



PI Builder

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Overview

PI Builder is a Microsoft Excel add-in that lets you use Excel to create, view, and modify objects in your Asset Framework (PI AF) database or PI points in your Data Archive. With PI Builder, you can easily make bulk changes, and accomplish the following tasks:

- Create, edit, and delete PI points on your Data Archive or edit the attributes of those points.
- Create multiple copies of existing PI AF objects (elements and attributes, categories, enumeration sets, templates, UOM classes, UOMs, reference types, event frames, transfers, ports, enumeration values, and extended properties).
- Copy existing PI AF objects. If you need to create many objects that are similar in structure, you can create just one, and use PI Builder to make copies of that template configuration.
- Change settings of existing objects. For example, you can change which PI point is associated with a PI AF attribute.

Videos

For more information on using PI Builder, watch the videos on the OSIsoft Learning channel playlist:

[https://www.youtube.com/embed/playlist?](https://www.youtube.com/embed/playlist?list=PLMcG1Hs2JbcsbdYkaLsU_fZYFMpclcw5v&rel=0&_ga=2.125084234.1764124889.1668027109-552001323.16663590)

[list=PLMcG1Hs2JbcsbdYkaLsU_fZYFMpclcw5v&rel=0&_ga=2.125084234.1764124889.1668027109-552001323.16663590](https://www.youtube.com/embed/playlist?list=PLMcG1Hs2JbcsbdYkaLsU_fZYFMpclcw5v&rel=0&_ga=2.125084234.1764124889.1668027109-552001323.16663590)

Install and setup PI Builder

You can install PI Builder from the PI AF Client or PI Server install kits. To download PI Server install kits, click [📄](#) on the [OSIsoft Customer Portal Products](#) page.

Close Microsoft Excel before installing PI Builder or other components in the PI AF Client or PI Server install kits. See the PI AF Client Installation and Upgrade Guide or PI Server Installation and Upgrade Guide for further information. You can also install the language pack to view the user interface in languages other than English. Also, consider your Data Archive configuration to ensure that you have proper access to PI points.

Random and Ramp Soak interfaces removal

Starting with PI Server 2018 SP3, the Random and Ramp Soak interfaces are no longer installed by default with a new Data Archive installation. Optionally, you can install them by using separate install kits: the PI Interface for Ramp Soak Simulator Data and the PI Interface for Random Simulator Data. After installing these interfaces, follow the instruction provided by the interface install kits to create default PI points and then receive simulated data from these interfaces. For upgrades, previous versions of Random and Ramp Soak interfaces will remain and the default PI Points will continue to retrieve simulated data.

Prior to PI Server 2018 SP3, the following default PI points are created automatically with the PI Data Archive install kit:

- BA:ACTIVE.1
- BA:CONC.1
- BA:LEVEL.1BA:PHASE.1
- BA:PHASE.1
- BA:TEMP.1
- CDEP158
- CDM158
- CDT158
- SINUSOID
- SINUSOIDU

View PI Builder in a supported language

PI Builder supports multiple languages. Install the PI AF Client MUI (multilingual user interface) language pack to view the PI Builder user interface in the same language as Microsoft Excel. If PI Builder does not support the language selected for Excel, the PI Builder user interface appears in English.

1. Set the desired language in Microsoft Excel:
 - a. Install the Microsoft Office language pack.
 - b. Use the Microsoft Office language-setting tool to change the language of Microsoft Excel.

2. To download the PI AF Client MUI language pack, click [📄](#) on the [OSIsoft Customer Portal Products page](#).
3. Install the PI AF Client MUI language pack.

Data Archive configuration for PI Builder

PI Builder can retrieve data from and write data to Data Archive. However, PI Builder must connect to Data Archive and have proper access to points. This might require configuration changes for:

- Firewall database. The firewall database on each Data Archive computer must be configured to allow access from client computers that run PI Builder.
- Authentication and authorization. Those using PI Builder must be able to authenticate their identity with Data Archive and have access to Data Archive. We recommend you use PI mappings. You can also use PI trusts or PI password authentication. PI password authentication is not recommended because it is less secure.
- Point definitions. Points must be defined to give authorized users read access, and write access, if necessary.

For more information, consult the Data Archive documentation.

Uninstall PI Builder

Use Windows to uninstall PI Builder.

1. Close Microsoft Excel.
2. Open Control Panel and click **Programs and Features** (or **Add/Remove Programs**).
3. From the list of installed applications, click **PI AF Client** and choose the appropriate option to remove PI Builder:
 - Click **Uninstall** to remove PI Builder, PI System Explorer, and AF SDK.
 - Click **Change** and then click **Modify** to change the installation to only remove PI Builder.

Note: Do not use Windows Explorer to move or delete PI Builder. Never delete the **PIPC\AF** directory without first uninstalling PI Builder, PI System Explorer, AF SDK, and PI AF server.

Microsoft Excel add-in configuration for PI Builder

PI Builder has one application add-in to Microsoft Excel.

Name	Location	Type
PIAFBuilder	..\PIPC\AF\PIAFBuilder.vsto	COM Add-in

To use PI Builder, this application add-in must be active. The setup program installs and activates the PI Builder add-in. In rare cases, Microsoft Excel might disable an add-in. To use a disabled add-in, you must enable and then activate the add-in.

Note: To activate an application add-in, you must have administrator privileges on the computer. If you are not an administrator, right-click **Excel.exe** in Windows Explorer, and then click **Run as administrator** to run Microsoft Excel as an administrator.

View add-in status

Check the status of an add-in to learn whether it is active, inactive, or disabled.

1. Click the **File** tab and then click **Options**.
2. On the Excel Options window, click **Add-Ins**.
3. Search the list of add-ins to find the current status of an add-in.

Each add-in will be listed under one of the following:

- **Active Application Add-ins**
- **Inactive Application Add-ins**
- **Disabled Application Add-ins**

Enable a disabled add-in

If an add-in is disabled, you must enable the add-in before you can make it active.

1. Click the **File** tab and then click **Options**.
2. On the Excel Options window, click **Add-Ins**.
3. From the **Manage** list, select **Disabled Items**, and then click **Go**.
4. Select the check box next to the add-in.
5. Click **Enable**.

Activate an inactive add-in

Activate an inactive add-in to make the add-in available in Microsoft Excel.

Note: To activate an application add-in, you must have administrator privileges on the computer. If you are not an administrator, right-click **Excel.exe** in Windows Explorer, and then click **Run as administrator** to run Microsoft Excel as an administrator.

1. Click the **File** tab and then click **Options**.
2. On the Excel Options window, click **Add-Ins**.
3. From the **Manage** list, select **Com Add-ins**, and then click **Go**.
4. Select the check box next to the add-in.
5. Click **OK**.

Run the PI Builder Ribbon Fixer script

There are several reasons the PI Builder tab may not appear in the Microsoft Excel Office Ribbon. You can run the PI Builder Ribbon Fixer script to add the PI Builder tab to the Excel Ribbon if it is missing after a PI AF Client installation. OSIsoft recommends that you use the Windows PowerShell ISE utility to run the PI Builder Ribbon Fixer script.

Note: Run the PI Builder Ribbon Fixer script with administrative permissions to ensure the script runs successfully.

1. Navigate to the Windows PowerShell ISE utility on your computer.
2. Right-click the **Windows PowerShell ISE** icon on the Programs menu, and then click **Run as Administrator**.
The Administrator: Windows PowerShell ISE window opens.
3. Select **File > Open**.
The Open window opens.
4. Navigate to the **C:\Program Files (x86)\PIPC\dat** folder.
5. Select the **PIRibbonFixer** file, then click **Open**.
The PI Ribbon Fixer script opens in the Script Pane.
6. On the toolbar, click **Run Script** or press F5.
The PI Ribbon Fixer script runs and the progress of the script is shown in the lower pane.
7. Upon successful execution of the script, close the Windows PowerShell ISE utility.

Note: View the log file in the **C:\Program Files (x86)\PIPC\dat** folder to see more detailed information about the script's execution. The backup file in the **C:\Program Files (x86)\PIPC\dat** folder can be used to reverse targeted registry key changes after running the PI Builder Ribbon Fixer script.

8. Open Microsoft Excel and verify that the PI Builder tab appears on the Microsoft Excel Ribbon.

Note: If the PI Builder tab does not appear on the Ribbon after running the PI Builder Ribbon Fixer, please contact OSIsoft Technical Support through the Contact Us page on the [OSIsoft Customer Portal](#).

Enable Publish function in protected worksheets

You cannot publish changes to a protected PI Builder worksheet unless you have permission to format cells.

1. To publish in protected worksheets, select **File > Info**.
2. On the Info page, click **Protect Workbook > Protect Current Sheet**.
3. In the Protect Sheet window, select **Format cells** and click **OK**.

When you click **Publish**, the Publish Options window opens. For more information, see [Publish objects](#).

Feature suggestions in PI Builder

With the PI Builder 2017 release, you can make suggestions on features you would like to see added to PI Builder. You can also review suggestions that other users have already submitted and vote for those you approve of.


To provide feedback, select **Feedback** and click **Sign in**. You can type your feedback into the **Enter your idea** field, and provide additional details as needed.

Get started with PI Builder

To retrieve and publish PI AF objects, PI Builder must connect to a PI AF database (on a PI AF server); to retrieve and publish PI points, PI Builder must connect to a Data Archive server. Therefore, before you retrieve or publish data with PI Builder, specify the PI AF database or Data Archive server.

Specify a database

To retrieve and publish PI AF objects, PI Builder must connect to a PI AF database. Use the **Connections** group to specify the PI AF server and database. After you specify a PI AF database, PI Builder automatically connects to the specified PI AF server and database for any operation that requires communication with the server or database. You can specify a different database at any time.

- On the **PI Builder** tab, in the **Connections** group, specify the PI AF server and database:
 - a. From the **Asset Server** list, select the PI AF server that stores your database.
 - b. From the **Databases** list, select the database.If the lists do not show the necessary server or database, select **Asset Server/Database Connections** from either list to open the Select Database window. From this window, you can:
 - Select a PI AF server and database.
 - Click **New Database** to add a new database.
 - Click **Show List**  to open the PI AF Servers window where you can add and connect to a PI AF server.

Specify a Data Archive server

To retrieve and publish PI points, PI Builder must connect to a Data Archive server. Use the **Connections** group to specify the Data Archive server. After you specify a Data Archive server, PI Builder automatically connects to the specified Data Archive server for any operation that requires communication with Data Archive. You can specify a different Data Archive server at any time.

- On the **PI Builder** tab, in the **Connections** group, from the **Data Server** list, select the Data Archive server that stores your PI points.

If the list does not show the necessary Data Archive server, select **Data Server Connections** to open the PI Data Archives window. From this window, you can:

 - Select a Data Archive server to connect to.
 - Click **Add Data Server** to specify connection information to a Data Archive server not listed.
 - Select a server and then click **Set as Default** to have PI Builder connect to that server when Microsoft Excel opens.

Connect to servers with explicit login

If you do not use PI mappings or PI trusts for authentication, use the PI SDK Utility to set up an explicit login to connect to Data Archive.

Note: These instructions are intended for PI AF 2015 and later versions.

1. Open **PISDKUtility** from the Windows Start menu.
2. Click **Connections > Options**.
3. In the Connection Options window, select the **Allow login prompt (if all configured protocols fail)** check box.
4. Click **OK**.
5. Click **File > Exit PISDKUtility**.
6. In PI Builder, in the **Connections** group, select **Data Server Connections** from the **Data Server** list.
7. In the PI Data Archives window, right-click the Data Archive computer to connect to and click **Connect As**.
8. In the Connect to PI Data Archive '*name*' window, select **PI User Authentication** from the **Authentication** list.
9. Enter your PI user name and its associated password in the **User name** and **Password** fields.
10. Click **OK**.

Common tasks

You will use the common tasks described in this section to complete many procedures with PI Builder. For example, when retrieving data from PI AF or Data Archive, you must always set the column headers for your worksheet. Similarly, the procedures to retrieve, edit, and delete are the same for most PI AF objects.

Set column headers in a worksheet

Use the Select Object Types and Column Headers window to specify the column headers and order in your worksheet. When configured in the retrieve settings, this window automatically opens when you retrieve data. You can also click **Headers** to add columns to the worksheet before retrieving or publishing data, or to rearrange columns in an existing worksheet without overwriting the worksheet.

1. Open the Select Object Types and Column Headers window.

You can:

- On the **PI Builder** tab, in the **Resources** group, click **Headers**.
- Retrieve data. With the default retrieve settings, the Select Object Types and Column Headers window opens after you specify the objects to retrieve.

2. From the **Object Type** list, select the type of AVEVA™ PI System™ object that you will retrieve into the worksheet.

The **Object Types** list updates to show possible columns for the selected PI System object type. Selected columns and order are based on the current worksheet or previous selections. For a list of columns, see [Column reference](#).

3. To restore the default column order, click **Reset**.

4. To clear all column selections, click **Clear All**.
5. Select the check boxes next to the columns that you want to appear in your worksheet.

The **Object Types** list does not automatically contain all the attributes that you can show in columns. To add attribute columns to the list of available columns, you can:

- From the **Template** list, select the template on which retrieved objects are based.
The **Object Types** list updates the available attribute columns to show those in the selected template.
- Click **More Attribute Columns** to open the Select Attributes window, and specify attributes to add:
- Select attributes from a template.
- Select attributes from a particular instance of a PI System object, such as customized attributes not from a template.
- Type the attribute name in the **Others** field and click **Add**.

Note: You must include the ObjectType column, unless using a worksheet created with PI Tag Configurator.

6. To change the column order, select a column and click the up or down arrow.
7. Click **OK** to apply the changes to the worksheet.

PI Builder updates the existing worksheet content to reflect the changes:

- If you opened the window during data retrieval, PI Builder retrieves available data into the selected columns.
- If you opened the window independently, PI Builder does not retrieve data into any columns, including newly added columns; click **Retrieve** to update data and retrieve data into newly added columns.

Security strings

You can use PI Builder to assign access permissions for an object. During retrieval, select the appropriate security columns in the Select Object Types and Column Headers window.

