controlled by itself or by another property in the asset type. To read and write to the same property, specify it as its own control point. A property without a control point is read-only.
HmiDataType	Data type from the underlying SCADA system. This is not required for this release.

Server Details

A server alias offers an indirect route between the model's data sources and the model itself, making it easier to transfer model data sources between servers. By using an alias to reference your data source (such as an iFIX node and OPC UA server) and associating it with your tag sources, you can change the node for a set of tag sources by changing the server name.

Property	Description
ServerDetailsHeader	Header column with the keyword `ServerDetails`.
Server Alias	Name of the server alias.
Server Name	Name of the server for the data source.
Server Type	Type of server from which data originates.

Tag Sources

A tag source defines where to retrieve asset property data, including real-time and historical data sources.

Property	Description
TagSourceHeader	Header column with the keyword `TagSource`.
Parent Asset Name	Name of the parent asset with a property with the tag source.
Property Name	Name of the property associated with the tag source.
Realtime Server Alias	Name of the real-time server alias to use with this tag source.
Realtime Data Source Name	HMI/SCADA data source tag ID that feeds data to this model property.
Historical Server Alias	(Optional) Name of the server alias to retrieve historical data for Trend views and the last known current value for Mimic Card views.
Historical Data Source Name	(Optional) Name of the historical tag ID to retrieve historical data for Trend views and the last known current value for Mimic Card views.

NameSpace Table

This table pertains to CIMPLICITY only and does not apply to this release. Populate this table using the project server and namespace information that was exported to a CSV file using the **Export to Web HMI** function on the CIMPLICITY Project menu.

Here is a sample NameSpace table:

#NameSpaceTableHeader	ServerAlias	NameSpaceIndex	NameSpaceUri
NameSpaceTable	<projectname>	2	http://ge.com/ua/CIMPLICITY
NameSpaceTable	<projectname>	3	http://ge.com/ua/CIMPLICITY/<projectname>
NameSpaceTable	<projectname>	4	http://ge.com/ua/CIMPLICITY/<projectname>/project

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 *(page 213)* 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.

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. In 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. In 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
Description	Enter a brief description of the new data source.

3. For relational database, refer to <u>Add Relational Database Data Source</u> *(page 222)*.

4. For Historian and REST API, refer to <u>Add Historian or Custom REST Data Source</u> *(page 223)*.

5. For CIMPLICITY, iFIX, and OPC UA, refer to <u>Add a Data Source with OPC UA Configuration</u> *(page 227)*.

6. Save the data source.

Option	Description
Save	Select to save the data source details and remain on the screen.

Option	Description
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

[Provide a name, product, and description for your data source *(page 221)*](#).

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.*
Port	Enter the port number to connect to the SQL Server.
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
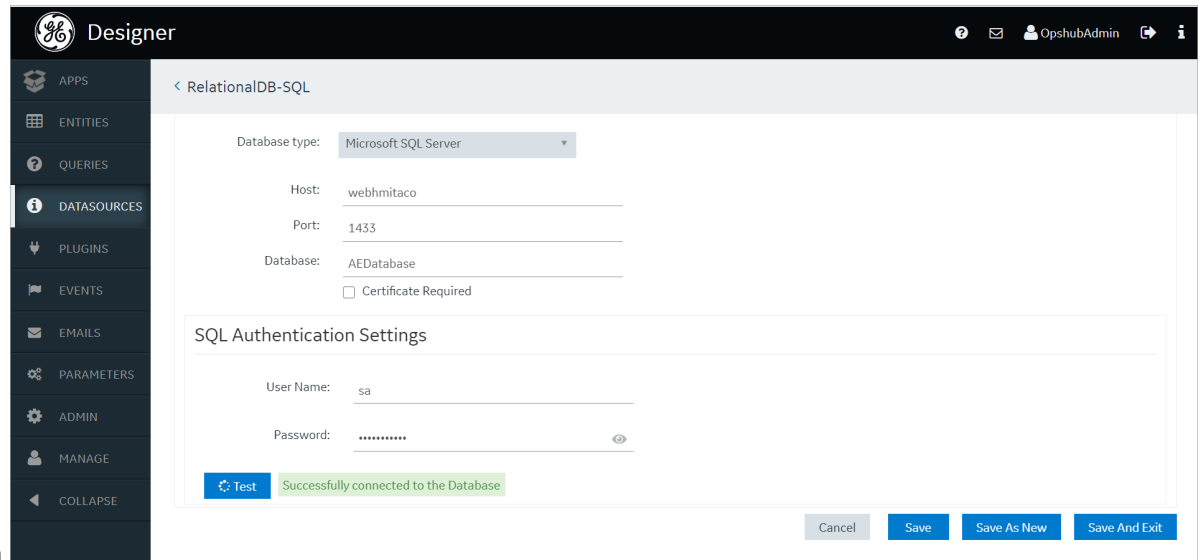
connection.

3. Select **Save**.

Add Historian or Custom REST Data Source

Creates a Historian or Custom REST data source.

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.

Field	Description
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. 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**
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.

Field	Description
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 authentication 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.

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.
Security Mode	This field is auto populated after defining a security profile for the OPC UA server. **Note:** If security mode is `None`, 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.
Security Policy	This field is auto populated after defining a security profile for the OPC UA server.
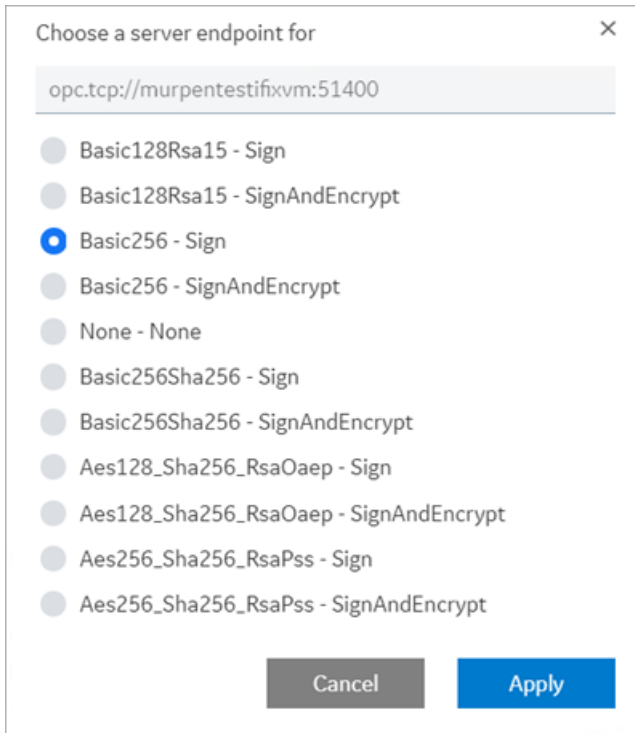
Field	Description
View Certificate	For a secured connection, security certificates must be exchanged between Operations Hub and the OPC UA server.

Select to view the OPC UA server certificate, and if `Untrusted`, select **Trust**.
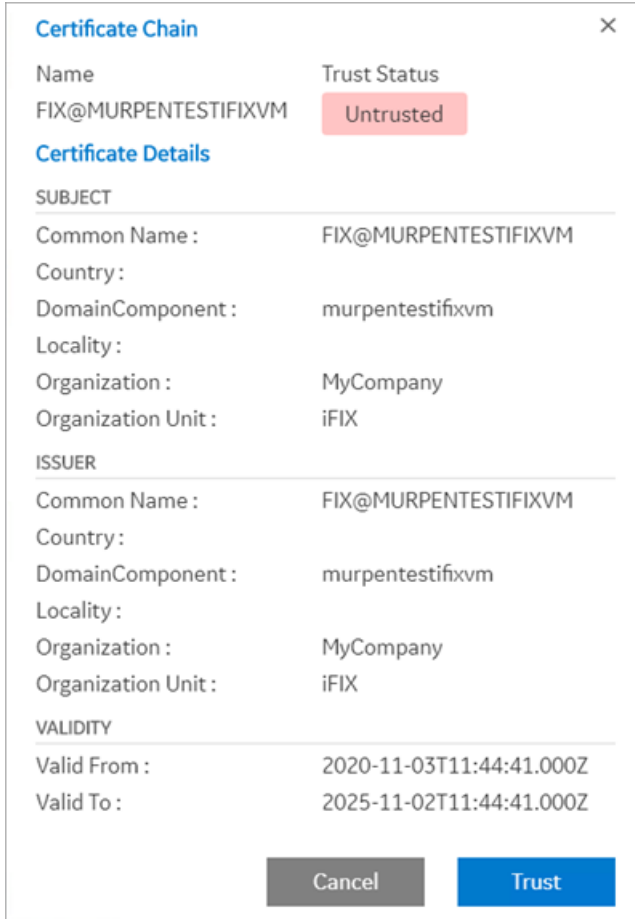
The server certificate gets added to the `C:\ProgramData\GE\Operations Hub\pki\trusted\certs` folder in your machine running Operations Hub.

The certificate status now appears as `Trusted`.
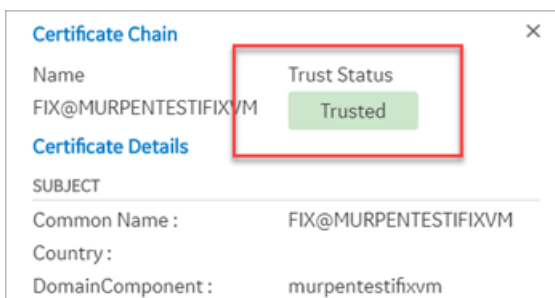
Select **Cancel** to close the trusted server certificate screen.

⚠️ **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,

2. Select the authentication type to access the database as **Anonymous** or with a **Username/Password**.

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
Username	Enter the user name to connect to the OPC UA server (iFIX, CIMPLICITY, IGS).
Password	Enter the password for the user name to connect to the OPC UA server.
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 *(page 387)*.

3. Select **Save**.

Name:	iFix_6.1	Description:	
Product:	Proficy iFIX ▾		

☑ Enable OPC UA Connection

Endpoint URL:	opc.tcp://murpentestifixvm:51400
Application URI:	urn:MURPENTESTIFIXVM:MyCompany:iFix:FIX
Security Mode:	Sign
Security Policy:	Basic256	**Discover Policies**

View Certificate

Authentication

○ Anonymous   ● Username/Password

Username:	pentst
Password:	•••••••• 👁

Test Connection

Delete a Data Source

1. In 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 datasource appear.

2. Expand the tree structure and select the check box for the value tags to pull data from the data source.

3. For Historian, you can search and select *(page 234)* 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. In 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. 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. Click the **Test** button.

The following example shows a successful SQL Database connection.
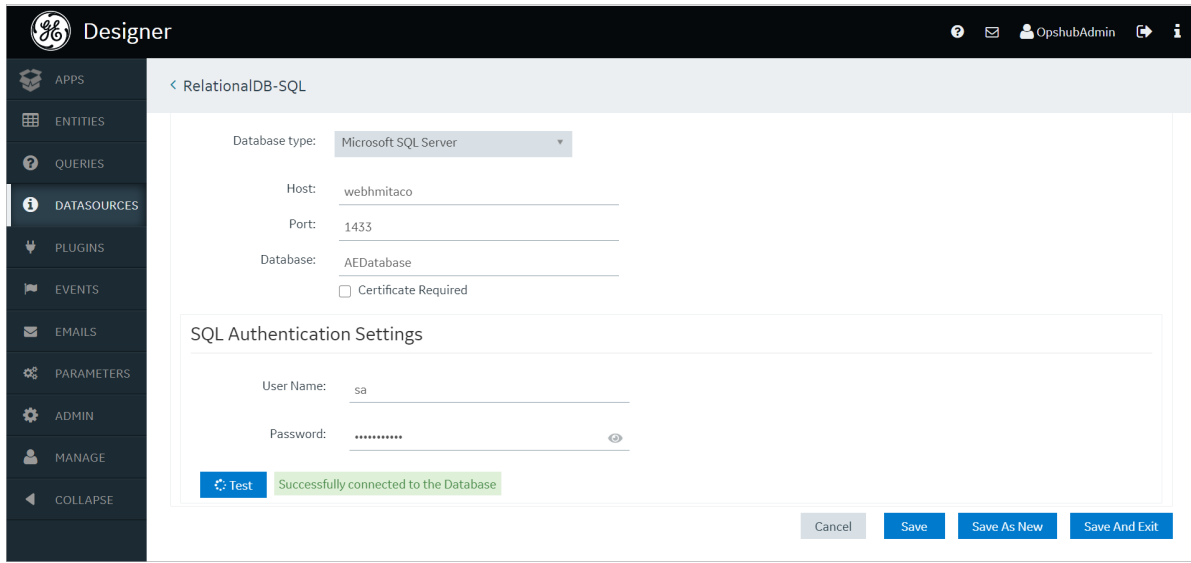
If it fails, a message appears stating: Failed to connect to the Database. Click on **More Details** link to view detailed reason in a popup.

4. Select **Save**.

Search for Tags

Allows to search for tags by tag name and description.

1. Enter a keyword in **Search** and select 🔍 .

   ℹ️ **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	Select the check box to match the keyword only to tag names.
	Additionally, to view the description for tags returned in keyword search, select 👁 next to **Description**.

Field	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 to both tag name and description. This is also the default search.

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.

Apps

ALL APPS   RECENTLY CREATED

+ Add new app	⬆ Import App	⚙	⏮ ◀ 1 ▶ ⏭	Quick Filter

☐ Name ▾	Description	Last updated		
☐ Asset Management	Manage Devices	3 months ago by Docs Team	🔒 ⬈ ⚙
☐ Asset Testing	Test Devices	3 months ago by Docs Team	🔒 ⬈ ⚙
☐ Building Monitor_Step1	Simple Sample App	3 months ago by Docs Team	🔒 ⬈ ⚙
☐ Building Monitor_Step2	Step 1 with History	3 months ago by Docs Team	🔒 ⬈ ⚙
☐ Building Monitor_Step3	Step 2 with Repeater	3 months ago by Docs Team	🔒 ⬈ ⚙
☐ Building Monitor_Step4	Step 3 and gauges	3 months ago by Docs Team	🔒 ⬈ ⚙
☐ Building Monitor_Step5	Step 4 with data from Pivot Entity	3 months ago by Docs Team	🔒 ⬈ ⚙
☐ ES Event Map View	Monitor Tags and Events with Map	3 months ago by Docs Team	🔒 ⬈ ⚙
☐ ES_M2MvsPivot	M2M vs Pivot Comparison	3 months ago by Docs Team	🔒 ⬈ ⚙
☐ Store Temp App	temp	2 months ago by Docs Team	🔒 ⬈ ⚙

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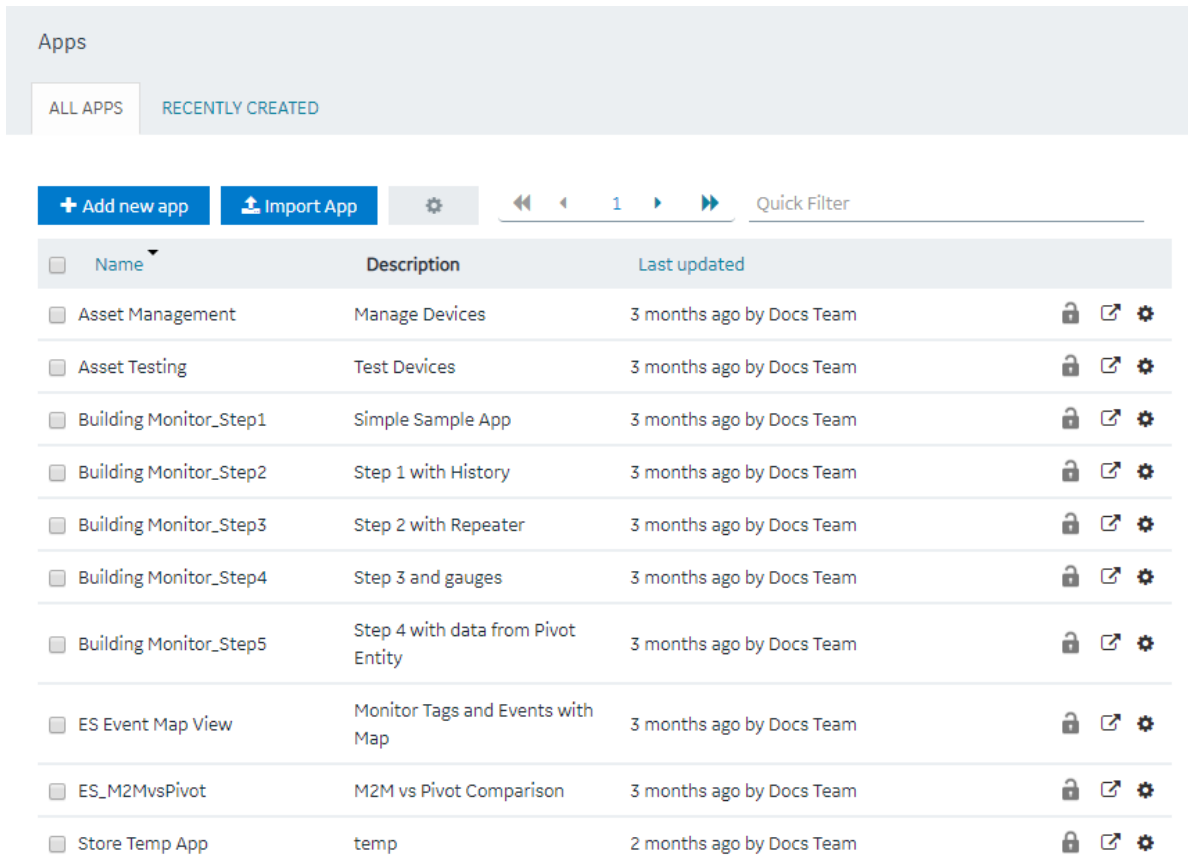
Note: It is possible to create a circular reference by nesting a parent group into its child. If there are circular references, the child groups will not display in the permissions dialog box.

Access a Page

1. In the main navigation menu, select **APPS**.
   The **APPS** workspace appears, displaying a list of applications created in the site.

Apps

ALL APPS   RECENTLY CREATED

Name	Description	Last updated
Asset Management	Manage Devices	3 months ago by Docs Team
Asset Testing	Test Devices	3 months ago by Docs Team
Building Monitor_Step1	Simple Sample App	3 months ago by Docs Team
Building Monitor_Step2	Step 1 with History	3 months ago by Docs Team
Building Monitor_Step3	Step 2 with Repeater	3 months ago by Docs Team
Building Monitor_Step4	Step 3 and gauges	3 months ago by Docs Team
Building Monitor_Step5	Step 4 with data from Pivot Entity	3 months ago by Docs Team
ES Event Map View	Monitor Tags and Events with Map	3 months ago by Docs Team
ES_M2MvsPivot	M2M vs Pivot Comparison	3 months ago by Docs Team
Store Temp App	temp	2 months ago by Docs Team

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.

> ℹ️ **Tip:** If needed, you can add or remove components from a container in the page, or modify the properties of a container *(page 350)*, 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.

Apps

ALL APPS   RECENTLY CREATED

	Name	Description	Last updated			
	Asset Management	Manage Devices	3 months ago by Docs Team	🔒	↗	⚙
	Asset Testing	Test Devices	3 months ago by Docs Team	🔒	↗	⚙
	Building Monitor_Step1	Simple Sample App	3 months ago by Docs Team	🔒	↗	⚙
	Building Monitor_Step2	Step 1 with History	3 months ago by Docs Team	🔒	↗	⚙
	Building Monitor_Step3	Step 2 with Repeater	3 months ago by Docs Team	🔒	↗	⚙
	Building Monitor_Step4	Step 3 and gauges	3 months ago by Docs Team	🔒	↗	⚙
	Building Monitor_Step5	Step 4 with data from Pivot Entity	3 months ago by Docs Team	🔒	↗	⚙
	ES Event Map View	Monitor Tags and Events with Map	3 months ago by Docs Team	🔒	↗	⚙
	ES_M2MvsPivot	M2M vs Pivot Comparison	3 months ago by Docs Team	🔒	↗	⚙
	Store Temp App	temp	2 months ago by Docs Team	🔒	↗	⚙

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

Apps > Asset Management > Pages

+ Add new page ⚙ 🔓   **↗ Preview App**

	Name	Description	
	1 Dashboard	Homepage	⚙
	2 Supported Devices Types	Manage device types	⚙
	3 Manage Devices	Manage devices	⚙
	4 Device Type Metrics	Manage metrics	⚙
	5 Device Type Groups	Manage groups	⚙
	Template	A template for new pages	⚙

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, <u>add components to the page</u> *(page 350)*.

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 lowercase 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.

   ℹ️ **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:
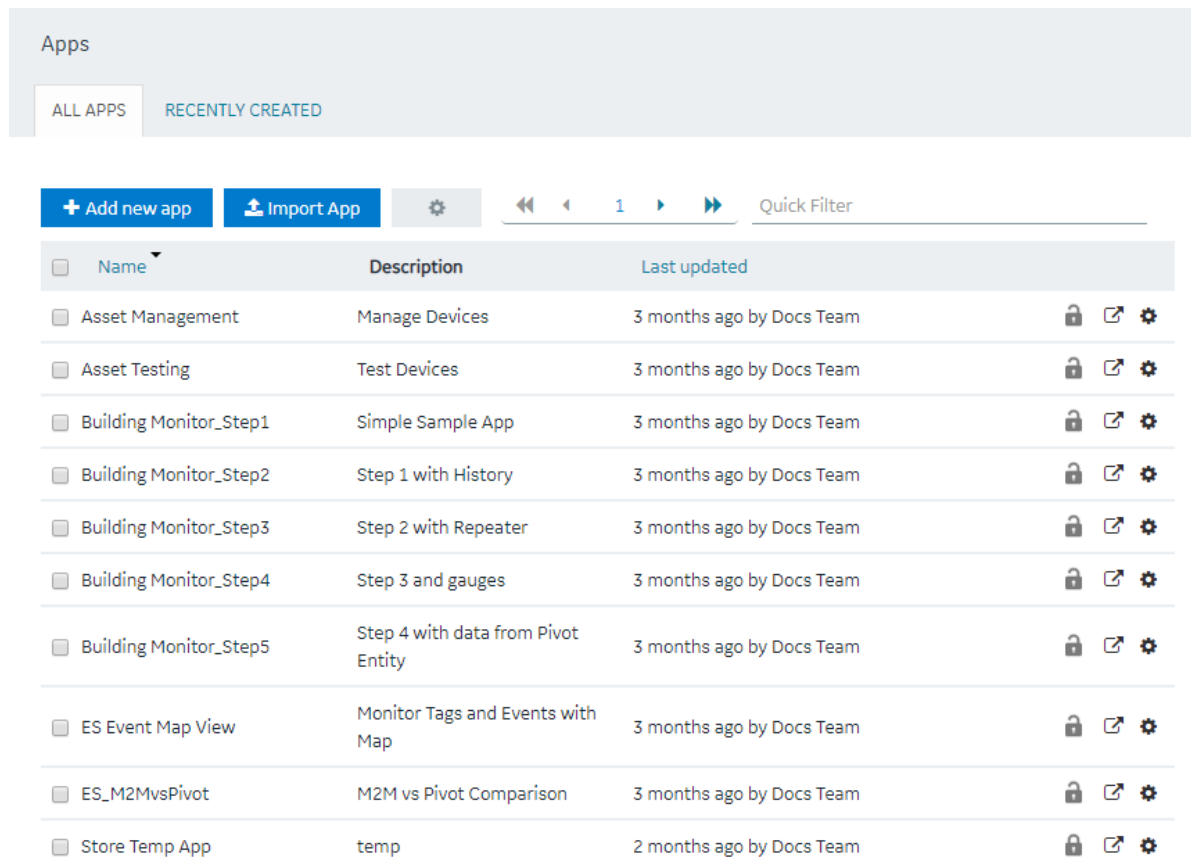
- Add a page to the navigation menu of the application.
- Remove a page from the navigation menu of the application.
- Specify the name of the page that should appear in the navigation menu of the application.
- Specify the sequence of the pages that should appear in the navigation menu of the application.