Object type	Column	Description
PI AF object	SecurityString	Use this column to specify the security string that controls access to PI AF objects. You can find this column in the object-type group, such as in the Element object group for PI AF elements.
PI point	datasecurity	Use this column to specify the security string for snapshot and event access. This string controls which users can read or modify data stored for a PI point. You can find this column in the Security object group.
	ptsecurity	Use this column to specify the security string for point configuration. This string controls which users can retrieve configuration information, such as point-attribute values, and which users can modify or delete a PI point. You can find this column in the Security object group.

The security string has the following format:


```
userid1:access_type1(rights1)|userid2:access_type2(rights2)|...
useridN:access_typeN(rightsN)
```

where:

- *useridX* identifies a user. Valid entries depend on the object type and the PI AF server version:
 - PI AF servers running 2012 (2.5) or older: For PI AF objects, either Microsoft Windows users or group accounts
 - PI AF servers running 2014 (2.6) or newer: For PI AF objects, AF security identities, such as Administrators, Engineers, Owner, and World
 - For PI points, either a PI user, PI group, or PI identity
- *access_typeY* indicates the access-rule type.
- *rightsZ* indicates the permissions affected by the rule. Specify the permissions in parenthesis and separate multiple permissions with a comma. PI points only support read and write permissions.

For example, on a 2012 PI AF server, the following security string gives the Everyone account permissions to read and read data, and it gives the ACME\bob account permissions to read, write, read data, write data, and delete:

```
ACME\bob:A(r,w,rd,wd,d)|Everyone:A(r,rd)
```

On a 2014 or newer PI AF server, the following security string gives the World AF identity permissions to read and read data, and it gives the Administrators AF identity all permissions:

```
World:A(r,rd)|Administrators:A(r,w,rd,wd,d,x,a,s,so,an)
```

The following table lists the supported access rules and the corresponding value to enter in the security string:

Access-rule type	Security string value
Allow access	A
Deny access	D

The following table lists supported permissions and the corresponding value to enter in the security string. PI points only support read and write permissions.

Permission	Security string value
Read	r
Write	w
Delete	d
Execute	x
Admin	a
Read data	rd
Write data	wd

Subscribe	s
Subscribe others	so
Annotate	an

Note: If you do not specify a security string when publishing an object, PI Builder uses the default settings.

Unique IDs

You can retrieve an object's unique ID into Microsoft Excel. During retrieval, select the **UniqueID** check box in the Select Object Types and Column Headers window to list the IDs under the UniqueID column header in your worksheet.

Retrieve unique IDs into Microsoft Excel for informational purposes only. You cannot use PI Builder to assign or change an object's unique ID.

Retrieve data for defined objects

Use the **Retrieve** command to retrieve or update data for objects defined in your worksheet. For example, if you specify columns and the minimum data to identify objects, such as the object type and name, you can use the **Retrieve** command to retrieve the data for those objects. Similarly, if you add columns to an existing worksheet, you can use the **Retrieve** command to retrieve the data for the new columns.

1. Open the worksheet that has objects defined.
2. Set the Selected(x) column to X for any object that you want to update data or retrieve new data for.
3. On the **PI Builder** tab, in the **Retrieve** group, click **Retrieve**.

For rows with an x in the Selected(x) column, PI Builder updates the data and retrieves appropriate new data.

Publish objects

To publish data from Microsoft Excel to PI AF or Data Archive, prepare your worksheet, click **Publish**, and set the options for publication.

1. Prepare your worksheet for publication:
 - a. Place new parent objects in rows before child objects that reference them.
For example, if you create new elements and attributes, place the elements in rows before the attributes.
 - b. Place notes and values that you do not want to publish in columns without headers.
 - c. Place blank rows and columns appropriately.
PI Builder publishes data row by row, but processes no rows after encountering two entirely blank rows and processes no columns after encountering two entirely blank columns.
 - d. Place an X in the Selected(x) column of any row that you want PI Builder to process.
PI Builder ignores rows without an X in this column.

2. On the **PI Builder** tab, click **Publish**.
3. In the Publish Options window, enter the settings that control PI Builder actions during publication:
 - From the **Edit Mode** list, select the method for processing rows when publishing data to a server:
 - **Create and Edit**
PI Builder edits PI AF objects that already exist and creates objects that do not exist.
 - **Create Only**
PI Builder creates new PI AF objects, and generates an error if an object already exists.
 - **Edit Only**
PI Builder edits existing PI AF objects, and generates an error if an object does not already exist.
 - Select the **Create or update PI points** check box to have PI Builder automatically create PI points for attributes derived from templates that use PI point data references. Relevant PI points are created or updated as needed, no matter which Edit Mode is selected. (This check box is not available when publishing PI point objects to PI Data Archive.)
 - Select the **Automatically create missing categories** check box to have PI Builder create missing categories. (This check box is not available when publishing PI point objects to PI Data Archive.)
 - Select the **Preserve Unique IDs** check box to have PI Builder retain unique IDs that exist in the source XML. This option is only valid when **Create and Edit** is also specified in the **Edit Mode** list.

Note: There is no guarantee that PI Builder will preserve unique IDs of attributes derived from templates because unique IDs of such attributes are generated based on the template's unique ID.

- 4. Click **OK** to start publishing.
The Publish Selected Objects window shows the operations completed.
- 5. Click **Close**.
PI Builder automatically checks in any changes to the PI AF database when you publish.

Create PI AF objects

With PI Builder you can enter the specifications for new PI AF objects in a Microsoft Excel worksheet, and then publish the worksheet to PI AF to create them. With the auto-fill features in Excel, you can easily create multiple objects with similar specifications. With the auto-fill features in Excel, you can easily create multiple objects with similar specifications. Follow this procedure to create:

- Elements
- Attributes
- Event frames
- Transfers
- Templates
- Models
- Categories
- Enumeration sets
- Reference types

- Units of measure
- Contacts
- Notification endpoints
- Security identities and mappings

Prerequisite: Before you create PI AF objects, you must [Specify a database](#).

Follow this procedure to create PI AF objects:

1. In the worksheet, add the column headers for the values that must be specified to define the new objects. See [Set column headers in a worksheet](#). For objects based on templates, include the Template column.

Note: To create new objects from existing objects, retrieve those existing objects into your worksheet, and then change the name and any other attributes.

2. In each row, specify the values that define a new object.
You must specify a unique name for each object. If you do not specify values for other attributes, PI AF will set those attributes to their default values.
3. Set the Selected(x) column to X for any object that you want to create.
4. Publish to PI AF:
 - a. Click **Publish** to open the Publish Options window.
 - b. From the **Edit Mode** list, select **Create Only**.
With this choice, PI Builder will only create new objects. If a selected object with the same name already exists, PI Builder generates an error. You can also select **Create and Edit**; then, PI Builder will modify existing objects and create any objects that do not already exist. PI Builder uses the Name column to find existing objects with the same name.
 - c. If you specified an attribute that references a PI point that does not yet exist, select the **Create or update PI points** check box to request that PI Builder automatically create the needed PI points.
If you do not select this check box, you must use PI System Explorer or PI Builder to create or update PI points after PI Builder creates the PI AF objects.
 - d. If you specified an attribute that references a category that does not yet exist, select the **Automatically create missing categories** check box to request that PI Builder automatically create the needed categories.
If you do not select this check box and one or more categories do not exist, PI Builder will generate an error during publication.
 - e. Click **OK** to publish the objects to PI AF.
PI Builder automatically checks in the changes. The Publish Selected Objects window shows the operations completed.
 - f. Click **Close**.

Edit PI AF objects

You can use PI Builder to edit PI AF objects in Microsoft Excel and then publish the changes to PI AF. Through edits, you can rename objects, move objects, or change many property values. Follow this procedure to edit:

- Elements
- Attributes
- Event frames
- Transfers
- Templates
- Models
- Categories
- Enumeration sets
- Reference types
- Units of measure
- Contacts
- Notification endpoints
- Security identities and mappings

Prerequisite: Retrieve the PI AF objects into Microsoft Excel. Refer to the object-specific topic in this guide for details.

1. If necessary, add additional columns that correspond to properties that you want to change and click **Retrieve** to retrieve current values.
See [Set column headers in a worksheet](#).
2. Optional: Clear all values from the Selected(x) column in the worksheet.
You want to mark only the rows that contain edits with an X. Clearing the column before you begin can help you track which rows changed.
3. Edit any values that you want to change.
 - a. To change the object name, include the **NewName** column and enter the new name in that column.
 - b. To change the parent and move the object in the hierarchy, include the **NewParent** column and enter the new parent in that column.

Note: You cannot change all property values. Specifically, PI Builder ignores changes that you make to read-only properties. These vary by object. See [Column reference](#) for details.

4. In the Selected(x) column, set the value to X for any row where you edited a value, and clear the value for any row that you did not change.
5. Publish the changes to PI AF:
 - a. On the PI Builder tab, click **Publish** to open the Publish Options window.
 - b. From the **Edit Mode** list, select **Edit Only** to guard against mistakenly creating new objects.
 - c. Click **OK** to publish the changes to PI AF.

If any of the selected objects do not already exist, PI Builder generates an error.

Delete PI AF objects

After you retrieve PI AF objects into Microsoft Excel, you can use PI Builder to delete chosen objects from PI AF. Follow this procedure to delete the following objects:

- Elements
- Attributes
- Event frames
- Transfers
- Templates
- Models
- Categories
- Enumeration sets
- Reference types
- Units of measure
- Contacts
- Notification endpoints
- Security identities and mappings

Prerequisite: Enable the **Delete** button. See Configure build settings.

1. Retrieve the PI AF objects into Microsoft Excel. (See the object-specific topic for details.)

Note: To delete attributes, you must show the attributes in rows. See [Show attributes in rows](#).

2. For objects that you want to delete, enter X in the Selected(x) column.

Note: Clear the column for any objects that you want to retain.

3. On the **PI Builder** tab, in the **Build** group, click **Delete**.

4. At the confirmation prompt, click **Yes**.

PI Builder deletes the selected objects from PI AF. The Delete Selected Objects window shows the operations completed.

Errors when retrieving or publishing

When PI Builder retrieves objects, the Retrieve Selected Objects window shows the operations completed. When PI Builder publishes objects, the Publish Selected Objects window shows the operations completed.

If an error occurs during an operation, then the Continue window shows the error message and prompts you to continue. To continue the retrieval or publishing but avoid future prompts, select the **Don't show this dialog box again (continue if other errors occur)** check box and click **Continue**.

Upon completion of all operations, each row where an error occurred is highlighted in red, and the error message text is displayed in the **Error** column. Note:that the error continues to be displayed until you clear it or perform the next delete, publish, or retrieve operation.


Settings

Settings control PI Builder behavior when retrieving data into a worksheet and when publishing data from a worksheet.

Configure appropriate settings to control PI Builder behavior when retrieving data into a worksheet or publishing data from a worksheet. Also, a build setting enables the **Delete** button.

Configure retrieve settings

Use the **Retrieve** tab of the Settings window to configure the settings that affect PI Builder behavior when retrieving data into a worksheet or selecting worksheet column headers.

1. Open the Settings window:
 - On the **PI Builder** tab, in the **Resources** group, click **Settings** to open the Settings window, and then click the **Retrieve** tab.
 - On the **PI Builder** tab, in the **Retrieve** group, click the dialog box launcher  to open the Settings window.
2. Configure the settings appropriately.
See [Retrieve settings](#).
3. Click **OK**.

Retrieve settings

The **Retrieve** tab of the Settings window contains settings that control PI Builder behavior when retrieving data from PI AF or PI Data Archive.

The following table describes the settings available on the Retrieve tab of the Settings window.


Category	Setting	Description
Worksheet	Prompt to append or overwrite	If selected (default setting) and the current worksheet contains any content, PI Builder prompts you to append or overwrite that content before retrieving data.
	Append to worksheet	If selected (after Prompt to append or overwrite is cleared), always appends to existing content in the worksheet without asking the user.
	Clear Worksheet options	
	Clear remainder of worksheet	If selected, when retrieving data into the worksheet, PI Builder clears remaining contents in the worksheet from the first row being populated. For example, if appending and row 8 is the first empty row, this option causes the contents starting at row 8 to be cleared to the end of the worksheet, prior to populating the worksheet starting at row 8.
	Overwrite and add empty	If selected (default setting), when retrieving data into the worksheet, PI Builder overwrites existing data and clears the two columns immediately to the right of the last column retrieved and the two rows immediately below

	cell boundary	the last row retrieved; this forms an empty cell boundary of two columns and two rows around the newly retrieved data.
	Clear to empty cell boundary	<p>If selected, when retrieving data into the worksheet, PI Builder first clears all data to the empty cell row and column boundaries. Then, PI Builder writes the newly retrieved data to the worksheet. If the cleared area is smaller than that required by the newly retrieved data, behavior differs:</p> <ul style="list-style-type: none"> • If you are overwriting data, behavior reverts to Overwrite and add empty cell boundary. • If you are appending data, behavior reverts to Clear remainder of worksheet.
Column	Prompt for columns when overwriting	<p>If selected (default setting) and you are not appending to an empty worksheet, PI Builder opens the Select Object Types and Column Headers window before retrieving data.</p> <p>If the worksheet is not empty and you are appending data to it or if the option is not selected, PI Builder uses the existing column headers to the extent possible and retrieves data without opening the Select Object Types and Column Headers window.</p>
	Expand columns to fit contents	If selected (default setting), PI Builder expands the column width to match the width of the contents retrieved (up to 80 characters wide).
Cell Content	Shade non-applicable cells	If selected, PI Builder applies a cross-hatch shading pattern to cells not applicable to the object type when retrieving data. For example, if you retrieve element and attribute data from PI AF and select this check box, PI Builder shades cells in the AttributeValue column in rows where the ObjectType is Element because elements do not have attribute values.
	Append units of measure to value cells	If selected, PI Builder appends the default unit of measure, if any, to attribute values retrieved into the AttributeValue column.
	Show simplified configuration strings	If selected (default setting), PI Builder removes PI System and tag identifiers (GUIDs) from configuration strings retrieved from PI AF.
	Show milliseconds on time stamps	<p>If selected, PI Builder shows any milliseconds in time stamps, such as 2/9/2018 9:00:00.258 AM. To retain maximum precision, select this check box to edit and view milliseconds in time stamps.</p> <p>If not selected, PI Builder truncates any milliseconds in time stamps.</p>
	Time Stamp Display	Specifies how dates and times retrieved from the PI System are displayed in a worksheet. The following options are available:

		<ul style="list-style-type: none"> • Local Time Zone (default setting) Specifies that dates and times are displayed in the local client machine's time zone. • Server Time Zone Specifies that dates and times are displayed in the time zone configured for the connected PI AF server (for PI AF objects) or the connected Data Archive (for PI points). The format of dates and times are: <i>Date Time Time_Zone_Offset</i> where <i>Time_Zone_Offset</i> is an indication of the number of hours' difference between the connected server's time zone and Universal Coordinated Time (UTC). For example, if the server's time zone is U.S. Eastern Time, the date and time might look as follows: <i>2/28/2018 08:11:34 -5:00</i> • UTC Specifies that dates and times are displayed in Universal Coordinated Time. This includes an indicator at the end of the date and time string (Z).
--	--	---

Configure build settings

Use the **Build** tab of the Settings window to set the default options on the Publish Options window and to enable the **Delete** button. Options on the Publish Options window control how PI Builder publishes worksheet data into PI AF or Data Archive.