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.
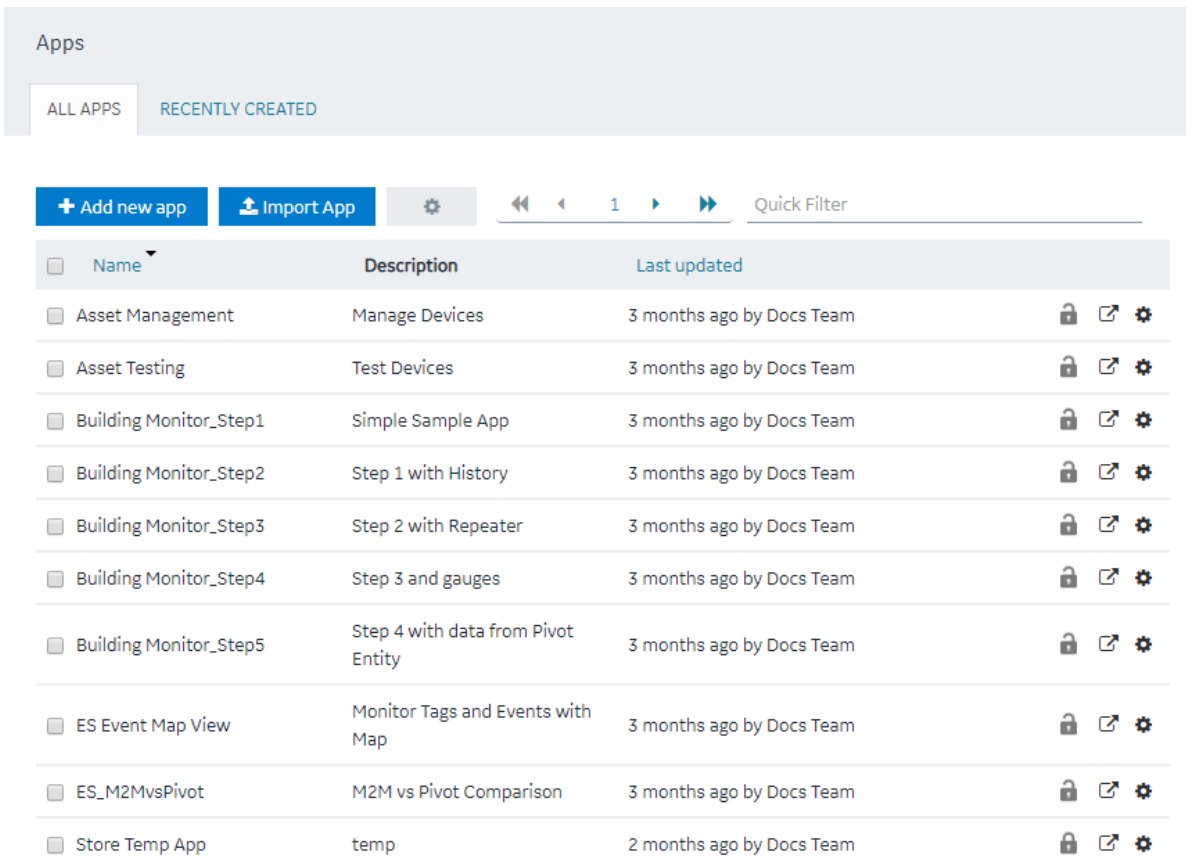
> ⓘ **Tip:**
>
> • You can modify the display name of a page by selecting 🖉 in the **DISPLAY NAME** column.
>
> • You can modify the name of a page by selecting 🖉 in the **Page Name** column.
> • You can select the icon that should appear for the page in the navigation menu of the application by selecting 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.

Apps > Asset Management > Pages

	Name ▾	Description	
☐	1 Dashboard	Homepage	⚙
☐	2 Supported Devices Types	Manage device types	⚙
☐	3 Manage Devices	Manage devices	⚙
☐	4 Device Type Metrics	Manage metrics	⚙
☐	5 Device Type Groups	Manage groups	⚙
☐	Template	A template for new pages	⚙

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.
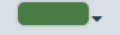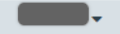
Tip: If needed, modify the settings, and then select **Save theme** to save your changes. You cannot, however, modify a baseline theme.

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.

Apps

ALL APPS   RECENTLY CREATED

+ Add new app   **⬆ Import App**   ⚙   ⏮ ◀ 1 ▶ ⏭   Quick Filter

☐ Name ▾	Description	Last updated			
☐ Asset Management	Manage Devices	3 months ago by Docs Team	🔒	⬈	⚙
☐ Asset Testing	Test Devices	3 months ago by Docs Team	🔒	⬈	⚙
☐ Building Monitor_Step1	Simple Sample App	3 months ago by Docs Team	🔒	⬈	⚙
☐ Building Monitor_Step2	Step 1 with History	3 months ago by Docs Team	🔒	⬈	⚙
☐ Building Monitor_Step3	Step 2 with Repeater	3 months ago by Docs Team	🔒	⬈	⚙
☐ Building Monitor_Step4	Step 3 and gauges	3 months ago by Docs Team	🔒	⬈	⚙
☐ Building Monitor_Step5	Step 4 with data from Pivot Entity	3 months ago by Docs Team	🔒	⬈	⚙
☐ ES Event Map View	Monitor Tags and Events with Map	3 months ago by Docs Team	🔒	⬈	⚙
☐ ES_M2MvsPivot	M2M vs Pivot Comparison	3 months ago by Docs Team	🔒	⬈	⚙
☐ Store Temp App	temp	2 months ago by Docs Team	🔒	⬈	⚙

2. In the **Name** column, select an application.
   The **PAGES** workspace appears.

📦 Apps > Asset Management > Pages

+ Add new page   ⚙   🔓   **⬈ Preview App**

☐ Name ▾	Description	
☐ 1 Dashboard	Homepage	⚙
☐ 2 Supported Devices Types	Manage device types	⚙
☐ 3 Manage Devices	Manage devices	⚙
☐ 4 Device Type Metrics	Manage metrics	⚙
☐ 5 Device Type Groups	Manage groups	⚙
☐ Template	A template for new pages	⚙

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.

Apps			
ALL APPS RECENTLY CREATED			

Name ▼	Description	Last updated	
☐ Asset Management	Manage Devices	3 months ago by Docs Team	🔒 ⬈ ⚙
☐ Asset Testing	Test Devices	3 months ago by Docs Team	🔒 ⬈ ⚙
☐ Building Monitor_Step1	Simple Sample App	3 months ago by Docs Team	🔒 ⬈ ⚙
☐ Building Monitor_Step2	Step 1 with History	3 months ago by Docs Team	🔒 ⬈ ⚙
☐ Building Monitor_Step3	Step 2 with Repeater	3 months ago by Docs Team	🔒 ⬈ ⚙
☐ Building Monitor_Step4	Step 3 and gauges	3 months ago by Docs Team	🔒 ⬈ ⚙
☐ Building Monitor_Step5	Step 4 with data from Pivot Entity	3 months ago by Docs Team	🔒 ⬈ ⚙
☐ ES Event Map View	Monitor Tags and Events with Map	3 months ago by Docs Team	🔒 ⬈ ⚙
☐ ES_M2MvsPivot	M2M vs Pivot Comparison	3 months ago by Docs Team	🔒 ⬈ ⚙
☐ Store Temp App	temp	2 months ago by Docs Team	🔒 ⬈ ⚙

Above the table: **+ Add new app**   **⬆ Import App**   ⚙   ⏮ ◂ 1 ▸ ⏭   Quick Filter

2. In the **Name** column, select an application.
   The **PAGES** workspace appears.

Apps > Asset Management > Pages

+ Add new page   ⚙   🔓   **⧉ Preview App**

	Name ▾	Description	
☐	1 Dashboard	Homepage	⚙
☐	2 Supported Devices Types	Manage device types	⚙
☐	3 Manage Devices	Manage devices	⚙
☐	4 Device Type Metrics	Manage metrics	⚙
☐	5 Device Type Groups	Manage groups	⚙
☐	Template	A template for new pages	⚙

3. In the main navigation menu, select **THEME**.
   The **THEME** workspace appears.

Apps > Asset Management > Themes

+ Create new theme   ⚙

		Name ▾	Palette		
☐		BM_MD_BKG_Transfer_1539066212786	■ ■ ☐ ☐ ■ ☐ ■		👁 ✎ ⚙
☐		BM_MD_GE_Transfer_1539066227763	■ ■ ☐ ☐ ■ ☐ ■		👁 ✎ ⚙
☐		BM_MD_Green 2_Transfer_1539066212786	■ ■ ☐ ☐ ■ ☐ ■		👁 ✎ ⚙
☐		BM_MD_Green_Transfer_1539066212786	☐ ■ ☐ ☐ ■ ☐ ■		👁 ✎ ⚙
☐		BM_MD_Navy_Transfer_1539066212786	☐ ■ ☐ ☐ ■ ☐ ■		👁 ✎ ⚙
☐		ES_Theme_Transfer_1539066212786	☐ ■ ☐ ☐ ■ ☐ ■		👁 ✎ ⚙
☐		Font testing_Transfer_1539085026126	☐ ☐ ☐ ☐ ■ ☐ ■		👁 ✎ ⚙
☐	✔	IQP AM_Theme_Transfer_1539066190326	☐ ■ ☐ ☐ ■ ☐ ■		👁 ✎ ⚙
☐		IQP AT_Theme_Transfer_1539066190326	☐ ■ ☐ ☐ ■ ☐ ■		👁 ✎ ⚙
☐		IQP Defaults	☐ ☐ ☐ ☐ ■ ■ ■		👁 ✎ ⚙

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.

Apps

ALL APPS   RECENTLY CREATED

	Name ▾	Description	Last updated			
☐	Asset Management	Manage Devices	3 months ago by Docs Team	🔒	↗	⚙
☐	Asset Testing	Test Devices	3 months ago by Docs Team	🔒	↗	⚙
☐	Building Monitor_Step1	Simple Sample App	3 months ago by Docs Team	🔒	↗	⚙
☐	Building Monitor_Step2	Step 1 with History	3 months ago by Docs Team	🔒	↗	⚙
☐	Building Monitor_Step3	Step 2 with Repeater	3 months ago by Docs Team	🔒	↗	⚙
☐	Building Monitor_Step4	Step 3 and gauges	3 months ago by Docs Team	🔒	↗	⚙
☐	Building Monitor_Step5	Step 4 with data from Pivot Entity	3 months ago by Docs Team	🔒	↗	⚙
☐	ES Event Map View	Monitor Tags and Events with Map	3 months ago by Docs Team	🔒	↗	⚙
☐	ES_M2MvsPivot	M2M vs Pivot Comparison	3 months ago by Docs Team	🔒	↗	⚙
☐	Store Temp App	temp	2 months ago by Docs Team	🔒	↗	⚙

2. In the **Name** column, select an application.
   The **PAGES** workspace appears.

Apps > Asset Management > Pages

+ Add new page   ⚙   🔓   ↗ Preview App

	Name ▾	Description	
☐	1 Dashboard	Homepage	⚙
☐	2 Supported Devices Types	Manage device types	⚙
☐	3 Manage Devices	Manage devices	⚙
☐	4 Device Type Metrics	Manage metrics	⚙
☐	5 Device Type Groups	Manage groups	⚙
☐	Template	A template for new pages	⚙

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.
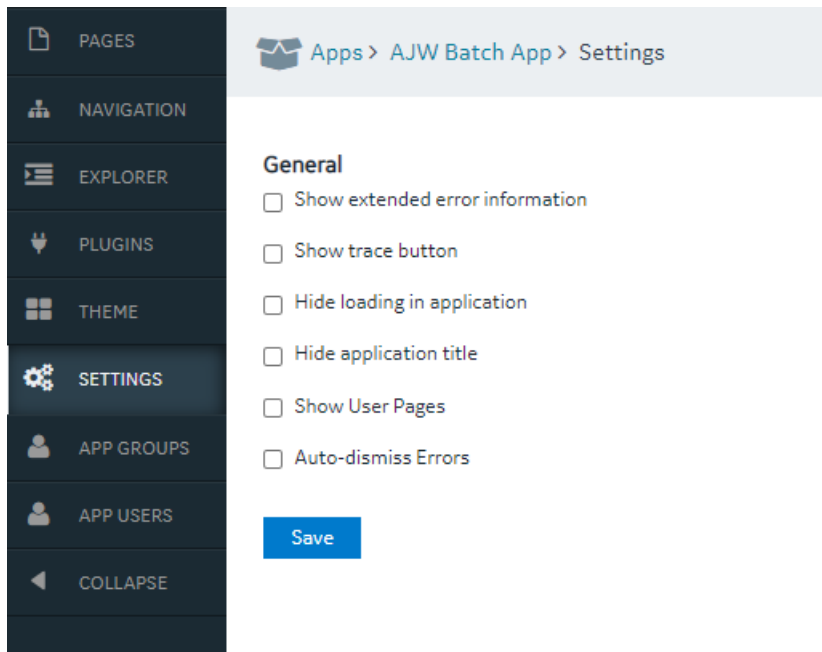
4. As needed, modify values as described in the following table.

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.

Field	Description
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	Select this check box to automatically dismiss error messages after 3-5 seconds if they pop up in the end application. Recommended for hands-free environments.

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:

Integration Widgets

Custom Widgets

Custom widgets 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 *(page 157)* section.

Native Widgets

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.

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.

Properties

• **Options**: Since radio buttons require multiple options that are mutually exclusive, there are various ways to enter options for each radio button. The following options are available:

- **Hard Coded**: Options that are created manually by clicking the **Add Option** button. Adding an option creates a button with a user-defined text (that is, option text) and the option value. The target data defines where the information will be sent.
- **Database**: Instead of specifying the options manually, it is possible to use predefined entities to create the options for a radio button. The target data defines where the information will be sent.
- **Dynamic**: While the database option can select data directly from an entity, the **Dynamic** option allows values to be selected from queries and displayed directly from the query information.
- **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.

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.

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

A dropdown is a graphical user interface element that allows a user to select one option out of a set of predefined options. Check boxes can allow for multiple selections, but, like radio buttons, dropdowns require that only one option be selected (multiple selections are not possible). 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.

Properties

- **Options**: Since dropdowns, like radio buttons, require multiple options that are mutually exclusive, there are various ways to enter options for each dropdown. The following options are available:

- ◦ **Hard Coded**: Options that are created manually by clicking the **Add Option** button. Adding an option creates a button with a user-defined text (that is, option text) and the option value. The target data defines where the information will be sent.
  - ◦ **Database**: Instead of specifying the options manually, it is possible to use predefined entities to create the options for a radio button. The target data defines where the information will be sent.
  - ◦ **Dynamic**: While the database option can select data directly from an entity, the **Dynamic** option allows values to be selected from queries and displayed directly from the query information.
- • **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.
- • **First Option**: By default, the first option will be blank. But, in many cases, it is recommended to manually insert the first option since this option will be seen by the end user.

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.

In this sample, 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.

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, for example.

In such an application, the **Submit on change** check box should be selected to pass the selected option value to the query.

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 in to 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
- **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.
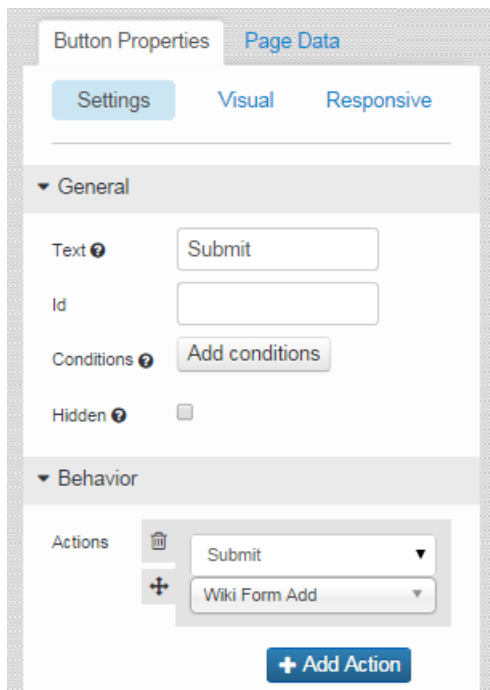
8. Save the application, and preview it.

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.

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.

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.

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 a user to a different page in the application (for example, from the home page to a different page in the navigation).
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.

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.

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.

Setting	Description
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.

Setting	Description
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.

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.

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.
Y-axis Data	The data source for the bars.
Y-axis Label	Displayed on the left side of the bar graph.
Add All Fields	This will add all the columns from the chosen entity. Each column can be labeled independently.
Sort By	Since an entity can contain several different types of data, it is possible to sort the data depending on the data in an entity.

Type of Graph	Description
Columns	Column graphs are similar to bar graphs but are shown vertically instead of horizontally. Specify the following settings for a column graph:

Setting	Description
X-axis Label	Displayed below the graph horizontally.
X-axis Data	The data source for the columns.
Y-axis Label	Displayed on the left side of the graph.
Add All Fields	This will add all the columns from the chosen entity. Each column can be labeled independently.
Sort By	Since an entity can contain several different types of data, it is possible to sort the data depending on the data in an entity.

Type of Graph	Description
Lines	Line graphs show how data changes over specific intervals of time. Specify the following settings for a line graph:

Setting	Description
X-axis Label	Displayed below the graph horizontally.
X-axis Data	The data source for the lines.
Y-axis Label	Displayed on the left side of the graph.
Add All Fields	This will add all the columns from the chosen entity. Each column can be labeled independently.
Sort By	Since an entity can contain several different types of data, it is possible to sort the data depending on the data in an entity.

Type of Graph	Description
Pie	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:

Setting	Description
Value	The data source for the pie graph.
Title	The title of the graph.
Y-axis Label	Displayed on the left side of the bar graph.
Sort By	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.
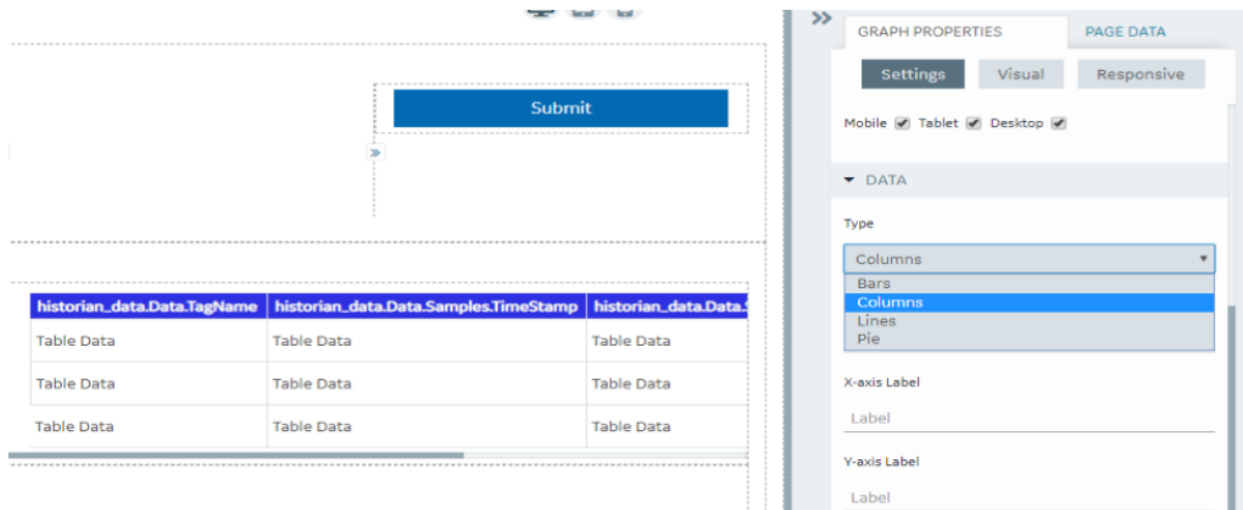
Possible Uses

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. • **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. • **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.
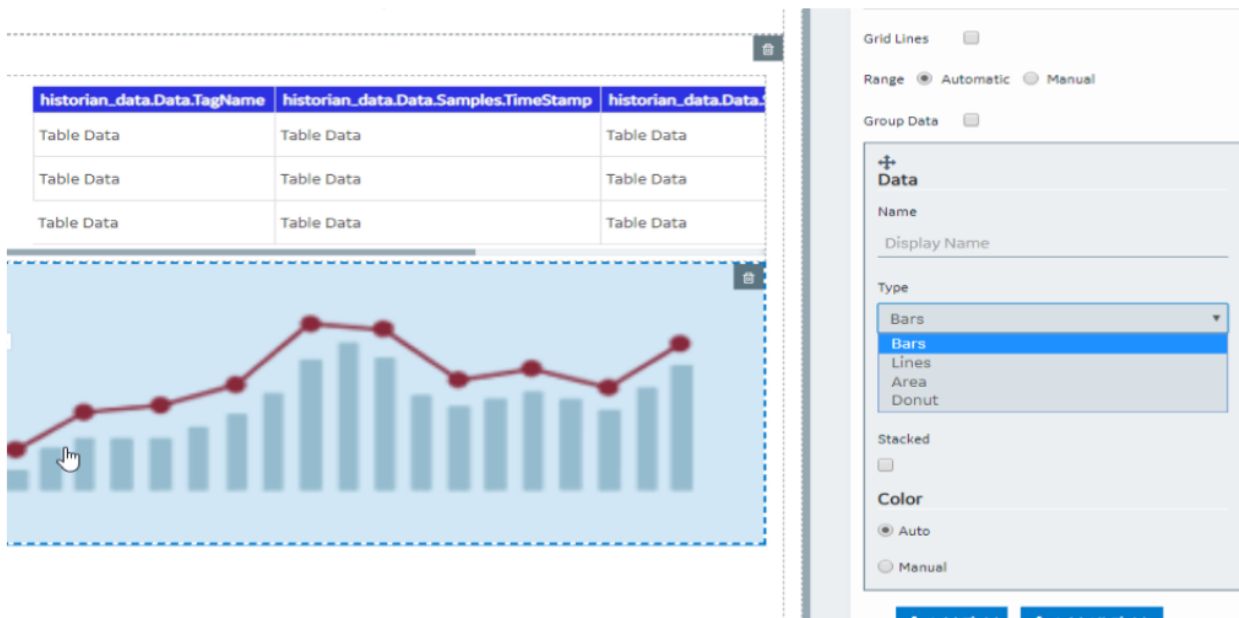
Using a Visualization Widget

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.

Setting	Description
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
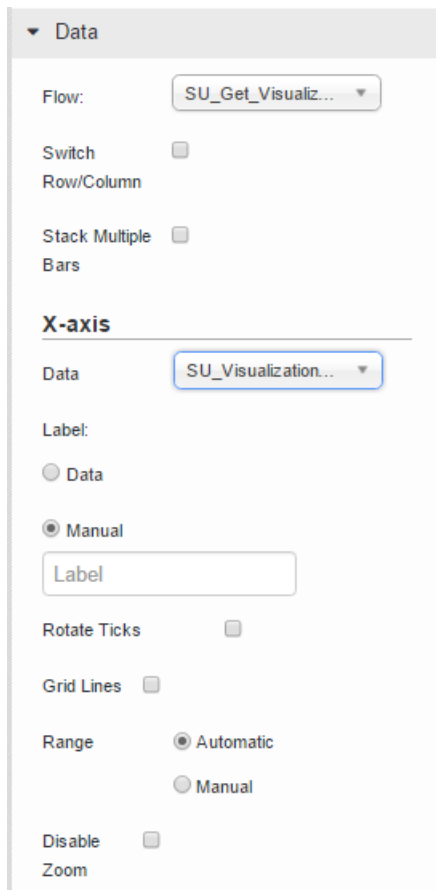
The bid data widget is a visualization widget that supports big data. Compared to the visualization widget, the big data widget allows you to specify the range more accurately.

📝 **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 ❓   ☐

Data   🗑 ✛

Name   [Data]

Type   [Lines ▾]

Data   [SU_Visualizati.. ▾]

Color

○ Auto

● Manual   [blue ▾]

Data   🗑 ✛

Name   [Data1]

Type   [Lines ▾]

Data   [SU_Visualizati.. ▾]

Color

○ Auto

● Manual   [green ▾]

For instructions on configuring these settings, refer to <u>Visualization</u> *(page 281)*.

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.
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. • **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.
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 *(page)*.

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.

Setting	Description
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. • **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.
	
	   📝 **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.

Setting	Description
MARKERS	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.

Section	Description
Position	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.
Label	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. • **Manual**: Select this option if you want to specify the label of the marker manually, and then enter the label.
Marker Icon	Select the icon and color of the marker.
Condition	Select **Add conditions**, and then specify the conditions for displaying the marker. *(i)* **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.
Actions	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).

Setting	Description
SHAPES	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. <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 shapes with different colors and the same position data, and then specify different signal strength conditions on each shape.</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.
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.

Setting	Description
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.
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.