1. Open the Settings window:
 - On the **PI Builder** tab, in the **Resources** group, click **Settings** to open the Settings window, and then click the **Build** tab.
 - On the **PI Builder** tab, in the **Build** group, click the dialog box launcher  to open the Settings window.
2. In the **Publish** area, set the preferred default settings for the Publish Options window.
 - From the **Edit Mode** list, select the method for processing rows when publishing data to a server:
 - **Create and Edit**
PI Builder edits PI AF objects that already exist and creates objects that do not exist.
 - **Create Only**
PI Builder creates new PI AF objects, and generates an error if an object already exists.
 - **Edit Only**
PI Builder edits existing PI AF objects, and generates an error if an object does not already exist.
 - Select the **Create or update PI points** check box to have PI Builder automatically create PI points for attributes derived from templates that use PI point data references. Relevant PI points are created or updated as needed, no matter which **Edit Mode** is selected. (This check box is not available when publishing PI point objects to PI Data Archive.)

- Select the **Automatically create missing categories** check box to have PI Builder create missing categories. (This check box is not available when publishing PI point objects to PI Data Archive.)
- Select the **Preserve Unique IDs** check box to have PI Builder retain unique IDs that exist in the source XML. This option is only valid when **Create and Edit** is also specified in the **Edit Mode** list.

Note: There is no guarantee that PI Builder will preserve unique IDs of attributes derived from templates because unique IDs of such attributes are generated based on the template's unique ID.

3. In the **Delete** area, select the **Allow delete** check box to enable the **Delete** button and be able to delete data from PI AF or Data Archive with PI Builder.

By default, the **Delete** button on the **PI Builder** tab in the **Build** group is disabled to reduce accidental deletions.

Note: Use caution when deleting PI points. If PI points are deleted by mistake, it could be very difficult to recover the related PI point data. For technical assistance, contact OSIsoft Technical Support through the [OSIsoft Customer Portal Contact Us page](#).

4. Click **OK**.

PI time

You can use a special syntax, called PI time, to specify inputs for time stamps and time intervals. PI time uses specific abbreviations, which you combine to create time expressions.

PI time abbreviations

When specifying PI time, you can use specific abbreviations that represent time units and reference times.

Time-unit abbreviations

Abbreviation	Full version	Plural version	Corresponding time unit
s	second	seconds	Second
m	minute	minutes	Minute
h	hour	hours	Hour
d	day	days	Day
mo	month	months	Month
y	year	years	Year
w	week	weeks	Week

To specify time units, you can specify the abbreviation, the full version, or the plural version of the time unit, such as s, second, or seconds. You must include a valid value with any time unit. If specifying seconds, minutes, or hours, you can specify a fractional value, such as 1.25h. You cannot specify fractional values for other time units.

Reference-time abbreviations

Abbreviation	Full version	Corresponding reference time
*		Current time
t	today	00:00:00 (midnight) of the current day
y	yesterday	00:00:00 (midnight) of the previous day
The first three letters of the day of the week. For example: sun	sunday	00:00:00 (midnight) on the most recent Sunday
The first three letters of the month. For example: jun	june	00:00:00 (midnight) on the current day in June of the current year
dec DD	december DD	00:00:00 (midnight) on the DDth day of December in the current year
YYYY		00:00:00 (midnight) on the current day and month in year YYYY
M-D or M/D		00:00:00 (midnight) on the Dth day of month M in the current year
DD		00:00:00 (midnight) on the DDth day of the current month

PI time expressions

PI time expressions can include fixed times, reference-time abbreviations, and time offsets. A time offset indicates the offset direction (either + or -) and the offset amount (a time-unit abbreviation with a value).

For example, PI time expressions can have the following structure:

Structure	Example
Fixed time only	24-aug-2012 09:50:00
Reference-time abbreviation only	t
Time offset only	+3h
Reference-time abbreviation with a time offset	t+3h

Include at most one time offset in an expression; including multiple time offsets can lead to unpredictable results.

Time-stamp specification

To specify inputs for time stamps, you can enter time expressions that contain:

- Fixed times

A fixed time always represents the same time, regardless of the current time.

Input	Meaning
23-aug-12 15:00:00	3:00 p.m. on August 23, 2012
25-sep-12	00:00:00 (midnight) on September 25, 2012

- Reference-time abbreviations

A reference-time abbreviation represents a time relative to the current time.

Input	Meaning
*	Current time (now)
3-1 or 3/1	00:00:00 (midnight) on March 1 of the current year
2011	00:00:00 (midnight) on the current month and day in the year 2011
25	00:00:00 (midnight) on the 25th of the current month
t	00:00:00 (midnight) on the current date (today)
y	00:00:00 (midnight) on the previous date (yesterday)
tue	00:00:00 (midnight) on the most recent Tuesday

- Reference-time abbreviations with a time offset

When included with a reference-time abbreviation, a time offset adds or subtracts from the specified time.

Input	Meaning
*-1h	One hour ago
t+8h	08:00:00 (8:00 a.m.) today
y-8h	16:00:00 (4:00 p.m.) the day before yesterday
mon+14.5h	14:30:00 (2:30 p.m.) last Monday
sat-1m	23:59:00 (11:59 p.m.) last Friday

- Time offsets

Entered alone, time offsets specify a time relative to an implied reference time. The implied reference time might be the current clock time or another time, depending on where you enter the expression.

Input	Meaning
-1d	One day before the current time
+6h	Six hours after the current time

Time-interval specification

Time-interval inputs define intervals for collecting or calculating values during a time period. For example, you might specify a 60-minute interval to compute an hourly average over a 12-hour period. To specify time-interval inputs, enter a valid value and time unit:

- Positive values define intervals that begin at the earlier time in the period and that finish at or before the later time in the period.

Start time	2:00:00
End time	3:15:00
Time interval	30m
Returned intervals	2:00:00 to 2:30:00 2:30:00 to 3:00:00

- Negative values define intervals that finish at the later time in the period and that begin at or after the earlier time in the period.

Start time	2:00:00
End time	3:15:00
Time interval	-30m
Returned intervals	2:15:00 to 2:45:00 2:45:00 to 3:15:00

Work with PI points

You can use PI Builder to create, edit, and delete PI points from any connected Data Archive server. With PI Builder, you can use a single Microsoft Excel worksheet to work with points from different point classes.

Create PI points

[Specify a Data Archive server.](#)

With PI Builder, you can enter the specification for new points in a Microsoft Excel worksheet, and then publish the worksheet to Data Archive to create the points. With the auto-fill features in Excel, you can easily create multiple points with similar specifications.

1. Add columns to the worksheet for the point attributes that you want to specify.

See [Set column headers in a worksheet.](#)

Note: To base your new points from existing points, retrieve those existing points into your worksheet, and then change the name and any other attributes.

2. Specify the point attribute values for the new points.

You must specify a unique name for each point. If you do not specify values for other attributes, PI Builder sets the attribute to its default value.

PI Builder ignores any entries you make for read-only system attributes: *changedate*, *changer*, *creationdate*, *creator*, *pointid*, *ptclassname*, and *srcptid*.

3. Set the Selected(x) column to X for any point that you want to create.

4. Publish the new points to Data Archive:

- a. Click **Publish** to open the Publish Options window.

- b. From the **Edit Mode** list, select **Create Only**.

With this choice, PI Builder will only create new points. If a point already exists with the same name, PI Builder generates an error. You can also select **Create and Edit**; then, PI Builder will edit existing points and create any points that do not already exist. PI Builder uses the Name column to find existing points with the same name.

- c. Click **OK**.

PI Builder creates the points on Data Archive. The Publish Selected Objects window shows the operations completed.

- d. Click **Close**.

Retrieve all PI points

You need to [Specify a Data Archive server](#) before you can retrieve PI points.

You can use PI Builder to retrieve all the PI points from Data Archive into Microsoft Excel.

Note: This operation can be lengthy if the specified Data Archive server contains a large number of points. Current versions of Microsoft Excel support 1,048,576 rows, so PI Builder can only retrieve 1,048,575 rows (the column heading occupies the extra row). If you attempt to retrieve a larger number of points along with their attributes, PI Builder produces an error.

1. On the **PI Builder** tab, click **PI Points > All PI Points**.
2. In the Select Object Types and Column Headers window, select the objects and column headers to include in the worksheet, and then click **OK**.


PI Builder retrieves all the points into the worksheet and fills the selected columns with available data.

Tag Search window

You can create a query to retrieve specific PI points from Data Archive in the Tag Search window. You can search by both PI point attributes and PI point snapshot values, and also apply filters to narrow query results. All PI point attributes can be searched.

Click **PI Points > Find PI Points** on the **PI Builder** tab to open the Tag Search window.

There are three ways to search for PI points:

1. Click the **Show/Hide**  arrow (2) to add the most frequently searched PI point attribute fields to the Tag Search window.

Note: You must type the name of the PI point attribute directly into the **Tag search** text box (1) if it is not populated in the field. You can include any PI point attribute in your search criteria. See [PI point columns](#) for a complete list of PI point attributes.

2. Click the **Add Criteria** ▼ down arrow to add more search criteria fields to the Tag Search window.
3. Type your query string in the **Tag search** text box (1).

The screenshot shows the 'Tag Search' dialog box. It has a title bar with a close button. The main area contains a 'Server(s):' field with 'afstaging' entered. Below this is a large text box for the search query, with a red callout '1' pointing to it. To the right of the query box is a 'Search' button (callout '5') and a 'Show/hide' button (callout '3'). Below the query box are several criteria fields: 'Name:', 'Data Type:' (with a dropdown), 'Engineering Units:', 'Point Source:', 'Point Class:' (with a dropdown), and 'Description:'. A red callout '4' points to the 'Add Criteria' button. Below these fields is a 'Tag match' dropdown (callout '2') and a 'Show/hide' dropdown (callout '3'). At the bottom of the criteria section is a 'Column list' dropdown (callout '6'). Below the criteria section is a large table area for results, with a red callout '7' pointing to it. The table has columns: 'Name', 'Data Server', 'Display Digits', 'Description', and 'Point Source'. At the bottom of the dialog are 'OK' (callout '8'), 'Cancel', and 'Reset' (callout '9') buttons. A status bar at the very bottom says '0 results returned in 0.0301469 seconds.'

4. **Tag search** text box: Query strings appear in this text box as you enter and select search criteria in the populated fields. You can also type a query string into this text box and then click the **Search** button to retrieve and view query results.
5. **Tag match** down arrow: Click ▼ to filter results (**Contains, Starts With, Exact Match, Ends With**). You can also view and select from a list of recently used queries.
6. **Show/hide** down arrow: Click ☑ to add common search fields (**Name, Point Source, Data Type, Point Class, Value**) to the window as shown above.
7. **Add Criteria** ▼ down arrow: Click to view and add more search criteria fields to the Tag Search window.
8. **Search** button: Click to search for matching PI points based on query criteria.
9. **Column list** down arrow: Click ⚙ to select what column headings appear in the query results list.
10. Query results list: After you specify search criteria and click the **Search** button, matching PI points are displayed here.
11. **OK** button: Click the **OK** button to populate your Excel spreadsheet with query results.
12. **Reset** button: Click the **Reset** button to clear search criteria from the **Tag search** text box.



Retrieve PI points by searching


Complete the following tasks before retrieving PI points:

- [Specify a Data Archive server.](#)
- Select the **Append to worksheet** setting in the Settings window to append query results to an existing list. See [Configure retrieve settings](#) for instructions.

You can use PI Builder to search for PI points in Data Archive and retrieve them into a Microsoft Excel spreadsheet. In PI AF and PI Builder 2017 and later versions, you can query based on PI point snapshot values in addition to PI point attributes. Snapshot values, sometimes referred to as end-of-stream, are defined as the latest value for a point. See [Snapshot](#) for more information on snapshot values.

1. On the **PI Builder** tab, click **PI Points > Find PI Points**.
The Tag Search window opens.
2. To build a search query, choose from the following actions.


To...	Do this...
Include common PI point attributes in a query	<ol style="list-style-type: none"> a. Click  to add commonly searched PI point attribute fields to the Tag Search window. b. Enter criteria in any of the following fields: <ul style="list-style-type: none"> • Name (alias for <i>tag</i> attribute) • Point Source • Data Type (alias for <i>pointtype</i> attribute) • Point Class (alias for <i>ptclassname</i> attribute) c. To enter criteria for engineering units and description, click Add Criteria or press ALT+C. Click Engineering Units, click Add Criteria or press ALT+C, then click Description. Criteria are appended to the string in the Tag search text box, separated by a space.
Include PI point snapshot values in a query	<ol style="list-style-type: none"> d. Click . e. Click Add Criteria or press ALT+C. f. Click any of the following fields: <ul style="list-style-type: none"> • Value • TimeStamp • IsGood • Annotated • Substituted • Questionable g. Enter criteria in the fields you have selected, as required. Note that you can select a comparison operator for Value and TimeStamp criteria. Criteria are appended to the string in the search query text box, separated by a space.