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.
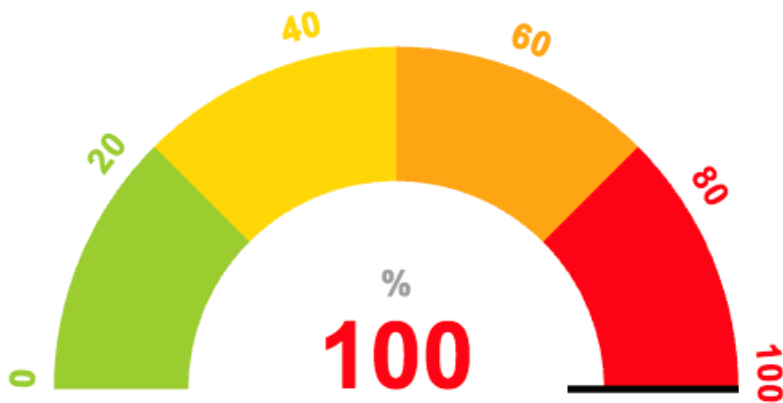
• Meter - Radial: In this gauge type, the value is plotted on a circular scale. The gauge can be an internal radial or an external radial depending on whether the scale appears inside the radial or outside. For example, the following image represents an external radial meter gauge that plots the temperature inside an engine combustion chamber.
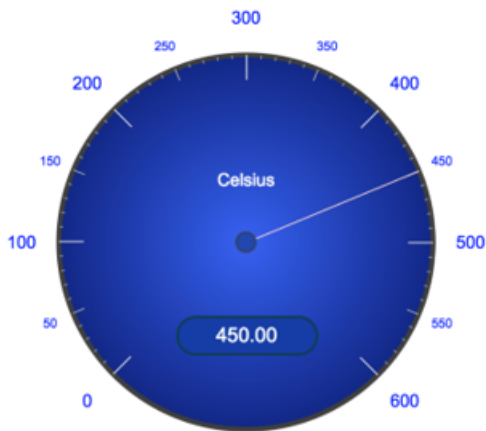
The following image represents an internal radial meter gauge that plots the pressure inside an engine combustion chamber.

- 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.
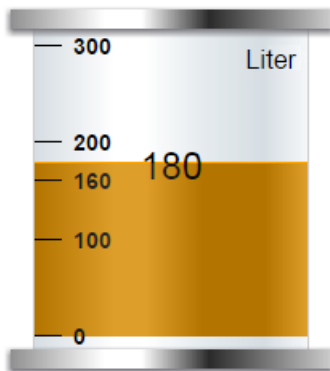
Gauge Settings

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.

Type of the Setting	Applicable Gauge Types	Description
Source	All gauges	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.
Sector	Battery, Tank, Meter - Arc	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: **Speed Range (in kph)** — **Category** 0 - 100 — Acceptable 101 - 160 — Slightly risky 161 - 200 — Risky 200 - 260 — Highly risky In this case, you will create four sectors and define the following settings: **Sector number / Start position / Color / Label** 1 / 0 / Green / Acceptable 2 / 101 / Yellow / Slightly risky 3 / 161 / Orange / Risky 4 / 200 / Red / Highly risky ⓘ **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.

Type of the Setting	Applicable Gauge Types	Description
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

A 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 a dropdown widget, you can use html code, along with css code, to crate the drop-down list box with customized look and feel.

📝 **Note:** The interaction of the html code can change based on how the responsive design works for some elements.

Html Settings

When you use a html widget, in addition to the default settings of a widget, the following settings are available.

Setting	Description
Add Field	Select this button to add an entity field for which you want to use html code. Using these fields, you can connect data to components that you create using the html widget. ⓘ **Tip:** You can select Add All Fields to add all the entity fields at once.
Edit Code	Select this button to access a code editor for html, css, and javascript codes. You can enter the custom code in the code editor. ⓘ **Tip:** The javascript code editor contains instructions on how to use the javascript API.

Setting	Description
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 a Html widget

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. Using page designer, add the html and dropdown widgets to the page.
2. Provide values in the **Dropdown Properties** section as specified in the following table.

Box	Description
Label	Enter Select an option.
Id	Enter ytID.
Global Data	Select the check box.

3. Provide values in the **HTML Properties** section as described in the following table.

Box	Description
Data	Select the check box, and then select the variable that stores the drop-down list box values.

The

4. Specify the name of the dropdown widget as ytID, and set it to global so that the html widget can access options in the drop-down list box.

A relationship is created between the dropdown and html widgets as shown in the following image.

Page Name = youtube


```
DropDown
ID = ytID
Global = True
```

```
HTML
Field
Data = ytID
Name = youtubeID
```

```
HTML Editor
Html
<iframe width="560" height="315"
src="//www.youtube.com/embed/LpOwzzQyK70" frameborder="0"
allowfullscreen ></iframe>
Jacascript
var iframe = EMBED.getRootElement().find("iframe")
EMBED.onChangeData(function(data) {
    iframe.attr("src", "//www.youtube.com/embed/" + data.youtubeID);
});
```

```
/* Welcome to our javascript API
* You have Access to the global object EMBED,
* this object contains two Methods:
* @ getData()
* @ onChangeData()
* @ getRootElement()  - returns jQuery element

* function useData(data) {
*           data = data || EMBED.getData();
*   doSomethingWithData(data);
* }
* useData();
* EMBED.onChangeData(useData);
*/
```

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, perform the following steps:

1. In the page designer for the **Compass** page:
   a. Add a text widget, and provide values as shown in the following image.
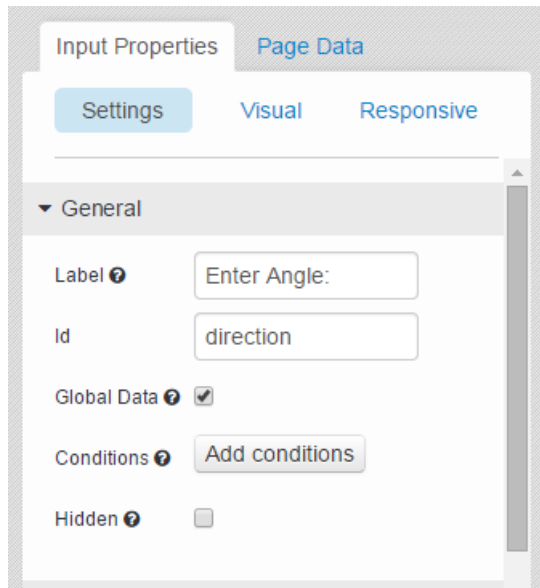
b. Add a html widget below the text widget, add a field, and provide values as shown in the following image.
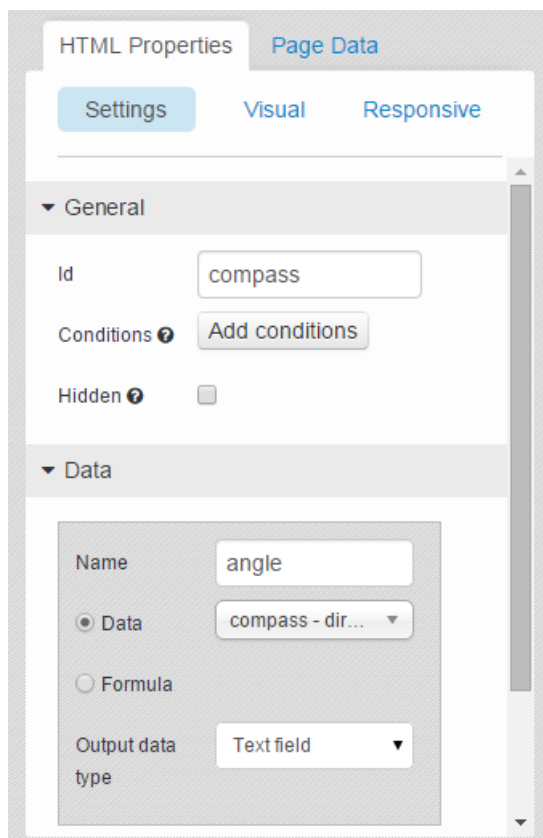
c. In the **Html** section, enter the lines of code shown in the following image.

```
Html    Css    Javascript
 1 <div class="compass">
 2    <div class="compass-inner">
 3       <div class="north">N</div>
 4       <div class="east">E</div>
 5       <div class="west">W</div>
 6       <div class="south">S</div>
 7       <div class="main-arrow">
 8          <div class="arrow-up"></div>
 9          <div class="arrow-down"></div>
10       </div>
11    </div>
12 </div>
```

d. In the **Css** section, 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;
} }
```

e. In the **Javascript** section, enter the lines of code as shown in the following image.

```
11  *        doSomethingWithData(data);
12  * })
13  */
14 var data = EMBED.getData();
15
16 var arrow = $('.main-arrow');
17
18 doSomethingWithData();
19
20 function doSomethingWithData() {
21    arrow.css({
22      '-webkit-transform' : 'rotate('+data.angle+'deg)',
23      '-moz-transform' : 'rotate('+data.angle+'deg)' ,
24      '-o-transform': 'rotate('+data.angle+'deg)',
25      '-ms-transform': 'rotate('+data.angle+'deg)',
26      'transform': 'rotate('+data.angle+'deg)',
27
28    });
29
30 }
31
32 EMBED.onChangeData(
33    function(){
34      data = EMBED.getData();
35      // console.log('data:' + data);
36      doSomethingWithData();
37 })
38
```

2. In the page designer for the **Stylish Header** page:

    a. In the **Html** section, enter the following lines of code:

```
<h1>3d text effect</h1>
```

  b. In the **Css** section, enter the following lines of code:

```
body{
   text-align:center;
   background:#dfdfdf;
}
h1{
   text-transform:uppercase;
   font-size:72px;
   font-family:'Verdana';
   padding:30px;
}
```

  c. In the **Javascript** section, enter the following lines of code:

```
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)');
   });
```

```
});
```

3. In the page designer for the **Tiles** page:
   a. Add a html widget.
   b. In the **Html** section, enter the following lines of code:

```
<div class="tile"></div>
```

c. In the **Css** section, enter the lines of code as shown in the following image.

4. In the page designer for the **Marquee** page:
   a. Add a html widget.
   b. In the **Html** section, enter the lines of code as shown in the following image.

```
Html    Css    Javascript

1  <marquee><h1>This text will scroll from right to left</h1></marquee>
2  </br>
3  <marquee direction="up">
4    <div class="up1">once apon a time<div>
5      <div class="up2">far far a way</div>
6    </marquee>
```

c. In the **Css** section, enter the lines of code as shown in the following image.