Include point descriptions in a query	<p>h. Click .</p> <p>i. Click Add Criteria or press ALT+C.</p> <p>j. Select Include Description in Search and set the value to True.</p>
Filter point names by contents, exact match or ending or a recently used query. By default, the Starts With filter is applied.	<p>k. Click ▼.</p> <p>l. Click the appropriate filter:</p> <ul style="list-style-type: none"> • Recent Searches > query • Contains • Exact Match • Starts With • Ends With
Type a query string in the Tag search text box to search on criteria that is not included in the built-in fields.	<p>m. Type the first character of the query. For example, type "c" to reveal a list of searchable point attribute names that begin with the letter C (such as changedate, compdev, compmax, compmin, compressing, etc.).</p> <p>n. Select from the list of matching point attributes and values, or continue typing a point attribute or value manually.</p> <p>o. Enter the criteria to be matched.</p>

Note: You can include any PI point attribute in your search criteria. See [PI point columns](#) for a complete list of searchable PI point attributes. PI Builder will autofill entries as you type. For example, you can type "p" to display a list of all the PI point attribute names that start with "p" (such as pointid, pointtype, pointsource).

- Click **Search** to retrieve and display matching points in the results list of the Tag Search window.

The search query returns only PI points that match the search criteria.

- Optional. Click  and modify the columns that you want displayed in the results list of the Tag Search window.
- Select one or more points in the results list to retrieve only those into the worksheet, then click **OK**.

Note To retrieve every point from the results table into the worksheet, do not select any point and click **OK**. If you are appending search results to an existing list, proceed to step 7.

- In the Select Object Types and Column Headers window, select the objects and column headers to include in the worksheet, then click **OK**.
PI Builder retrieves the selected points into the worksheet and fills the selected columns with matching data.
- In the Retrieve Selected Objects window, click **Close**.

Examples of PI point attribute queries:

- sin*
- tag:=sin*
- tag:<>sin* datatype:float
- step:0 AND pointsource:L

- `tag:<>sin* AND PointType:Float64`

Note Queries that contain a query filter name (such as `name:*sine*`), perform searches on tag attributes only. In previous versions of PI AF, queries that contained a query filter name would search the descriptor attribute as well as the specified filter, unless the descriptor attribute was actually specified as part of the query filter.

Examples of PI point snapshot value queries:

- `Value:>1000`
- `creationdate:>y-1d AND future:true AND timestamp:<*`

Examples of combined PI point attribute/snapshot value queries:

- `tag:<>sin* AND Value:>10`
- `PointType:Int32 AND Value:>10`
- `location1:3 OR creationdate:>2019-1-1`
- `PointSource:L AND Annotated:1 AND TimeStamp:t`
- `Value:>100 AND Quality:IsGood`

Syntax for PI point searches

Refer to the following sections for details on the syntax for building PI point queries in PI AF and PI Builder. For complete details on PI point query syntax, see “PIPoint Query Syntax Overview” in PI System Explorer Help > AF SDK Reference > Overview, or go to the Tech Support page [PI Point Query Syntax Overview](#).

Condition filters

To build a PI point query, enter one or more *AND* condition filters that you can also combine with an *OR* condition as needed. Each *AND* condition contains one or more queries, separated by a space or *AND*. A query consists of a query filter name, an operator, and the query filter. This enables you to specify multiple conditions with a single query, as shown in the following example:

```
(tag:<>sin* AND PointType:Float64) OR (tag:="*Tank*" AND DataType:=Int32)
```

Note: You can only use parentheses between *OR* conditions.

You can only reference a filter name once per *AND* condition of the query string. For example, `PointId:>5 AND PointId:<10` generates an error, whereas `PointType:=Int32 OR PointType:=Float32` is valid.

For maximum efficiency, build your query so that you eliminate most items from the retrieved results with your first condition filters.

Query filter names

When querying based on PI point attributes, the query filter name is a PI point attribute name or alias. Common aliases are:

Alias name	Attribute name
Name	Tag
DataType	PointType
Description	Descriptor
PointClass	PtClassName

Starting in PI AF 2017, you can query based on values, in addition to querying PI points based on attribute. However, you cannot use the *OR* condition to query a PI point value. For example, you would generate an error if you were to enter the following queries:

- `IsGood:false OR Annotated:true`
- `PointType:Float AND Value:>10` because `PointType:Float` is implicitly translated to `'PointType:=Float16 OR PointType:=Float32 OR PointType:=Float64'`
- `PointType:Int AND Value:>10` because `PointType:Int` is implicitly translated to `'PointType:=Int16 OR PointType:=Int32'`
- `sin* AND Value:>10` because `sin*` is implicitly translated to `'tag:=sin* OR Descriptor:=sin*'` if the default filter setting for **Include Description in Search** is selected. To be valid, you would need to clear the **Include Description in Search** filter.

Wildcard characters

You can use the following special characters in a PI point query.

Special character	Description	Example
*	Substitute any number of unspecified characters	<code>sin*</code> Returns all PI points that have names starting with "sin", for example, <i>sinusoid</i> and <i>sinusoidu</i> .
?	Substitute a single unspecified character	<code>CD?158</code> Returns all PI points that have names starting with "CD", followed by any single character, followed by "158" (for example, <i>CD1158</i> , <i>CDA158</i> , and so on).
: or :=	When searching for all PI points with a specific attribute value (other than name), separates the attribute and the value you are searching for. Note When searching for a PI point name that contains a colon, enclose the n	<code>pointsource:R</code> Returns all PI points that have the <i>pointsource</i> value <i>R</i> . <code>"ba:temp.1"</code> <code>ba\:temp.1</code>

	ame in double quotation marks, or precede the colon with a backslash.	Either of the above examples returns the PI point named ba:temp.1.
' ' or '''	Delimiters for search strings containing spaces or special characters	'*Owner Change*' or "*Owner Change*" Returns all PI points that have names containing Owner Change. "ba:temp.?" Returns all PI points that have names starting with ba:temp. and ending with any single character.

Note: Results of the examples above assume you are using the default search option, which searches for PI point names that start with your search string.

Operators

The following table lists the operators that you can use in an *AND* condition.

Operator	Description	Example
=	The <i>EQUALS</i> operator.	Tag:Tank* or Tag:=Tank*
<>	The <i>NOT EQUALS</i> operator.	PointType:<>Int32
<	The <i>LESS THAN</i> operator.	Descriptor:<M
<=	The <i>LESS THAN OR EQUAL</i> operator.	Tag:<=Tank
>	The <i>GREATER THAN</i> operator.	Tag:>Tank
>=	The <i>GREATER THAN OR EQUAL</i> operator.	Tag:>=Tank

In PI point value queries with a String data type, you cannot use the following operators: <, <=, >, or >=. Furthermore, when boolean values are expected (as with *Substituted*, *Questionable*, *Annotated*, and *IsGood* point value queries), you can only use the = and <> operators.

Syntax restrictions

- You cannot query future point attributes, such as creationdate:>y-1d AND future:true, on Data Archive servers older than 3.4.395.
- You cannot query security point attributes, such as *PtSecurity* and *DataSecurity*, on Data Archive servers older than 3.4.380.

Edit PI points

Complete the following task before retrieving PI points: [Retrieve PI points by searching](#).

After you retrieve PI points into Microsoft Excel with PI Builder, you can edit the point attributes and then publish those changes to Data Archive.

1. If necessary, add additional columns that contain the point attributes that you want to change and click **Retrieve** to retrieve current values.
See [Set column headers in a worksheet](#).
2. Optional: Clear all values from the Selected(x) column in the worksheet.
You want to mark only the rows that contain edits with an X. Clearing the column before you begin can help you track which rows changed.
3. Edit any attributes that you want to change.
You cannot change all point attributes. Specifically, PI Builder ignores changes that you make to read-only system attributes: *changedate*, *changer*, *creationdate*, *creator*, *pointid*, *ptclassname*, and *srcptid*. To change the point name (the *tag* attribute), include the NewName column and enter the new point name in that column.
If you enter a space or null value for an attribute, PI Builder will reset the attribute to its default value when you publish worksheet changes.
4. Set the Selected(x) column to X for any point that has a changed attribute value.
5. Publish the changed points to Data Archive:
 - a. Click **Publish** to open the Publish Options window.
 - b. From the **Edit Mode** list, select **Edit Only**.
With this choice, PI Builder will only edit existing points. You can also select **Create and Edit**; then, PI Builder will edit existing points and create any points that do not already exist. PI Builder uses the Name column to find existing points with the same name.
 - c. Click **OK**.
PI Builder edits the points on Data Archive. The Publish Selected Objects window shows the operations completed.
 - d. Click **Close**.

Delete PI points

Before you can delete PI Points, you need to enable the **Delete** button. See [Configure build settings](#).

After you retrieve PI points into Microsoft Excel, you can use PI Builder to delete selected points from Data Archive.

1. [Retrieve PI points by searching](#).
2. For points that you want to delete, enter X in the Selected(x) column; clear the column for any points that you want to retain.
3. On the **PI Builder** tab, in the **Build** group, click **Delete**.
4. At the confirmation prompt, click **Yes**.
PI Builder deletes the selected points from Data Archive. The Delete Selected Objects window shows the operations completed.

Use worksheets created with PI Tag Configurator

To ensure search results are appended to an existing list and not overwritten, select the **Append to worksheet** option in the Settings window. See [Configure retrieve settings](#) for more information.

The column headers of worksheets created with PI Tag Configurator differ from those created with PI Builder. However, you can use PI Builder to process worksheets created with PI Tag Configurator. Simply open the worksheet, and use PI Builder functions to create, edit, delete, or refresh points on Data Archive. You can also search for and append PI points to an existing list as well as add additional column headers.

Note: You can rearrange the order of PI Tag Configurator column headings in your spreadsheet. See [Set column headers in a worksheet](#).

1. In Microsoft Excel, open the worksheet created with PI Tag Configurator.
2. On the **PI Builder** tab, specify the Data Archive server that stores the points referenced in the worksheet.
(See [Specify a Data Archive server](#).)
3. Place an X in the Select (x) column of any row that you want PI Builder to process.
4. Perform the desired operation:

To...	Do this...
Create new points	Edit worksheet values, click Publish , and select Create Only from the Edit Mode list in the Publish Options window to create new PI points.
Edit existing points	Edit worksheet values, click Publish , and select Edit Only from the Edit Mode list in the Publish Options window to edit the selected PI points.
Delete existing points	Click Delete to delete the selected PI points.
Update data	Click Retrieve to retrieve updated data for the selected PI points.
Search for and append PI points to an existing list	<p>Click PI Points > Find PI Points. In the Tag Search window, enter PI point search criteria and execute your query. Select desired PI points and click OK to retrieve and append search results to the existing list.</p> <p>Note: Be sure to select the Append to worksheet setting in the Settings window before performing this step. You can include PI point attribute and values in a query, and combine multiple search criteria. For more information and examples, see Retrieve PI points by searching.</p>

Work with elements and attributes

PI Builder offers you a convenient way to work with PI AF elements and attributes in Microsoft Excel. You can use PI Builder to create, retrieve, edit, and delete elements and attributes. With PI Builder you can change multiple elements or attributes at the same time, in bulk.

Elements

This section provides instructions for creating elements and analysis templates. It also covers how to edit elements, as well as retrieve them.

Create multiple elements

You can use PI Builder to create quantities of similar elements in Microsoft Excel. For step-by-step examples, see [Create multiple elements linked to existing PI points](#) and [Create multiple elements linked to new PI points](#).

Note: Alternatively, you can use the import and export features in PI System Explorer to create and edit multiple objects. The PI System Explorer feature imports and exports a representation of a database in XML. See the PI AF user documentation for more information (in PI System Explorer, choose **Help > Help Topics**).

1. In PI System Explorer, create an element that is similar to the elements you want to create.

Ideally, base the element on an element template. With a template, you can:

- Automatically generate the PI point names in your data references, using substitution parameters (see [Create multiple elements and generate referenced PI points automatically](#))
- Automatically create the PI points on your Data Archive
- Get all the other benefits of template-based elements

2. In Excel, retrieve the element on which you want to base other elements:

- a. On the **PI Builder** tab, click **Elements > Find Elements**.

- b. In the Element Search window, find the element that you just created.

If you based the element on a template, you can search for elements that use that template. See [Retrieve elements by searching](#) for more information on search options.

- c. In the **Search results** table, select the element and click **OK**.

You will use the selected element to create similar elements in bulk.

3. In the Select Object Types and Column Headers window, select the worksheet column headers.

Select the columns that store values that you want to copy or change when you create the other elements.

- a. If the element is based on a template, then select the **Template** check box in the **Element** group.
- b. Choose whether to show attributes in columns, in rows, or both.

It might be helpful not to show attributes initially. After you configure and publish the new elements, you can then retrieve them again with the attributes. See [Display of attributes](#) for information on displaying attributes.

- c. Click **OK**.
PI Builder inserts the selected column headers into the worksheet and retrieves the data for the selected element.
4. In the worksheet, set the worksheet values to define the elements you want to create:
 - a. Fill in the Name column for as many elements as you need.
Use Excel's copy and paste features to create the names that you need. For example, you can:
 - Name the elements sequentially by pasting names with Excel's fill series option (select the **AutoFill** option on the Series window).
 - Copy and paste the names from a column in another worksheet.
 - b. In the Parent column, enter the element path.
This determines the element's place in the element hierarchy (see [Child elements](#)). If the elements are all at the same level, then you can just copy and paste directly from the first element. Some guidelines:
 - List the parent objects before the child objects in the worksheet. PI Builder cannot create a child object before its parent object exists. PI Builder creates the objects in the order they appear in the worksheet.
 - When adding child objects to an existing parent object, you do not need to include the parent objects in the worksheet.
 - c. Set the ObjectType column to Element for all the elements.
 - d. Set the Template column to the name of the appropriate element template.
 - e. Set the Selected(x) column to X for all the elements that you want to create.
5. Publish the elements to PI AF:
 - a. On the **PI Builder** tab, click **Publish** to open the Publish Options window.
 - b. From the **Edit Mode** list, select **Create Only** or **Create and Edit**.
 - c. Select the **Create or update PI points** check box to have PI Builder automatically create the PI point data references associated with published elements.
 - d. Click **OK** to publish the elements in the worksheet to PI AF.
PI Builder creates the elements in PI AF and automatically checks in the changes.