```
Html    Css    Javascript

1  h1,.up1,.up2{
2  padding:0px;
3  margin:0px;
4  text-shadow: 0 5px 0 #ccc,
5               0 2px 0 #c9c9c9,
6               0 3px 0 #bbb,
7               0 4px 0 #b9b9b9,
8               0 5px 0 #aaa,
9               0 6px 1px rgba(0,0,0,.1),
10              0 0 5px rgba(0,0,0,.1),
11              0 1px 3px rgba(0,0,0,.3),
12              0 3px 5px rgba(0,0,0,.2),
13              0 5px 10px rgba(0,0,0,.25),
14              0 10px 10px rgba(0,0,0,.2),
15              0 20px 20px rgba(0,0,0,.15);
16
17    text-align: center;
18    width:70%;
19  }
20  marquee{
21      text-align: center;
22    width:70%;
23  }
24  .up1{
25      font-size: 400%;
26  }
27  .up2{
28      font-size: 200%;
```

5. Save the application, and preview it.

The application contains the four pages.

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.

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: • **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. 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.

Setting	Description
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 container. 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.
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.

Setting	Description
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.
Item Horizontal Alignment	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.

Device ID	Latest Time Stamp
Device 1	2019/12/22 8:04:37:037
Device 2	2019/12/22 22:14:31:545
Device 3	2019/12/22 8:04:40:040
Device 4	2019/12/21 5:28:59:059

If you enter 2 in this box, the table is split as follows in the repeater.

Device ID	Latest Time Stamp	Device ID	Latest Time Stamp
Device 1	2019/12/22 8:04:37:037	Device 2	2019/12/22 22:14:31.545
Device 3	2019/12/22 8:04:40:040	Device 4	2019/12/21 5:28:59:059

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.
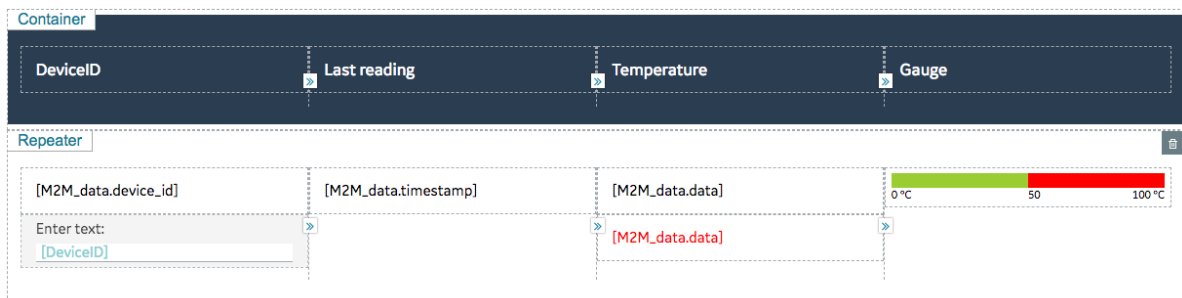
15. Save the application, and preview it.

    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.
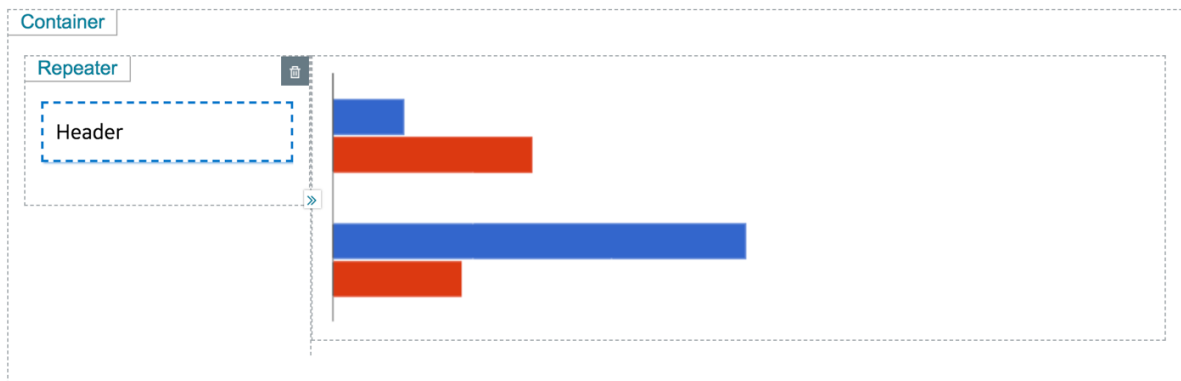
- The repeater provides a list of devices that the application users can select.
- The graph plots the temperature recorded by the selected devices.

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.
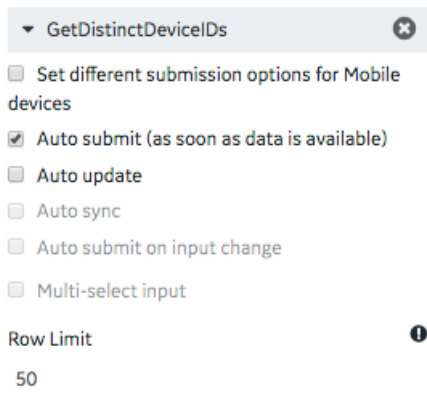
   c. For the GetLatestDeviceTemperature query, configure the settings as shown in the following image.

GetLastDeviceTemperature ✕

☐ Set different submission options for Mobile devices

☑ Auto submit (as soon as data is available)

☑ Auto update

Interval 2

Units

Seconds

☐ Auto sync

☐ Auto submit on input change

☑ Multi-select input

DeviceID ▾

Row Limit ❶

50

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.
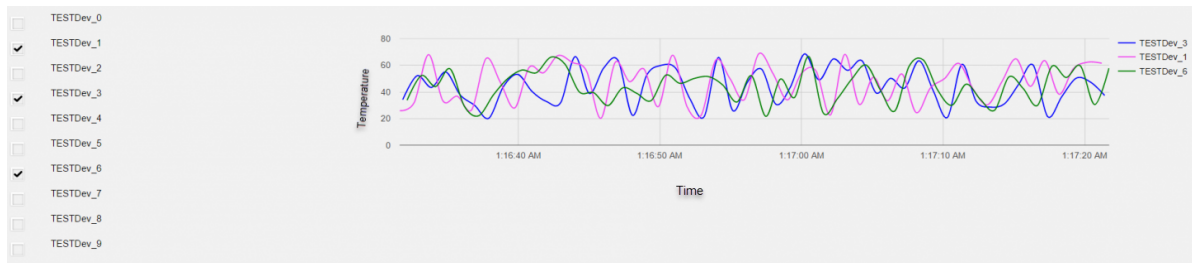
Tools

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 <u>Events *(page 167)*</u> 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.
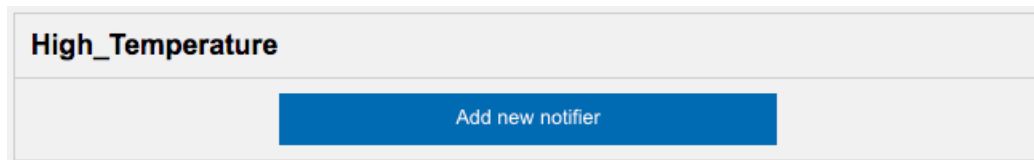
6. Select **Add new notifier** to add an instance of the event.

   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.

Setting	Description
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 M2M_groups_device_thing	device_id gateway_thing_id
device_type	Identifies the type of the device gateway or asset.	This column is required.	device_gateway supported_device_gateway	device_type 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
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.		

Column Heading	Purpose	Usage	Mapped to Entity	Mapped to Entity Field
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 Widgets

Date Picker

With the DatePicker plugin, you can 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.
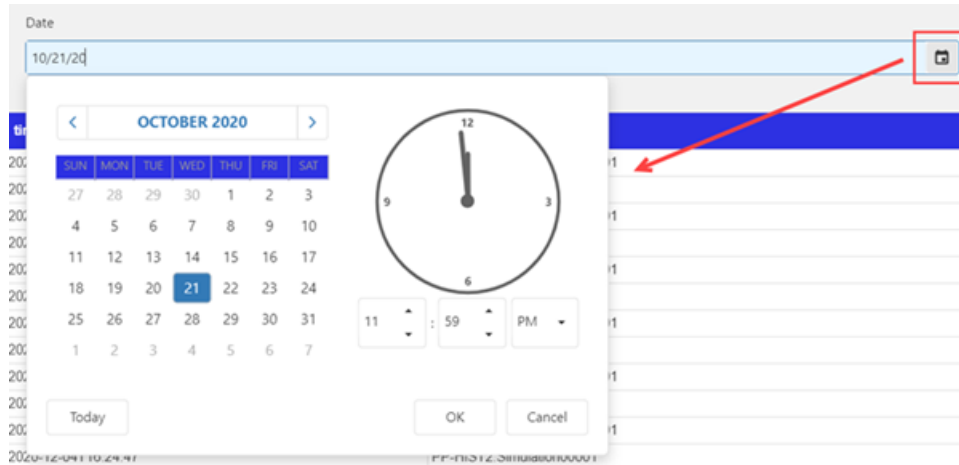
To use the plugin in the page designer, drag [📅] from **Integration > General** to a container in the page.

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.

Item	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.

Item	Description
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.

Item	Description
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.

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.
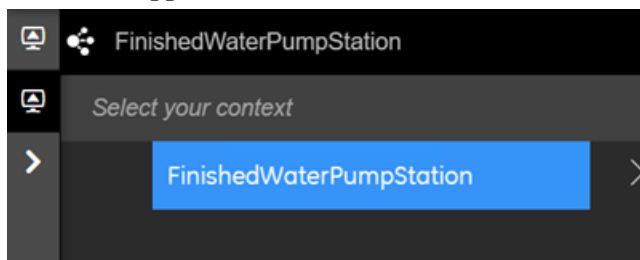
To use the plugin in the page designer, drag ⟫ from **Integration > General** to a container in the page.
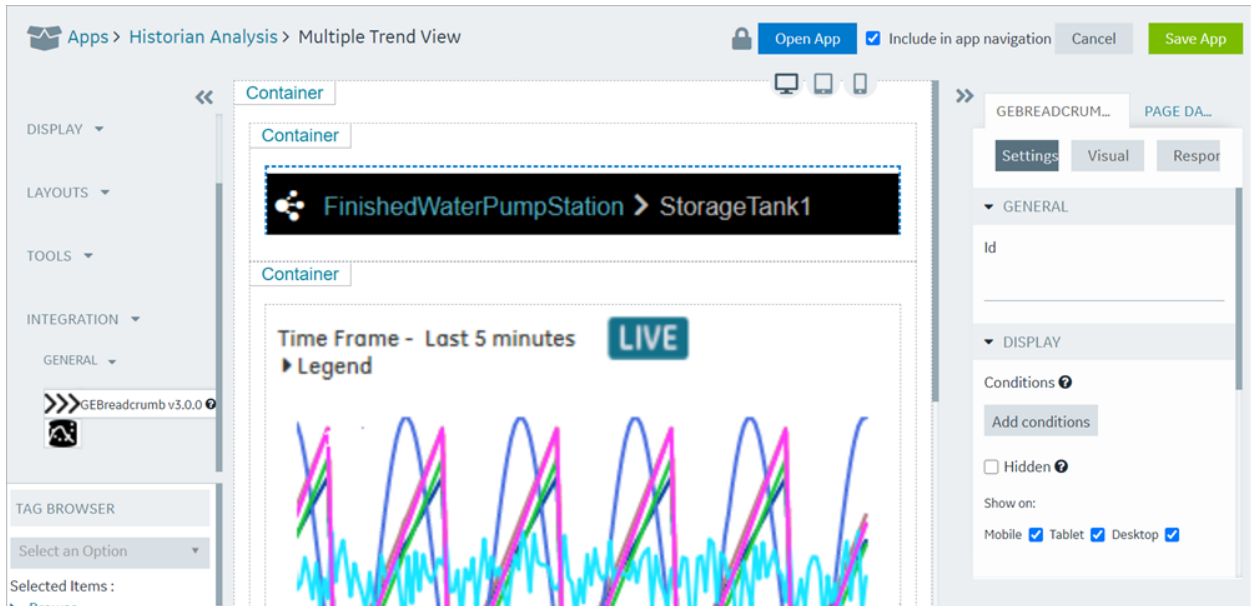
You must specify these breadcrumb properties:

📝 **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 *(page 207)*.
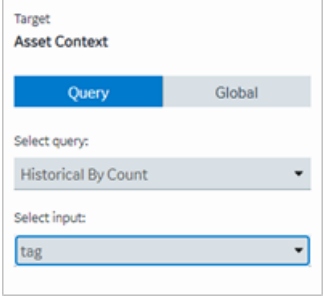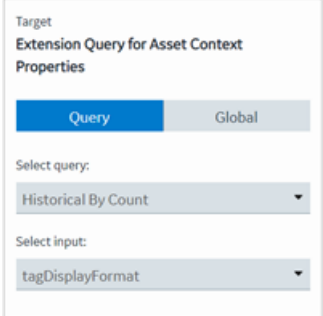
Item	Description
Target Asset Context	Select the target for an asset context. This target defines where that output goes on selecting an asset in a breadcrumb, so that it can be fed either to a query or a global.

Item	Description
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 *(page 350)* for common widget properties.

Trend Chart

Trend Chart Overview
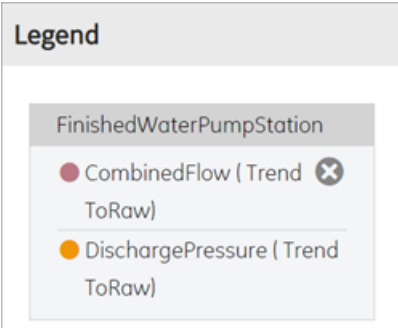
The trend chart widget allows you to plot real time data from OPC UA servers and historical data from Historian servers. You can plot the data using the context of a model or browse for a Historian or OPC UA server. You can then add tags to the chart.
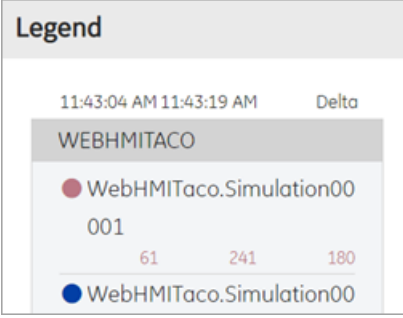
The model contains asset types and assets. The assets have properties associated with them, which are, in turn, associated with tags defined in Historian or OPC UA.

The following image shows an example of a trend chart.
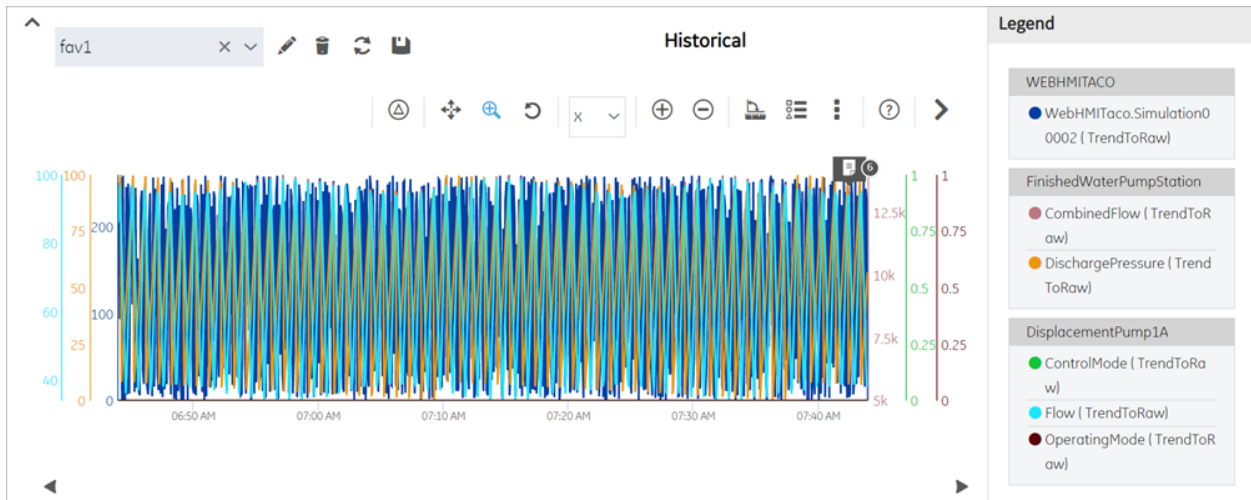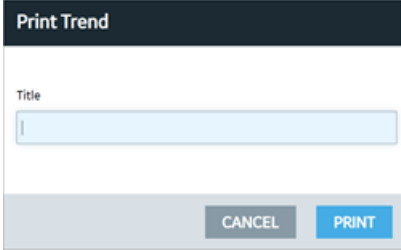
The following table describes the tasks that you can perform on a trend chart.

Task	Procedure
Access the properties used in a trend chart.	The properties used in a trend chart appear in the **Legend** section.
Remove a property from a trend chart.	To delete a property from the trend chart, select the property, then select ⊗.
Increase the area of a trend chart.	• Hide the toolbar by selecting ⌃. • Hide the **Legend** section by selecting ❯.
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 ▶.

Task	Procedure
View the delta value between two data points.	The delta values for the trend is displayed in the **Legend** section. **Legend** 11:43:04 AM 11:43:19 AM Delta WEBHMITACO ● WebHMITaco.Simulation00 001 61 241 180 ● WebHMITaco.Simulation00 On the toolbar, select ⬟, and select the two data points whose delta value you want to view.
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 🔍. 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.	On the toolbar, select ✛, and then drag the mouse pointer to the area on that chart that you want to view.

Task	Procedure
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**. Enter a name for your new favorite: sampling Cancel Add To load a favorite view, select the view from the drop-down list box next to ☆.
View the statistics of tags plotted on a trend chart.	The statistical data for the Historian tags used in the trend chart appear below the chart. • On the toolbar, select to show the statistical data. • To hide statistics, select again. 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. **Export Trend Data** Output file name GE Operations Hub Trend.csv Item delimiter , CANCEL EXPORT

Task	Procedure
Print a trend chart.	On the toolbar, select ⋮ , then select 🖶 . You have the option to provide a title that appears above the trend chart. **Print Trend** Title [ ] CANCEL PRINT
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.

Configure Trend Chart Settings

for Historian or OPC UA.

1. Access the trend chart whose settings you want to configure.

2. In the toolbar of the chart, select ▤ .
   The **Trend Configuration** window appears.
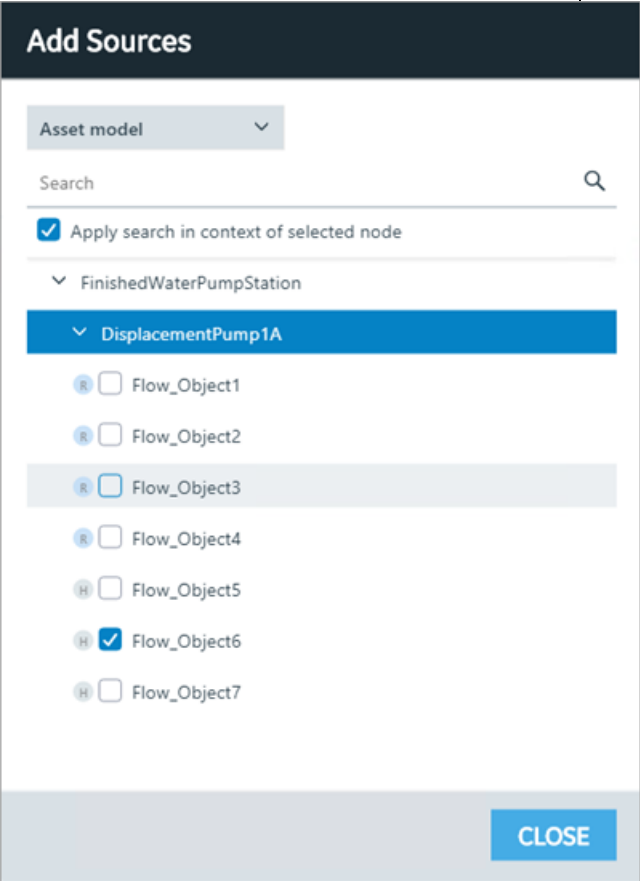
3. Modify the trend chart settings as specified in the following table.

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 mode, these changes reflect when you move to the Historical mode as well.
Duration	Select the duration for which you want to plot the data. If you want to select a duration that is not included in the default options, select **Custom**.
Start	Select the start date for the historical data. This option is available only for the historical mode.
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 can zoom in to view more accurate data.

Setting	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 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.

Setting	Description
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 *(page 232)*. Tags marked as H are from the Historian data source. Tags marked as R 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.

Setting	Description
SAMPLING MODE	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. These are the modes available to plot data: • Trend To Raw • Minimum • Maximum • Average • Total • Standard Deviation • Interpolated • Lab • Lab To Raw 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. To delete a plotted sampling mode, select ✖ next to the tag.

Setting	Description
Specification Limits	Select to define upper, lower, and targeted limits to monitor the process performance.

Enter values for all or any of the limits to plot these lines on the trend chart. You can highlight each plotted line with a unique line color, thickness, and/or style.

You can set the specification limits for both live and historical mode, and save the chart to favorites.

Setting	Description
COLOR	Select to color code each trend line for unique identification.
LINE WEIGHT	Select to highlight each trend line with a unique line width.
LINE STYLE	Select to highlight each trend line with a unique line style.

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**.
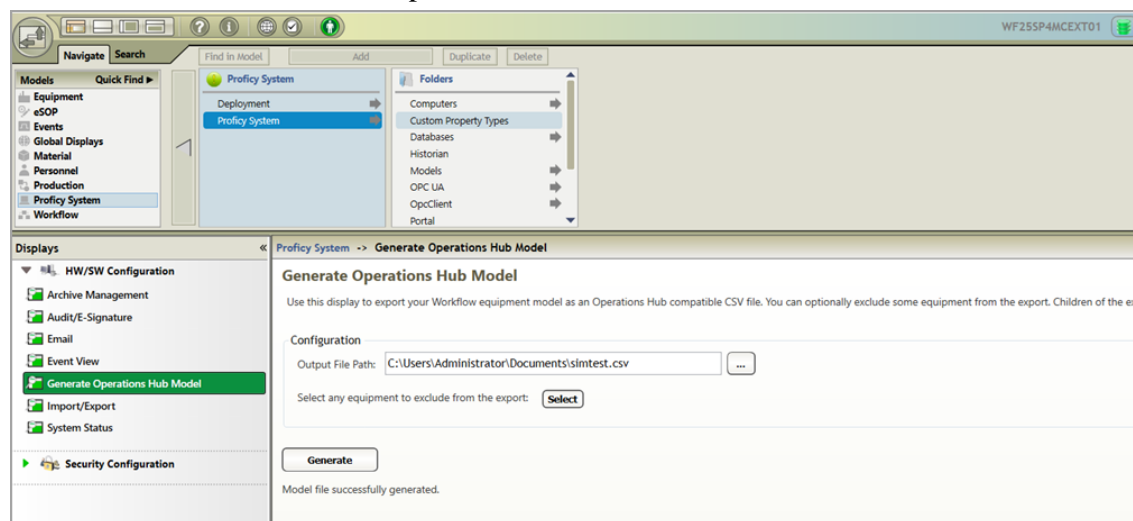
   The equipment model data is exported to a .csv file format, and saved in the specified location.

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 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 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.

ℹ️ **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 *(page 345)* 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.

Username:	admin
Password:	•••••••••|
Server Address:	https://wftrunkl:8447/

   Log On

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 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.
■0	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 ■3 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.

Icon	Description
	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.
	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. **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.

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 of the following categories to a page:

Field	Description
INPUTS	Contains UI components that receive input from application users. • Check Box *(page 265)* • Radio Button *(page 266)* • Dropdown *(page 267)* • Input *(page 270)* • Slider *(page 272)* • Toggle *(page 273)* • Button *(page 274)* • Camera *(page 275)* • Text Area *(page 276)*
DISPLAY	Contains UI components that display information in the application. • Text *(page 276)* • Header *(page 277)* • Image *(page 278)* • Graph *(page 279)* • Visualization *(page 281)* • Big Data *(page 285)* • Grid *(page 287)* • Map *(page 289)* • Table *(page 292)* • List *(page 293)* • Gauge *(page 294)* • Html *(page 298)* • Interactive Map *(page 308)*

Field	Description
LAYOUTS	Contains UI components that are used to design a page layout. • New Line *(page 310)* • Separator *(page 310)* • Container *(page 310)* • Repeater *(page 311)*
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. • Event Settings *(page 326)* • Upload Excel *(page 327)* • Upload Devices *(page 329)*
Custom / INTEGRATION	Contains custom UI plug-in components that have been uploaded by an application developer. • Date Picker *(page 330)* • Breadcrumb *(page 332)* • Trend Chart *(page 334)*

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.

Field	Description
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.
Style	The style of a meter-type gauge component.
Settings > Display	
Conditions	The condition based on which the component appears in the application. For example, you can create a condition that a control button or a warning image be displayed if the temperature recorded by the sensor exceeds 40 degrees Celsius.
Show on	The devices wherein the component appears. By default, the options Mobile, Tablet, and Desktop are selected.
Hidden	Indicates whether the component should appear in the application. By default, this check box is cleared. You can configure hidden components to appear when an action is performed.
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 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.

Field	Description
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.
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.
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.

Field	Description
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.
Responsive	
Responsive Pattern	Select how the container layout must respond on web pages.

Globals

Globals are applied outside of a query. Multiple widgets can access the same globals.

You can apply 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.

Add globals to plugin outputs. To modify an added global, select to switch between Page Global and App Global.
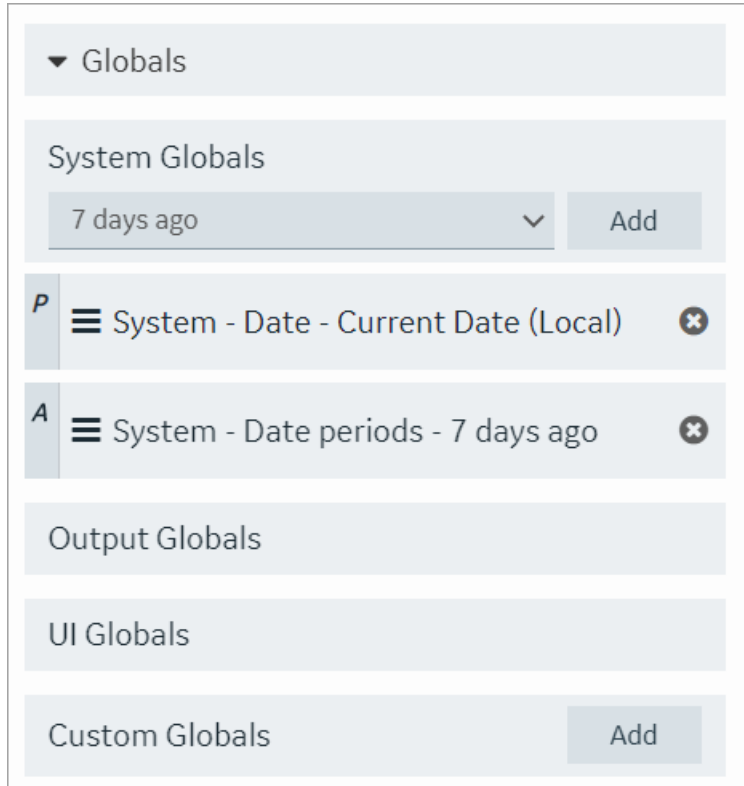
These are the different types of globals available for the widgets in Operation Hub:

- 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 *(page 99)*.

2. Create a page *(page 238)*.

3. Design a page layout using widgets such as a guage, line graph, etc.
   Refer to Page Components *(page 350)*.

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 .
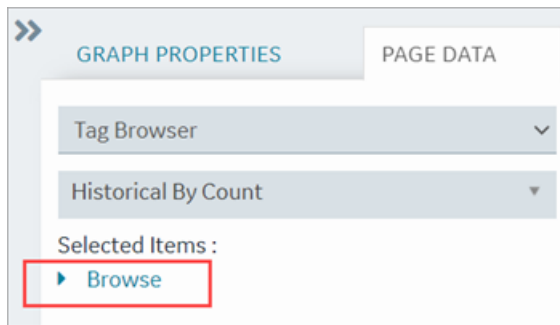
8. Drag this data and drop it on the graph.
   A message appears that the data is bound successfully.

9. Select **Save App**.

10. Select **Open App**.
    The application page opens in a web browser.

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.

Keyname	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	DateTime	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":"va
                          ]
                          }
                          }]}
```