Create multiple elements and generate referenced PI points automatically

When you create multiple attributes that reference PI points, you can use template features to automatically create the points. For a complete example of how this works, see [Create multiple elements linked to new PI points](#).

1. In PI System Explorer, define a template for the elements (or update an existing template).
In the template definition of attributes that reference PI points, configure the points for automatic creation:
 - Use substitution parameters, such as *%Element%*, in the point-name specification.
 - Select the tag-creation setting.

Later, when you create elements from this template, PI AF will generate the point name from your specification and create the referenced PI points on Data Archive. As shown in subsequent steps, you can use PI Builder to initiate the point creation or use PI System Explorer.

2. In Excel, set the worksheet column headers:
 - a. On the **PI Builder** tab, in the **Resources** group, click **Headers** to open the Select Object Types and Column Headers window.
 - b. From the **Object Type** list, select **Element**.
 - c. Click **Clear All** to clear selected object types except those in the **Required Columns** group (you cannot clear the required columns).
 - d. In the **Object Types** list, expand the **Element** group, and then select the **Template** check box and any other columns that you want in the worksheet.
 - e. In the **Attribute Columns** group, select the attributes that you want to configure.
 When creating multiple elements, you will find it easier to work with attributes displayed in columns of the parent element's row. If necessary, select a different template from the **Template** list to show available attributes in other element templates.
 - f. Select any other items that you want to configure.
 - g. Click **OK**.
 PI Builder adds the selected columns to the worksheet.
3. In the worksheet, define the elements you want to create:
 - a. In the second row, enter values to define the first element.
 - b. Copy the second row and paste to use as the basis for other elements.
 - c. Edit subsequent rows to define elements.
 You might:
 - Change the element names.
 - Specify an element path in the Parent column to create a hierarchical structure (see [Child elements](#)).
 - Make other edits.
4. Publish the elements to PI AF:
 - a. On the **PI Builder** tab, click **Publish** to open the Publish Options window.
 - b. From the **Edit Mode** list, select **Create Only**.
 - c. Select the **Create or update PI points** check box to request that PI Builder automatically create the PI points that the published elements and attributes need.
 If you do not select this check box, you must create or update PI points after publishing the elements.
 - d. Click **OK** to publish the elements in the worksheet to PI AF.
 PI Builder creates the elements in PI AF and automatically checks in the changes.
5. If necessary, create or update PI points.

To use:	Then:
PI Builder	See Create PI points .
PI System Explorer	<ol style="list-style-type: none"> a. Open PI System Explorer. b. Select the database in which you created the elements. c. In the navigation pane, click Elements.

	<p>d. Right-click the element that contains the PI point data reference, and then click Create or Update Data Reference. (To generate PI points for multiple elements, right-click the parent element and then click Create or Update Data Reference.)</p> <p>e. Click Check In to check in your work.</p>
--	---

This procedure creates all the points that the new elements reference. This only works because the elements were based on a template and the attribute template for the data reference uses the tag-creation option.

Note: After PI System Explorer creates the PI points, it might take some time before the specified interface writes values to Data Archive. Until then, the values appear as Pt. Created.

Child elements

PI Builder lets you create hierarchies of elements. PI Builder uses the element path, specified in the Parent column, to determine the hierarchical location of an element.

Specify an element path relative to the top-level element in the database. In the path, separate elements with backslashes (\). For example:

My Company\Chemicals Division\Equipment List\Reactors

For information on attribute paths, see [Child attributes](#).

Retrieve all elements

Before you can retrieve all elements, you need to [Specify a database](#).

You can use PI Builder to retrieve all elements from a PI AF database into Microsoft Excel.

Note: This operation can be lengthy if your PI AF database contains a large number of elements. Furthermore, current versions of Microsoft Excel support 1,048,576 rows. If you attempt to retrieve a large number of elements along with their attributes, analyses, and extended properties, you might reach the Excel row limit and produce an error.

1. On the **PI Builder** tab, click **Elements > All Elements**.
2. In the Select Object Types and Column Headers window, select the objects and column headers that you want to appear in the worksheet.

Note: Use the **Template** field to retrieve attributes from a template. The attributes defined by the selected template are displayed in the **Attributes Columns (from Template 'name')** group in the **Object Types** list.

If you want to retrieve:	Then:
Elements from all levels of the hierarchy into the worksheet	Select the Child Elements check box from the Object Types list.
Information about references to other elements	Select the Element References check box from the Object Types list.
Attributes into separate rows	Select columns in the Attribute group.

	With attributes shown in rows, you can edit information about the attributes. See Show attributes in rows.
Attributes in multiple columns	Select columns in the Attribute Columns group. With attributes shown in columns, you can only edit the attribute value or configuration string. See Show attributes in columns.
Analyses for the elements	Select columns in the Analysis group.

See **Element columns** for a list of available columns for elements.

3. Click **OK** to retrieve the elements into the worksheet and fill the selected columns with any data for the elements.

Retrieve elements by searching

Before you retrieve elements, you need to [Specify a database](#).

You can use PI Builder to search for elements in a PI AF database, and then select the elements to retrieve into Microsoft Excel.

1. On the **PI Builder** tab, click **Elements > Find Elements** to open the Element Search window.
2. In the **Results** table, select the elements you want to retrieve into the worksheet and click **OK**.


Note: To retrieve all the elements from the results table into the worksheet, select none of the elements and click **OK**. Beginning with PI Builder 2018, this also overrides the **Results per Page** setting and returns all results that match your search criteria.

3. Choose from the following actions:

- **Name**

Enter the name of the element to retrieve, based on the filter type. You can enter special characters to match part of a name. See Special characters in name searches.

- **Element Search Root**

Enter the element that you want to use as the root or base level for the element search. Type the exact name or click  to open the Element Browser window, where you can view the element hierarchy and select an element. You cannot include wildcard characters in the entered name. If you do not specify an element, you set the main level of the element hierarchy as the root.

Depending on your PI AF hierarchy, specifying an element in the **Element Search Root** field can improve search performance.

- **All Descendants**

Select **True** to retrieve any sub-element in the hierarchy that matches the specified criteria. Select **False** to retrieve only root-level elements that match the specified criteria.

- **Template**

Select the template that retrieved elements must be based on. After you select a template, you can add criteria to find elements by attribute value.

- **Category**

Select the category that retrieved elements must match.

- **Attribute Value**

- You can specify up to three conditions for an attribute value. For each condition, specify an attribute name, operator, and attribute value, such as Temperature >= 98.
- In versions prior to PI AF 2018, only available when you specify a template. For more details, see [Configure search conditions for attribute values when a template is specified](#).
- In PI AF 2018 and later versions, you can specify attribute values without needing to specify a template. For more details, see [Configure search conditions for attribute values when no template is specified](#).

- **Description**

Enter a string (of up to 440 characters) that retrieved elements must match.

- **Element Type**

Select the type that retrieved elements must match.

- **Is Annotated**

(PI AF 2017 or later versions.) Set to True to retrieve only elements that have annotations. Set to False to retrieve only elements that do not have annotations.

- **Creation Date**

(PI AF 2017 or later versions.) Select an operator and enter a date or a PI time abbreviation (>= *-30d is the default) to retrieve elements that were created in the specified period. You can also click to select a date in the Date and Time Picker window. You can select **Creation Date** a second time and filter the search for results between two values (< *+1d is the default).

- **Modify Date**

(PI AF 2017 or later versions.) Select an operator and enter a date or a PI time abbreviation (>= *-30d is the default) to retrieve elements that were modified in the specified period. You can also click to select a date in the Date and Time Picker window. You can select **Modify Date** a second time and filter the search for results between two values (< *+1d is the default).



Note: An element's modify date is updated whenever an annotation or child element is added, as well as when a change to its configuration is checked into the database. Most template changes, or any modification to an attribute value that is not a configuration item, will not affect an element's modify date.

- **Results per Page**

Enter the maximum number of elements to show on a single page of the search results.

4. Optional. Specify how you want results to be displayed in the **Results** table.

To ...	Do this ...
Group by template	Select the Template check box.
Group by category	Select the Category check box.
Change column selections	a. Right-click the column heading in the Results table or the white space below.

	<p>b. Click Column Visibility.</p> <p>c. Select or clear column selections as needed.</p>
Display attributes as columns	<p>d. Click  and click Select Attributes.</p> <p>e. In the Select Attributes window, use standard Windows keystrokes to highlight contiguous (SHIFT+<click>) or non-contiguous (CTRL+<click>) attributes.</p> <p>f. Click .</p> <p>g. Click OK.</p>
Display full paths of elements	<p>h. Right-click the column heading in the Results table or the white space below.</p> <p>i. Click Show Full Paths.</p>
Conceal full paths of elements	<p>j. Right-click the column heading in the Results table or the white space below.</p> <p>k. Click Hide Full Paths.</p>

5. In the **Results** table, select the elements you want to retrieve into the worksheet and click **OK**.

Tip: To retrieve all the elements from the results table into the worksheet, select none of the elements and click **OK**. Beginning with PI Builder 2018, this also overrides the **Results per Page** setting and returns all results that match your search criteria.

6. In the **Select Object Types and Column Headers** window, select the objects and column headers that you want to appear in the worksheet.

Note: Use the **Template** field to retrieve attributes from a template. The attributes defined by the selected template are displayed in the **Attributes Columns (from Template 'name')** group in the **Object Types** list.

See **Element columns** for a list of available columns for elements.


7. Click **OK** to retrieve the selected elements into the worksheet and fill the selected columns with any data for those elements.




Configure search conditions for attribute values when a template is specified


Before you configure search conditions, you should be aware of the following:

- Unindexed attributes can take a significant amount of time to evaluate, particularly if they are configured with a data reference.
- You cannot search for attributes with Object or Array value types.

You can restrict your search based on the value of an attribute. After you specify a template (required in versions prior to PI AF 2018), use the **Attribute Value** field to configure up to three conditions that the search must match regarding an attribute value.

1. Click  (**Display attribute choices**) and select an attribute from the list of possible attribute categories:

Option	Description
 attribute a	Indexed attributes, including configuration attributes.
 Configuration Attributes	Configuration attributes that are not indexed.
 Other Attributes	Non-configuration attributes that are not indexed.

- Click , and select a mathematical operator from the list.
 - For attribute value types Single and Double, queries do not support the In operator.
 - For attribute value types String, Boolean, and Int64, queries do not support the following operators:
 - < (less than)
 - > (greater than)
 - <= (less than or equal to)
 - >= (greater than or equal to)
- Enter a value in the units specified by the default UOM in the attribute template.


Note: For indexed attributes that store String value types, the search only uses the first 40 characters of the entered value.

Configure search conditions for attribute values when no template is specified

Before you configure search conditions, you should be aware of the following:

- When no template is selected, all attributes are searched, including those used in templates.
- When no template is selected, wildcard characters should not be used in the **Attribute Value** field.
- Unindexed attributes can take a significant amount of time to evaluate, particularly if they are configured with a data reference.
- You cannot search for attributes with Object or Array value types.

When using a PI AF 2018 or later client and connected to a PI AF 2018 or later server, you can restrict your search based on the value of an attribute, without first having to specify a template. Use the **Attribute Value** field to configure up to three conditions that the search must match regarding an attribute value.

- From the **Add Criteria** list, select **Attribute Value**.
- In **Attribute Value**, enter the name of the attribute to retrieve.
- Click , and select a mathematical operator from the list.
- Enter a value. If the value type is Enumeration Set or Guid, you also need to append as `Enumeration_Set` or as `Guid` to the search query displayed in the **Enter element criteria** field.

For example, to search for assets with a Health Status attribute value of Error, you would enter the following as the **Attribute Value** criteria:

Attribute Value: ...

To complete the search query, you would append the name of the Health Status enumeration set to the string already displayed in the **Enter element criteria** field:

as 'Health Status'

The completed search query in the **Enter element criteria** field would look as follows:

Note: Keep in mind the following guidelines when appending to search queries:

- Append *As String* or *As Numeric* whenever the value type of an attribute does not match what the query search value appears to be.
- For example, if the value type of an attribute were *String* and the search value were 55 (which looks like a numeric), you would need to append *As String* to the query.
- Use uppercase and lowercase combinations when you append to search queries: *As String*, *as string*, and *as STRING* are all equivalents.
- Use either ' or " to enclose enumeration sets and strings that contain space characters.

Special characters in name searches

When searching for objects by name, such as element names, event frame names, or attribute names (when associated with a template), you can use special characters:

Special character	Purpose
*	Substitute any number of unspecified characters.
?	Substitute a single unspecified character.
[xyz]	Specify a set of characters (x, y, or z) to match.
[!xyz]	Specify a set of characters (x, y, or z) to preclude a match.
\	Ignore the subsequent special character and interpret as its actual character.
[first-last]	Specify a range of characters (from <i>first</i> to <i>last</i>) to match. For example, a[a-c] matches aa, ab, or ac, but does not match ad or abc.

Retrieve elements by browsing

Before you can retrieve elements, you need to [Specify a database](#).

You can use PI Builder to browse the element hierarchy in a PI AF database, and then select an element to retrieve into Microsoft Excel.

1. On the **PI Builder** tab, click **Elements > Browse Elements** to open the Element Browser window.
2. Navigate the element hierarchy by expanding parent elements.

3. Select the element you want to retrieve into your worksheet and click **OK**.
4. In the Select Object Types and Column Headers window, select the objects and column headers that you want to appear in the worksheet.

Note: Use the **Template** field to retrieve attributes from a template. The attributes defined by the selected template are displayed in the **Attributes Columns (from Template 'name')** group in the **Object Types** list.