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+
[

 {"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+
[

 {"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
                     ]
                     }
```

- `"<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

ⓘ **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
                     ]
                     }
```

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

ⓘ 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

About 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 *(page 375)* description.

To troubleshoot data source test connection errors, refer to Error Messages *(page 387)* 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.

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.

Code	Integer	String	Description
0x80010000	2147549184	BadUnexpectedError	An unexpected error occurred.
0x80020000	2147614720	BadInternalError	An internal error occurred as a result of a programming or configuration error.
0x80030000	2147680256	BadOutOfMemory	Not enough memory to complete the operation.
0x80040000	2147745792	BadResourceUnavailable	An operating system resource is not available.
0x80050000	2147811328	BadCommunicationError	A low level communication error occurred.
0x80060000	2147876864	BadEncodingError	Encoding halted because of invalid data in the objects being serialized.
0x80070000	2147942400	BadDecodingError	Decoding halted because of invalid data in the stream.
0x80080000	2148007936	BadEncodingLimitsExceeded	The message encoding/decoding limits imposed by the stack have been exceeded.
0x80B80000	2159542272	BadRequestTooLarge	The request message size exceeds limits set by the server.
0x80B90000	2159607808	BadResponseTooLarge	The response message size exceeds limits set by the client.
0x80090000	2148073472	BadUnknownResponse	An unrecognized response was received from the server.
0x800A0000	2148139008	BadTimeout	The operation timed out.
0x800B0000	2148204544	BadServiceUnsupported	The server does not support the requested service.
0x800C0000	2148270080	BadShutdown	The operation was cancelled because the application is shutting down.
0x800D0000	2148335616	BadServerNotConnected	The operation could not complete because the client is not connected to the server.
0x800E0000	2148401152	BadServerHalted	The server has stopped and cannot process any requests.
0x800F0000	2148466688	BadNothingToDo	There was nothing to do because the client passed a list of operations with no elements.
0x80100000	2148532224	BadTooManyOperations	The request could not be processed because it specified too many operations.
0x80DB0000	2161836032	BadTooManyMonitoredItems	The request could not be processed because there are too many monitored items in the subscription.

Code	Integer	String	Description
0x80110000	2148597760	BadDataTypeIdUnknown	The extension object cannot be (de)serialized because the data type id is not recognized.
0x80120000	2148663296	BadCertificateInvalid	The certificate provided as a parameter is not valid.
0x80130000	2148728832	BadSecurityChecksFailed	An error occurred verifying security.
0x81140000	2165571584	BadCertificatePolicyCheckFailed	The certificate does not meet the requirements of the security policy.
0x80140000	2148794368	BadCertificateTimeInvalid	The certificate has expired or is not yet valid.
0x80150000	2148859904	BadCertificateIssuerTimeInvalid	An issuer certificate has expired or is not yet valid.
0x80160000	2148925440	BadCertificateHostNameInvalid	The HostName used to connect to a server does not match a HostName in the certificate.
0x80170000	2148990976	BadCertificateUriInvalid	The URI specified in the ApplicationDescription does not match the URI in the certificate.
0x80180000	2149056512	BadCertificateUseNotAllowed	The certificate may not be used for the requested operation.
0x80190000	2149122048	BadCertificateIssuerUseNotAllowed	The issuer certificate may not be used for the requested operation.
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.
0x002E0000	3014656	GoodCompletesAsynchronously	The processing will complete asynchronously.
0x002F0000	3080192	GoodOverload	Sampling has slowed down due to resource limitations.
0x00300000	3145728	GoodClamped	The value written was accepted but was clamped.
0x80310000	2150694912	BadNoCommunication	Communication with the data source is defined, but not established, and there is no last known value available.
0x80320000	2150760448	BadWaitingForInitialData	Waiting for the server to obtain values from the underlying data source.
0x80330000	2150825984	BadNodeIdInvalid	The syntax of the node id is not valid.
0x80340000	2150891520	BadNodeIdUnknown	The node id refers to a node that does not exist in the server address space.

Code	Integer	String	Description
0x80350000	2150957056	BadAttributeIdInvalid	The attribute is not supported for the specified Node.
0x80360000	2151022592	BadIndexRangeInvalid	The syntax of the index range parameter is invalid.
0x80370000	2151088128	BadIndexRangeNoData	No data exists within the range of indexes specified.
0x80380000	2151153664	BadDataEncodingInvalid	The data encoding is invalid.
0x80390000	2151219200	BadDataEncodingUnsupported	The server does not support the requested data encoding for the node.
0x803A0000	2151284736	BadNotReadable	The access level does not allow reading or subscribing to the Node.
0x803B0000	2151350272	BadNotWritable	The access level does not allow writing to the Node.
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.
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.

Code	Integer	String	Description
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.
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.

Code	Integer	String	Description
0x80C60000	2160459776	BadIdentityChangeNotSupported	The server does not support changing the user identity assigned to the session.
0x805A0000	2153381888	BadRequestCancelledByRequest	The request was cancelled by the client with the Cancel service.
0x805B0000	2153447424	BadParentNodeIdInvalid	The parent node id does not to refer to a valid node.
0x805C0000	2153512960	BadReferenceNotAllowed	The reference could not be created because it violates constraints imposed by the data model.
0x805D0000	2153578496	BadNodeIdRejected	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	BadNodeIdExists	The requested node id is already used by another node.
0x805F0000	2153709568	BadNodeClassInvalid	The node class is not valid.
0x80600000	2153775104	BadBrowseNameInvalid	The browse name is invalid.
0x80610000	2153840640	BadBrowseNameDuplicated	The browse name is not unique among nodes that share the same relationship with the parent.
0x80620000	2153906176	BadNodeAttributesInvalid	The node attributes are not valid for the node class.
0x80630000	2153971712	BadTypeDefinitionInvalid	The type definition node id does not reference an appropriate type node.
0x80640000	2154037248	BadSourceNodeIdInvalid	The source node id does not reference a valid node.
0x80650000	2154102784	BadTargetNodeIdInvalid	The target node id does not reference a valid node.
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.

Code	Integer	String	Description
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.
0x00BA0000	12189696	GoodResultsMayBeIncomplete	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	BadNotTypeDefinition	The provided Nodeid was not a type definition nodeid.
0x406C0000	1080819712	UncertainReferenceOutOfServer	One of the references to follow in the relative path references to a node in the address space in another server.
0x806D0000	2154627072	BadTooManyMatches	The requested operation has too many matches to return.
0x806E0000	2154692608	BadQueryTooComplex	The requested operation requires too many resources in the server.
0x806F0000	2154758144	BadNoMatch	The requested operation has no match to return.
0x80700000	2154823680	BadMaxAgeInvalid	The max age parameter is invalid.
0x80E60000	2162556928	BadSecurityModeInsufficient	The operation is not permitted over the current secure channel.
0x80710000	2154889216	BadHistoryOperationInvalid	The history details parameter is not valid.
0x80720000	2154954752	BadHistoryOperationUnsupported	The server does not support the requested operation.
0x80BD0000	2159869952	BadInvalidTimestampArgument	The defined timestamp to return was invalid.
0x80730000	2155020288	BadWriteNotSupported	The server does not support writing the combination of value, status and timestamps provided.
0x80740000	2155085824	BadTypeMismatch	The value supplied for the attribute is not of the same type as the attribute's value.
0x80750000	2155151360	BadMethodInvalid	The method id does not refer to a method for the specified object.
0x80760000	2155216896	BadArgumentsMissing	The client did not specify all of the input arguments for the method.

Code	Integer	String	Description
0x81110000	2165374976	BadNotExecutable	The executable attribute does not allow the execution of the method.
0x80770000	2155282432	BadTooManySubscriptions	The server has reached its maximum number of subscriptions.
0x80780000	2155347968	BadTooManyPublishRequests	The server has reached the maximum number of queued publish requests.
0x80790000	2155413504	BadNoSubscription	There is no subscription available for this session.
0x807A0000	2155479040	BadSequenceNumberUnknown	The sequence number is unknown to the server.
0x807B0000	2155544576	BadMessageNotAvailable	The requested notification message is no longer available.
0x807C0000	2155610112	BadInsufficientClientProfile	The client of the current session does not support one or more Profiles that are necessary for the subscription.
0x80BF0000	2160001024	BadStateNotActive	The sub-state machine is not currently active.
0x81150000	2165637120	BadAlreadyExists	An equivalent rule already exists.
0x807D0000	2155675648	BadTcpServerTooBusy	The server cannot process the request because it is too busy.
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.
0x40940000	1083441152	UncertainEngineeringUnitsExceeded	The value is outside of the range of values defined for this parameter.
0x40950000	1083506688	UncertainSubNormal	The value is derived from multiple sources and has less than the required number of Good sources.
0x00960000	9830400	GoodLocalOverride	The value has been overridden.
0x80970000	2157379584	BadRefreshInProgress	This Condition refresh failed, a Condition refresh operation is already in progress.
0x80980000	2157445120	BadConditionAlreadyDisabled	This condition has already been disabled.
0x80CC0000	2160852992	BadConditionAlreadyEnabled	This condition has already been enabled.
0x80990000	2157510656	BadConditionDisabled	Property not available, this condition is disabled.
0x809A0000	2157576192	BadEventIdUnknown	The specified event id is not recognized.
0x80BB0000	2159738880	BadEventNotAcknowledgeable	The event cannot be acknowledged.

Code	Integer	String	Description
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	BadConditionBranchAlreadyConfirmed	The condition branch has already been confirmed.
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.
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.

Code	Integer	String	Description
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.
0x40DE0000	1088290816	UncertainDominantValueChanged	The related EngineeringUnit has been changed but the Variable Value is still provided based on the previous unit.
0x00E00000	14680064	GoodDependentValueChanged	A dependent value has been changed but the change has not been applied to the device.
0x80E10000	2162229248	BadDominantValueChanged	The related EngineeringUnit has been changed but this change has not been applied to the device. The Variable Value is still dependent on the previous unit but its status is currently Bad.
0x40E20000	1088552960	UncertainDependentValueChanged	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	BadDependentValueChanged	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	GoodCommunicationEvent	The communication layer has raised an event.

Code	Integer	String	Description
0x00A80000	11010048	GoodShutdownEvent	The system is shutting down.
0x00A90000	11075584	GoodCallAgain	The operation is not finished and needs to be called again.
0x00AA0000	11141120	GoodNonCriticalTimeout	A non-critical timeout occurred.
0x80AB0000	2158690304	BadInvalidArgument	One or more arguments are invalid.
0x80AC0000	2158755840	BadConnectionRejected	Could not establish a network connection to remote server.
0x80AD0000	2158821376	BadDisconnect	The server has disconnected from the client.
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:

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:** The Application URI does not match with the URI in the certificate. **Action:** Re-issue the security 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.