See **Element columns** for a list of available columns for elements.

5. Click **OK** to retrieve the selected element into the worksheet and populate the selected columns with any data for that element.

Edit elements with PI Builder

With PI Builder, you can use Microsoft Excel to edit PI AF elements. The features of Microsoft Excel let you easily edit multiple elements at the same time.

1. Retrieve elements into your Microsoft Excel worksheet:

- [Retrieve all elements.](#)
- [Retrieve elements by browsing.](#)
- [Retrieve elements by searching.](#)

2. Edit any values that you want to change.

To change the element name, include the NewName column and enter the new name in that column.

You cannot change all property values. Specifically, PI Builder ignores changes that you make to read-only properties. See [Element columns](#).

3. In the **Selected(x)** column, set the value to X for any row where you edited a value, and clear the value for any row that you did not change.
4. Publish the changes to PI AF:
 - a. On the PI Builder tab, click **Publish** to open the Publish Options window.
 - b. From the **Edit Mode** list, select **Edit Only** to guard against mistakenly creating new objects.
 - c. Click **OK** to publish the changes to PI AF.

If any of the selected objects do not already exist, PI Builder generates an error.

Reset time rules to template specification

Retrieve the element that uses the analysis into your worksheet. Be sure to include the TimeRule column. You can use PI Builder to reset the time rules of analyses to the specification in the template.

1. In the TimeRule column, select the cells in the rows of any analysis that you want to reset.
2. On the **PI Builder** tab, in the **Build** group, click **Reset to Template**.
PI Builder writes *<Template>* in the selected cells to mark the corresponding analyses for resetting to template specification.
3. Place an X in the Selected(x) columns of the analyses marked for resetting to the template specification.
4. Publish the changes to PI AF:

- a. On the PI Builder tab, click **Publish** to open the Publish Options window.
- b. From the **Edit Mode** list, select **Edit Only** to guard against mistakenly creating new objects.
- c. Click **OK** to publish the changes to PI AF.

If any of the selected objects do not already exist, PI Builder generates an error.

Create analyses (templates) with PI Builder

You can use PI Builder to create analyses (templates) based on an existing analysis (template) in an element (template).

- Although it is possible to create a new analysis in PI Builder, we recommend first configuring an analysis in PI System Explorer and then importing it to Microsoft Excel using PI Builder to play with it.
- By nature, analyses in PI Builder may not be very intuitive. Some examples are given below for your reference:

	AnalysisRuleConfigString	AnalysisRuleVariableMapping
single variable	TagVal('att1')	VariableName OutputAttributeName;
multiple variables	<ul style="list-style-type: none"> Variable1:=TimeEq('att1', '-1h', '*', 100); Variable2:=TagVal('att1') 	<ul style="list-style-type: none"> Variable1 OutputAttribute1; Variable2 OutputAttribute2;

- In PI System Explorer, create an analysis that is similar to the analyses you want to create.
You can base the analysis on an analysis template.
- In Excel, retrieve the analysis on which you want to base other analyses:
 - a. On the **PI Builder** tab, click **Elements > Find Elements**.
 - b. In the Element Search window, find the element with the analysis (template) you want to use.
If you based the element on a template, you can search for elements that use that template. See [Retrieve elements by searching](#) for more information on search options.
 - c. In the **Search results** table, select the element and click **OK**.
You will use the analysis in the selected element to create similar analyses in bulk.
 - d. In the Overwrite or Append Data window, click Overwrite or Append.
- In the Select Object Types and Column Headers window, select the worksheet column headers.
Make sure to select the **Analysis** check box.
 - a. If the element is based on a template, then select the **Template** check box in the **Element** group.
 - b. Click **OK**.
PI Builder inserts the selected column headers into the worksheet and retrieves the data for the selected element.
 - c. Click Close in the Retrieve Selected Objects window.
- In the worksheet, set the worksheet values to define the analyses you want to create:

- a. Fill in the **Name** column for as many analyses as you need.
Use Excel's copy and paste features to create the names that you need. For example, you can:
 - Name the analyses sequentially by pasting names with Excel's fill series option (select the **AutoFill** option on the Series window).
 - Copy and paste the names from a column in another worksheet.
 - b. In the Parent column, enter the element path.
This determines the element's place in the element hierarchy (see [Child elements](#)). If the elements are all at the same level, then you can just copy and paste directly from the first element. Some guidelines:
 - List the parent objects before the child objects in the worksheet. PI Builder cannot create a child object before its parent object exists. PI Builder creates the objects in the order they appear in the worksheet.
 - When adding child objects to an existing parent object, you do not need to include the parent objects in the worksheet.
 - c. Set the ObjectType column to Analysis for all the analyses.
For analyses templates, set it to AnalysisTemplate.
 - d. Set the Template column to the name of the appropriate element template.
 - e. For AnalysisRuleVariableMapping to carry over, make sure you have created the output attributes in PI AF before mapping.
 - f. Set the Selected(x) column to X for all the analyses that you want to create.
5. Publish the analyses to PI AF:
- a. On the **PI Builder** tab, click **Publish** to open the Publish Options window.
 - b. From the **Edit Mode** list, select **Create Only** or **Create and Edit**.
 - c. Click **OK** to publish the analyses in the worksheet to PI AF.
PI Builder creates the analyses in PI AF and automatically checks in the changes.

Edit analyses with PI Builder

With PI Builder, you can use Microsoft Excel to edit multiple analyses at once. For example, you can change the scheduling for a number of analyses from event-triggered to periodic.

1. Retrieve the analysis that you want to edit.
 - a. On the **PI Builder** tab, click **Elements > Find Elements**.
 - b. In the Element Search window, find the element on which you created an analysis.
 - c. In the **Search results** table, select the element and click **OK**.
2. In the Select Object Types and Column Headers window, select the worksheet column headers.
 - a. Select the **Template** check box in the **Element** group if the element is based on a template.
 - b. Select the **Analysis** check box.
 - c. Click **OK**.
PI Builder inserts the selected column headers into the worksheet and retrieves the data for the selected element.

3. Edit any values that you want to change.
4. In the Selected(x) column, set the value to X for any row where you edited a value, and clear the value for any row that you did not change.
5. Publish the changes to PI AF:
 - a. On the PI Builder tab, click **Publish** to open the Publish Options window.
 - b. From the **Edit Mode** list, select **Edit Only** to guard against mistakenly creating new objects.
 - c. Click **OK** to publish the changes to PI AF.

If any of the selected objects do not already exist, PI Builder generates an error.

Attributes

The Attributes section explains how to display and retrieve attributes, and show values from data references. PI point creation is also covered.

For more information, see [Configure search conditions for attribute values when a template is specified](#).

Display of attributes

You can show attributes in worksheet rows or columns.

If you show attributes in worksheet rows (see [Show attributes in rows](#)), the worksheet includes a row for each attribute. Rows that correspond to attributes contain the name of the parent element in the Parent column. For example, the following worksheet contains an element named MixHopper, which has an attribute named Level; the worksheet shows that attribute in a separate row.

	A	B	C	D	E	G	H
1	Selected(x)	Parent	Name	ObjectType	Template	AttributeType	AttributeValue
2	x		MixHopper	Element	Hopper		
3	x	MixHopper	Level	Attribute		Double	0

If you show attributes in worksheet columns (see [Show attributes in columns](#)), the worksheet adds columns for the attributes. Those column names contain the pipe symbol followed by the attribute name. Cells in an attribute column show the attribute value or the attribute-configuration string (see [Data references in attribute columns](#)) in the row of the attribute's parent element. For example, the following worksheet has the MixHopper element and shows the Level attribute in a column. The column name is |Level and the value is 362.

	A	B	C	D	E	F	G	H
1	Selected(x)	Parent	Name	ObjectType	Template	ReferenceType	Level	
2	x		MixHopper	Element	Hopper		362	

You can combine the two methods, and show attributes in rows and columns (see [Show attributes in rows and columns](#)). For example, the following worksheet has the MixHopper element and shows the Level attribute in both a column and a row.

	A	B	C	D	E	F	G	J
1	Selected(x)	Parent	Name	ObjectType	Template	ReferenceType	Level	AttributeValue
2	x		MixHopper	Element	Hopper		362	
3	x	MixHopper	Level	Attribute				362

Show attributes in columns

Worksheets can include columns for attributes. The names of these columns contain the attribute path preceded by a pipe symbol (|). Cells in an attribute column show the attribute value or the attribute-configuration string (see [Data references in attribute columns](#)) in the row of the attribute's parent element. To show attributes in columns, add the appropriate worksheet column headers from the **Attribute Columns** group when you retrieve elements.

Prerequisite: Select an element or elements to retrieve and open the Select Object Types and Column Headers window:

- Retrieve all elements
- Retrieve elements by browsing
- Retrieve elements by searching

1. In the Select Object Types and Column Headers window, from the **Object Types** list, expand the **Attribute Columns** group.

The list shows available attributes ordered by template. If necessary, you can select a different template from the **Template** list to show attributes from that template.

2. Select the attributes that you want to include as columns in the worksheet.
3. Select any other columns you also want to include in the worksheet.
4. Click **OK**.

PI Builder adds the selected column headers to the worksheet and retrieves the previously selected elements. Each selected attribute appears as a column in the worksheet; the name of each column is the attribute path (see [Child attributes](#)). The cells in these columns contain the attribute values, though a data reference attribute can contain either a value or the attribute configuration string (see [Data references in attribute columns](#)).

Show attributes in rows

Worksheets can include rows for each attribute of an element. To show attributes in rows, select the **Attribute** group when you retrieve elements into the worksheet.

Prerequisite: Select an element or elements to retrieve and open the Select Object Types and Column Headers window:

- Retrieve all elements
- Retrieve elements by browsing
- Retrieve elements by searching

1. In the Select Object Types and Column Headers window, from the **Object Types** list, expand the **Attribute** group.
2. Select the attribute-specific columns that you want to include in the worksheet, such as value, type, and so on. See [Attribute-specific columns](#).

Alternatively, to show attributes in rows but not include any attribute-specific columns, select the **Attribute** group check box and clear the check boxes for the attribute-specific columns. When the **Attribute** group check box is selected, PI Builder shows attributes in rows.

3. Select any other columns you also want to include in the worksheet.
4. Click **OK**.

PI Builder adds the selected column headers to the worksheet and retrieves the previously selected elements. The attributes of the retrieved elements appear in rows in the worksheet.

Attribute-specific columns

If the worksheet displays attributes in rows, PI Builder writes the attribute name in the Name column, the attribute's parent element in the Parent column, and the type (attribute) in the Object Type column. You can include additional columns about attributes:

- **AttributesHidden**

A flag that indicates whether PI AF returns the attribute in search results. For attributes created from a template, the template defines the value of the flag, which cannot be changed for individual instances of the attribute. Possible values:

- TRUE

PI AF does not retrieve this attribute in searches for attributes. However, PI AF does show the attribute when browsing the element hierarchy.

- FALSE

PI AF retrieves this attribute in searches for attributes.

- **AttributesConfigurationItem**

A flag that indicates whether the attribute is a configuration item. For attributes created from a template, the template defines the value of the flag, which cannot be changed for individual instances of those attributes. Possible values:

- TRUE

Upon a change to the attribute value or any other attribute property, PI AF checks out the attribute's parent element from the PI AF database and marks the element as changed.

- FALSE

PI AF does not mark the parent element as changed if the attribute value changes, but will mark the parent element as changed if any other attribute properties change.

For attributes not created from a template, the default value is TRUE.

- **AttributesExcluded**

A flag that indicates whether PI AF returns the attribute in search results and when browsing the element hierarchy. Only applicable to attributes with templates. The initial value comes from the attribute template, but each instance of an attribute can have its own value. Possible values:

- TRUE

PI AF does not retrieve this attribute in searches for attributes and does not show the attribute when browsing the element hierarchy. PI Builder returns the string *Excluded* as the value.

- FALSE

PI AF retrieves this attribute in searches for attributes and shows the attribute when browsing the element hierarchy.

- **AttributeDefaultUOM**

The default unit of measure.

- **AttributeType**

The attribute value type.

- **AttributeTypeQualifier**

The name of the enumeration set that the attribute uses, if the attribute value type is an enumeration set.

- **AttributeValue**

The value of the attribute at retrieval time. For excluded attributes, PI Builder returns *Excluded*. For attributes that have a data reference, this cell is empty if the **Show Values in Rows** check box is clear, or contains the value at a specified time if the **Show Values in Rows** check box is selected. See [Show values from data references](#).

- **AttributeDataReference**

The type of data reference, if the attribute has a data reference. Possible values include: Formula, PI Point, PI Point Array, or Table Lookup. If the attribute does not have a data reference, this cell is empty.

- **AttributeConfigString**

The attribute configuration string (see [Attribute configuration strings in PI Builder](#)), if the attribute has a data reference. If the attribute does not have a data reference, then this cell is empty.

Note: If the worksheet shows attributes in columns, these attribute-specific columns do not apply. See [Data references in attribute columns](#).

Show attributes in rows and columns

Worksheets can show attributes in rows and columns. To show attributes in rows and columns, add the appropriate worksheet column headers from the **Attribute Columns** and the **Attribute** groups when you retrieve elements.

1. Select the attributes to show in columns:

- a. In the Select Object Types and Column Headers window, from the **Object Types** list, expand the **Attribute Columns** group.

The list shows available attributes ordered by template. If necessary, you can select a different template from the **Template** list to show attributes from that template.

- b. Select the attributes that you want to include as columns in the worksheet.

2. Set the worksheet to show attributes in rows:

- a. From the **Object Types** list, expand the **Attribute** group.

- b. Select the attribute-specific columns that you want to include in the worksheet, such as value, type, and so on. See [Attribute-specific columns](#).

Alternatively, to show attributes in rows but not include any attribute-specific columns, select the **Attribute** group check box and clear the check boxes for the attribute-specific columns. When the **Attribute** group check box is selected, PI Builder shows attributes in rows.


3. Select any other columns you also want to include in the worksheet.
4. Click **OK**.

PI Builder adds the selected column headers to the worksheet and retrieves the previously selected elements. The worksheet contains the selected attribute columns and also writes attributes in separate rows.

Retrieve attributes by searching

You can use PI Builder to search for attributes in a PI AF database, and then select the attributes to retrieve into Microsoft Excel. You cannot search for and retrieve attributes configured as excluded or hidden.

Prerequisite: Before you retrieve attributes, you need to [Specify a database](#).

1. On the **PI Builder** tab, click **Elements > Find Element Attributes** to open the Attribute Search window.
2. Set the Attribute Search window to find the desired attributes in the PI AF database:
 - a. Under **Where**, set the fields to restrict attributes retrieved:
 - **Attribute name**
Enter the name of the attribute to retrieve. You can enter special characters to match part of a name. See Special characters in name searches.
 - **Attribute description**
Enter a string (of up to 440 characters) that retrieved attributes must match.
 - **Attribute category**
Select the category that retrieved attributes must match.
 - **Attribute value type**
Select the type of value that the retrieved attributes must store.
 - **Maximum results**
Enter the maximum number of matching attributes to retrieve.
 - b. In the **Element Criteria** area, set the fields to restrict the elements searched for matching attributes:
 - **Search Root**
Enter the element that you want to use as the root or base level for the attribute search. Type the exact name or click **Browse**  to open the Element Browser window, where you can view the element hierarchy and select an element. You cannot include wildcard characters in the entered name. If you do not specify an element, you set the main level of the element hierarchy as the root. Depending on your PI AF hierarchy, specifying an element in the **Search Root** field can improve search performance.

Select the **Search Sub-Elements** check box to search the entered root and any sub-elements. Clear this check box to search only the entered root.
 - **Name**
Enter the name of the elements in which you want to search for attributes. You can enter special characters to match part of a name. See Special characters in name searches.
 - **Description**
Enter a string (of up to 440 characters) to retrieve only those elements that match.

- **Category**
Select the category of the elements in which you want to search for attributes.
- **Template**
Select the template of the elements in which you want to search for attributes.
- **Type**
Select the type of the elements in which you want to search for attributes.
If you specify values for multiple settings, the search returns only those attributes that match all the specified settings.

3. Click **Search** to retrieve the matching attributes into the **Search results** table.

Alternatively, use the element tree under **Search results** to browse for attributes under particular elements, and then select the attributes to add them to the **Search results** table.

Remember that the attributes available by searching and the attributes available by browsing the element hierarchy depend on the configuration properties of the attributes.

4. In the **Search results** table, select the attributes to retrieve into the worksheet and click **OK**.
5. In the Select Object Types and Column Headers window, select the column headers to include in the worksheet.
6. Click **OK** to retrieve the element attributes.

Data references

Attributes can reference other data, such as PI points. With PI Builder, you can view the values from data references or the configuration of the data references. Topics in this section contain information useful when you work with attributes that contain data references.

Show values from data references

Worksheets can show the values of attributes that contain a data reference. However, you cannot publish values of data-reference attributes to PI AF.

1. On the **PI Builder** tab, in the **Attribute Data References** group, select the check box appropriate for the attribute display:
 - For attributes displayed in rows, select the **Show Values in Rows** check box.
 - For attributes displayed in columns, select the **Show Values in Columns** check box.
2. In the list under the check boxes, specify the time for which you want to retrieve the data reference value. You can enter a PI time expression, or select one of the choices:
 - **Values at Yesterday Midnight**
 - **Values at Today Midnight**
 - **Values at Current Time** (default choice)
 - **Select Date and Time**
3. Update or retrieve values, as appropriate:
 - If the worksheet already contains the attributes, click **Retrieve** to retrieve values from the data references at the specified time and write them to the worksheet.

- If you need to add attributes to the worksheet, retrieve them with elements, models, event frames, or transfers:
- [Retrieve attributes by searching](#)
- [Retrieve selected models](#)
- [Event frames](#)
- [Transfers in PI Builder](#)

Data references in attribute columns

If a worksheet contains an attribute column and the attribute in that column has a data reference, then the cell content depends on whether you select the **Show Values in Columns** check box:

- If you select the **Show Values in Columns** check box, the attribute cell contains a value from the data reference at the specified time. Note that PI Builder does not publish values for attributes with data references.
- If you do not select the **Show Values in Columns** check box, the attribute cell contains a string that contains a *data-reference name* followed by the attribute configuration string (see [Attribute configuration strings in PI Builder](#)).

A data-reference name indicates the type of data reference.

The following table lists different types of data references, the corresponding data-reference name, and an example of a value that might appear in a cell.

Data-reference type	Data-reference name	Example
Formula	=Formula.	=Formula.D=Density;V=Volume;[D*V] =Formula.A=Attribute3;[A*3];UOM=cm
PI Point ¹ (server specified in configuration string)	=	=\\MyDataServer\sine
PI Point ¹ (server not specified in configuration string)	=PI Point.	=PI Point.MyPITag
PI Point Array	=PI Point Array.	=PI Point Array.\\MyDataServer\Point.1 Point.2 Point.3
String Builder	=String Builder.	=String Builder."%Attribute% value is";'Density';
Table Lookup	=Table Lookup.	=Table Lookup.SELECT Density FROM [Material Specifications] WHERE MaterialID = @Product
URI Builder	=URI Builder.	Generic web link: https://www.MappingService.com:443/maps/dir/%27%27'Street Address','City','State','Zip Code'

		PI Coresight link: https://MyDataServer.int/Coresight/#/Displays/29072/Vehicle-Data?Asset=\\csaf\cspi_speedys_pizza\Speedys_Pizza\Vehicles\SP3
¹ If you are using the PI point data reference and the configuration string starts with double backslashes to indicate that the Data Archive server is next, then you can omit the PI Point. prefix.		

The separator character between the data-reference name and the configuration string is a period (.). In earlier versions of PI AF, the separator character was a colon (:). Both the new and legacy separator characters are supported for publishing from Excel into PI AF, but retrieving data from PI AF into Excel returns the new separator character.

Note: If you have custom data-reference types and the data-reference name itself contains either a period (.) or a colon (:), then you must enclose the data-reference name in single quotes. For example, if the custom data-reference name is FormulaV.1, then you would need to specify the following combination of data reference and configuration string:

```
'= 'FormulaV.1'.Configuration_String
```

Attribute-specific columns for data references

When worksheets show attributes in rows, the following columns contain information about data-reference attributes:

- **AttributeConfigString**

The attribute configuration string (see [Attribute configuration strings in PI Builder](#)) that defines the data reference.

- **AttributeDataReference**

The type of data reference. Possible values include: Formula, PI Point, PI Point Array, String Builder, Table Lookup or URI Builder.

- **AttributeValue**

The value of the attribute at retrieval time. For attributes that have a data reference, this cell is empty (if the **Show Values in Rows** check box is clear) or contains the value at a specified time (if the **Show Values in Rows** check box is selected). See [Show values from data references](#).

Note: PI Builder never publishes values for attributes that have data references.

Attribute configuration strings in PI Builder

An attribute configuration string describes a data reference. The syntax of a configuration string depends on the type of data reference.

The configuration string for string-builder data references can contain substitution parameters. For attribute templates, any configuration string can contain substitution parameters. See [List of PI AF substitution parameters](#).

With PI Builder, you can see attribute configuration strings in a worksheet. For attributes shown in rows, include the AttributeDataReference column. For attributes shown in attribute columns, clear the **Show Values in Columns** check box (on the **PI Builder** tab in the **Attribute Data References** group).

Examples: Configuration strings for different types of data references

The following table contains examples of configuration strings for different types of data references.

Type of data reference	Sample configuration string
Formula	D=Density;V=Volume;[D*V]
	A=Attribute3;[A*3];UOM=cm
PI Point	\\MyPIDataArchiveServer\sinecosoid
	\\192.168.0.255\ChocMilkMeter;TimeMethod=TimeRange; RelativeTime=-1h;TimeRangeMethod=Total;ReadOnly=False
PI Point Array	\\MyPIDataArchiveServer\Point.1 Point.2 Point.3
String Builder	"%Attribute% value is";'Attribute1';
Table Lookup	SELECT Density FROM [Material Specifications] WHERE MaterialID = @Product
URI Builder	https://MyDataServer.int:443/Vision/#Displays/215915/Mine-Truck-10-Brake-Temp?Asset=\\%System%%Database%%Element%&StartTime=03%2F21%2F2016 09:26:00&EndTime=&Mode=kiosk

Configuration strings for PI point data references

The attribute configuration string for PI point data references must contain the path to the point. The string can also contain parameters that specify the value that the data reference returns. If specified in an attribute template, the string can contain parameters that specify the point to create. In the string, you separate the parameters with semi-colons.

Examples

- Simple reference to a point on a Data Archive server called MyPIDataArchiveServer:
\\MyPIDataArchiveServer\sinecosoid
- Configuration string referencing the same point, but with a time retrieval specification and specified units of measure:
\\MyPIDataArchiveServer\sinecosoid;TimeMethod=ExactTime;UOM=°C
- Configuration string referencing the same point, but returning a total of point values over a time range:
\\MyPIDataArchiveServer\sinecosoid;TimeMethod=NotSupported;TimeRangeMethod=Total;RateConversion=day
- Configuration string from an attribute template, using substitution parameters:
\\%Server%%Element%.%Attribute%
- Same configuration string, but with tag creation enabled and point configuration specified:

```
\\%Server%\%Element%.%Attribute%;ptclassname=classic;pointtype=Float32; engunits=m3/s;location1=1;location2=30;location4=1;location5=1;pointsource=R
```

Data reference parameters that specify values to return

Configuration strings for PI point data references can include optional parameters that specify the value that the data reference returns. The following table lists available parameters:

Parameter	Syntax	Example	Default
<i>TimeMethod</i>	TimeMethod= <i>time_method</i> where <i>time_method</i> is one of: <ul style="list-style-type: none"> • After • AtOrAfter • Before • AtOrBefore • Automatic • ExactTime • Interpolated • NotSupported • TimeRange • TimeRangeOverride 	TimeMethod=Automatic	Automatic
<i>RelativeTime</i>	RelativeTime=[*] +/- integertime_unit where <i>time_unit</i> is one of: <ul style="list-style-type: none"> • y • M • d • h • m • s 	RelativeTime=-1h	N/A
<i>TimeRangeMethod</i>	TimeRangeMethod= <i>method_name</i> where <i>method_name</i> is one of <ul style="list-style-type: none"> • Average • Count • Delta • EndTime 	TimeRangeMethod=Total	EndTime

	<ul style="list-style-type: none"> • Maximum • Minimum • PopulationStandardDeviation • Range • StandardDeviation • StartTime • Total 		
<i>TimeRangeMinPercentGood</i> ¹	TimeRangeMinPercentGood= <i>percentage</i>		80
<i>CalculationBasis</i> ¹	CalculationBasis= <i>calculation_basis</i> where <i>calculation_basis</i> is one of: <ul style="list-style-type: none"> • EventWeighted • EventWeightedExcludeEarliestEvent • EventWeightedExcludeMostRecentEvent • EventWeightedIncludeBothEnds • TimeWeighted • TimeWeightedContinuous • TimeWeightedDiscrete 		TimeWeighted
<i>RateConversion</i> ²	RateConversion= <i>uom</i> where <i>uom</i> is a defined unit of measure	RateConversion=minute	day
<i>UOM</i>	UOM= <i>uom</i> where <i>uom</i> is a defined unit of measure	UOM=°C	Attribute's Default UOM
<i>ReadOnly</i>	ReadOnly= <i>boolean</i> where <i>boolean</i> is one of: <ul style="list-style-type: none"> • true • false 	ReadOnly=false	true

¹ Used when specifying *TimeRangeMethod*.

² Used only when *TimeRangeMethod*=Total.

Data reference parameters that specify PI point to create

In attribute templates that specify new PI points, configuration strings for PI point data references include parameters that specify the type of point to create. Point creation parameters consist of a point attribute and

value. To specify a new PI point, attribute templates must include the *pointtype* attribute as a parameter; other attributes are optional.

- Create a PI point of type Float64 and use default settings for the rest of the point configuration:

```
\\%Server%\%Element%.%Attribute%;pointtype=Float64
```

- Create a PI point that sets the point attributes shown in the following table:

Point attribute	Setting
<i>ptclassname</i>	classic
<i>pointtype</i>	Float32
<i>pointsource</i>	R
<i>location4</i>	1
<i>location5</i>	2
<i>span</i>	200
<i>zero</i>	1100

```
\\%Server%\%Element%.%Attribute%;ptclassname=classic;pointtype=Float32;  
location4=1;location5=2;pointsource=R;span=200;zero=1100
```

PI point creation when publishing

If you use PI Builder to create an element based on an element template, select the **Create or update PI points** check box on the Publish Options window to have PI Builder automatically create the PI points that data references refer to but do not already exist. If you do not select this check box, you must create those PI points separately with PI Builder, PI System Explorer, or other PI System tools.

List of PI AF substitution parameters

PI AF interprets numerous types of substitution parameters. The following tables are grouped by type:

- Name
- Time
- ID
- Description
- Path
- Environment variable

Name substitution parameters

The following table lists the name substitution parameters that supports.

Parameter name	Substitution
%@path%	The value of the object's attribute or attribute template, represented by the path.
%Analysis%	Name of analysis, if obtainable from the context.
%Attribute%	Name of the object's attribute or attribute template.
% Attribute%	Name of the root attribute or attribute template that holds this data reference.
%../Attribute%	Name of the parent attribute or attribute template that holds this data reference.
%Database%	Name of the PI AF database in which the attribute resides.
%Destination%	Name of the destination element for the transfer in which the attribute resides.
%Element%	Name of the element in which the attribute resides. For event frames, this refers to the name of the primary-referenced element.
%\Element%	Name of the root element in which the attribute resides.
%..\Element%	Name of the parent element of the element in which the attribute resides. To retrieve further ancestors, use the ..\ notation, such as %..\Element%.
%EventFrame%	Name of the event frame in which the attribute resides.
%\EventFrame%	Name of the root event frame in which the attribute resides.
%..\EventFrame%	Name of the parent event frame of the event frame in which the attribute resides. To retrieve further ancestors, use the ..\ notation, such as %..\EventFrame%.
%Model%	Name of the model, if obtainable from the context.
%Name:path%	Name of the object represented by the path to the object. If the path is not specified, null is returned since the name of the current object is being referenced.
%Server%	<p>Name of the default Data Archive. It first resolves to the current PI AF database's default Data Archive if one is specified; otherwise, it resolves to the PI AF server's default Data Archive if one is specified. If one is not specified there, it resolves to the local default Data Archive.</p> <hr/> <p>Note: If the default Data Archive is not specified on the PI AF server or PI AF database, it can resolve to a different Data Archive for different client machines depending on their configuration.</p>
%Source%	Name of the source element for the transfer in which the attribute resides.
%System%	Name of the PI AF server or collective where the attribute resides.

<i>%Template%</i>	Name of the template on which the element or event frame is based. For example, if you created element Valve101 from a template called Valve, then the substitute text would be Valve.
<i>%\Template%</i>	Name of the root template on which the element or event frame is based.
<i>%..\Template%</i>	Name of the parent template on which the element or event frame is based. To retrieve further ancestors, use the <i>..\</i> notation, such as <i>%..\Template%</i> .
<i>%Transfer%</i>	Name of the transfer in which the attribute resides.

Time substitution parameters

PI AF supports substitution parameters that specify a particular time and time zone, depending on the context. Optionally, you can augment these supported parameters by including a format string that specifies the format of the time string. See [Format strings for time substitution parameters](#).

The following table lists the time substitution parameters that supports.

Parameter name	Substitution
<i>%Duration%</i>	<p>Time span between the start time and end time, if it can be obtained from the time context. In open event frames, obtains the time span from start time to the current time. The time span uses a different format from other time substitution parameters.</p> <ul style="list-style-type: none"> You can use standard formats such as "c" (constant), "g" (general, short), or "G" (general, long), for example: <i>%Duration:c%</i>. For more information, see the MSDN article Standard TimeSpan Format Strings. You can also use a custom time span format, as described in the MSDN article Custom TimeSpan Format Strings. <p>Note that you need to define the symbols that separate days from hours, and so on with a string literal. For example, <i>%Duration:d\hh:mm:ss%</i> defines a period (.) as the separator between days and hours, and a colon (:) as the separator between hours, minutes, and seconds.</p>
<i>%EndTime%</i>	Local end time, if obtainable from the time context. For event frame-based objects that do not have an end time yet specified, the result is an empty string.
<i>%StartTime%</i>	Local start time, if obtainable from the time context.
<i>%Time%</i>	Local time, if obtainable from the time context.
<i>%UtcEndTime%</i>	Coordinated universal (UTC) end time, if it can be obtained from the time context. For event frame-based objects that do not have an end time yet specified, the result is an empty string.

<code>%UtcStartTime%</code>	Coordinated universal (UTC) start time, if it can be obtained from the time context.
<code>%UtcTime%</code>	Coordinated universal (UTC) time, if it can be obtained from the time context.

ID substitution parameters

The following table lists the ID substitution parameters that supports.

Parameter name	Substitution
<code>%AnalysisId%</code>	ID of the analysis with which the attribute is associated.
<code>%AttributeId%</code>	ID of the attribute that holds this data reference.
<code>% AttributeId%</code>	ID of the root attribute or root attribute template in which the attribute resides.
<code>%. AttributeId%</code>	ID of the parent attribute or parent attribute template in which the attribute resides. Further ancestors can be retrieved by using the <code>.. </code> notation, such as <code>%. .. AttributeId%</code> .
<code>%DatabaseId%</code>	ID of the database in which the attribute resides.
<code>%ElementId%</code>	ID of the element in which the attribute resides. For event frames, this refers to the ID of the primary referenced element.
<code>%\ElementId%</code>	ID of the root element in which the attribute resides. For event frames, this refers to the ID of the primary referenced element of the root event frame in which the attribute resides.
<code>%. \ElementId%</code>	ID of the parent element in which the attribute resides. For event frames, this refers to the ID of the primary referenced element of the parent event frame in which the attribute resides. Further ancestors can be retrieved by using the <code>.. \</code> notation, such as <code>%. \.. \ElementId%</code> .
<code>%EventFrameId%</code>	ID of the event frame in which the attribute resides.
<code>%\EventFrameId%</code>	ID of the root event frame in which the attribute resides.
<code>%. \EventFrameId%</code>	ID of the parent event frame in which the attribute resides. Further ancestors can be retrieved by using the <code>.. \</code> notation, such as <code>%. \.. \EventFrameId%</code> .
<code>%Id:path%</code>	ID of the object represented by the path to the object. If the path is not specified, the ID of the current object is used. .
<code>%ModelId%</code>	ID of the model in which the attribute resides.
<code>%SystemId%</code>	ID of the PI AF server in which the attribute resides.
<code>%TransferId%</code>	ID of the transfer in which the attribute resides.

Description substitution parameters

The following table lists the description substitution parameters that supports.

Parameter name	Substitution
<i>%Description:path%</i>	Description of the attribute represented by the path to the attribute. If the path is not specified, the description of the current attribute is used.
<i>%/Description%</i>	Description of the root attribute or root attribute template in which the attribute resides.
<i>%../Description%</i>	Description of the parent attribute or parent attribute template in which the attribute resides. Further ancestors can be retrieved by using the <i>../</i> notation, such as <i>%../Description%</i> .
<i>%ElementDescription%</i>	Description of the element in which the attribute resides. For event frames, this refers to the description of the primary referenced element of the event frame in which the attribute resides.
<i>%\ElementDescription%</i>	Description of the root element where the attribute resides. For event frames, this refers to the description of the primary referenced element of the root event frame in which the attribute resides.
<i>%..\ElementDescription%</i>	Description of the parent element in which the attribute resides. For event frames, this refers to the description of the primary referenced element of the parent event frame in which the attribute resides. Further ancestors can be retrieved by using the <i>..\</i> notation, such as <i>%..\ElementDescription%</i> .
<i>%EventFrameDescription%</i>	Description of the event frame in which the attribute resides.
<i>%\EventFrameDescription%</i>	Description of the root event frame in which the attribute resides.
<i>%..\EventFrameDescription%</i>	Description of the parent event frame in which the attribute resides. Further ancestors can be retrieved by using the <i>..\</i> notation, such as <i>%..\EventFrameDescription%</i> .

Path substitution parameters

Path substitutions cannot generally be used to create references to other attributes, because they contain backslash characters. The Path substitution parameters are most useful with String Builder data references when you construct paths for output into strings. The path that is produced does not include the PI AF server or database.

The following table lists the path substitution parameters that supports.

Parameter name	Substitution
<i>%ElementPath%</i>	Path of the base element, the element of an attribute, or the primary referenced element of an event frame.
<i>%..\ElementPath%</i>	Path of the parent element in which the attribute resides. For event frames, this refers to the path of the primary referenced element of the parent event frame in which the attribute resides. Further ancestors can be retrieved by using the <i>..\</i> notation, such as <i>%..\..\ElementPath%</i> .
<i>%EventFramePath%</i>	Path of the event frame, or the element of an attribute of an event frame.
<i>%..\EventFramePath%</i>	Path of the parent event frame in which the attribute resides. Further ancestors can be retrieved by using the <i>..\</i> notation, such as <i>%..\..\EventFramePath%</i> .

Environment variable parameter

The following table lists the environment variable parameter that supports.

Parameter name	Substitution
<i>%Environment Variable%</i>	Value of the matching system-environment variable. For example, <i>%COMPUTERNAME%</i> is replaced with the name of the computer on which the data reference is executing.

Format strings for time substitution parameters

In time substitution parameters, you can include a format string that specifies the format of the time string.

Standard date and time format

Use any standard format string supported by the `DateTime.ToString` method, described in the MSDN article [Standard Date and Time Format Strings](#). In the specification of the time substitution parameter, separate the substitution and the format string with a colon. For example, *%TIME:d%* specifies the local time in a short-date pattern.

The following table provides an abbreviated description of `DateTime` format strings:

Format specifier	Description	Example
d	Short date pattern	6/15/2009 (en-US) 15/06/2009 (fr-FR) 2009/06/15 (ja-JP)
D	Long date pattern	Monday, June 15, 2009 (en-US) Montag, 15. Juni 2009 (de-DE)
f	Full date/time pattern (short time)	Monday, June 15, 2009 1:45 PM (en-US)

F	Full date/time pattern (long time)	Monday, June 15, 2009 1:45:30 PM (en-US)
g	General date/time pattern (short time)	6/15/2009 1:45 PM (en-US) 15/06/2009 13:45 (es-ES) 2009/6/15 13:45 (zh-CN)
G	General date/time pattern (long time)	6/15/2009 1:45:30 PM (en-US) 15/06/2009 13:45:30 (es-ES) 2009/6/15 13:45:30 (zh-CN)
M, m	Month/day pattern	June 15 (en-US)
O, o	Round-trip date/time pattern	2009-06-15T13:45:30.0000000-07:00
R, r	RFC1123 pattern	Mon, 15 Jun 2009 20:45:30 GMT
s	Sortable date/time pattern	2009-06-15T13:45:30
t	Short time pattern	1:45 PM (en-US)
T	Long time pattern	1:45:30 PM (en-US)
u	Universal sortable date/time pattern	2009-06-15 20:45:30Z
U	Universal full date/time pattern	Monday, June 15, 2009 8:45:30 PM (en-US)
Y, y	Year month pattern	June, 2009 (en-US)
Any other single character	Unknown specifier	

Custom date and time format

You can also construct custom patterns in the date and time format string, using time specifiers described in the MSDN article [Custom Date and Time Format Strings](#). For example, `%TIME:yyyy/MM/dd HH:mm:ss.ffffff%` produces output similar to 2015/03/31 09:28:03.843512.

Child attributes

PI AF attributes can have child attributes. Similarly, PI AF attribute templates can have child attribute templates. You specify attribute and attribute-template hierarchies with an *attribute path*. Separate attributes in the path by the pipe symbol (|).

For example, an element called Reactor1 has an attribute called Temperature. The Temperature attribute has a child attribute called Lower Limit. The attribute path (relative to the Reactor1 element) for the Lower Limit attribute looks like this:

```
|Temperature|Lower Limit
```

Relative to the top-level parent attribute, the attribute path would not contain the leading pipe symbol:

Temperature | Lower Limit

The attribute path for the Temperature attribute (again, relative to the Reactor1 element) looks like this:

| Temperature

When you display attributes as separate rows in Excel, the Name column contains the attribute path, relative to the top-level parent attribute (without the leading pipe symbol).

When you display attributes in attribute columns, the attribute column heading contains the attribute path, relative to the element.

Note: For information on *element* paths, see [Child elements](#).

Reset attributes to template specification

Retrieve the attributes that you want to reset into your worksheet. Be sure to include the AttributeValue and AttributeDataReference columns.

You can use PI Builder to reset attributes derived from templates to the specification in the template. Specifically, PI Builder can reset the values of attributes and the configurations of attribute data references to those in the template.

1. Select the cells that correspond to attributes that you want to reset to the template specification.

- If the attribute contains a data reference, select cells in:
- AttributeDataReference column of attributes shown in rows
- Attribute column of attributes shown in columns
- If the attribute contains a constant value, select cells in:
- AttributeValue column of attributes shown in rows
- Attribute column of attributes shown in columns
- Alternatively, select:
- Rows that correspond to an attribute to reset all those attributes
- Columns that contain attributes to reset that attribute for all objects in the worksheet
- AttributeDataReference or AttributeValue columns to reset all attributes in the worksheet

Note: When you reset a data reference to the template specification, PI Builder resets the configuration string to the template value and ignores any change to the AttributeConfigString column in the worksheet.

2. On the **PI Builder** tab, in the **Build** group, click **Reset to Template**.

PI Builder writes *<Template>* in the selected cells to mark the corresponding attributes for resetting to template specification.

You cannot use PI Builder to set the value of an attribute to the string "<Template>" unless the attribute is not based on a template and the attribute type is String.

3. Place an X in the Selected(x) column of any object that contains attributes you marked to reset to the template specification.
4. Publish the changes to PI AF:
 - a. On the **PI Builder** tab, click **Publish** to open the Publish Options window.

- b. From the **Edit Mode** list, select **Edit Only** to guard against mistakenly creating new objects.
- c. Click **OK** to publish the changes to PI AF.

If any of the selected objects do not already exist, PI Builder generates an error.

Templates

You can use PI Builder to create, retrieve, edit, and delete templates with Microsoft Excel.

Retrieve selected templates

Before you can retrieve templates, you need to [Specify a database](#).

You can use PI Builder to retrieve selected templates from a PI AF database into Microsoft Excel.

1. On the **PI Builder** tab, click **Library > Templates > Find Templates** to open the Template Selection window.
Alternatively, click **Library > Templates** and then click the template type to retrieve all the templates of that type. For example, click **Library > Templates > Element Templates** to retrieve all the element templates available in PI AF, and then proceed to step 5 to specify the columns.
2. From the **Type** list, select the type of template you want to find.
Select **<All>** to see all the templates in the database.
In the results table, PI Builder lists the templates of the selected type.
3. If desired, filter the list of templates further:
 - a. From the Actions ▼ list, select the search criteria:
 - Select one type of filter: **Contains**, **Exact Match**, **Starts With**, or **Ends With**.
 - Select one or more fields to search for matches: **Name**, **Description**, **Category**, and **Type**.
 - b. In the **Filter** field, type the text that you want to search for and press Enter
PI Builder returns the templates that match the filter in any of the specified fields.
4. Select one or more templates to retrieve and click **OK**.
5. In the Select Object Types and Column Headers window, select the objects and column headers to include in the worksheet, and then click **OK**.

Note: Use the **Template** field to retrieve attributes from a template. The attributes defined by the selected template are displayed in the **Attributes Columns (from Template 'name')** group in the **Object Types** list.

PI Builder retrieves the selected templates into the worksheet and fills the selected columns with available data.

Note: PI Builder also retrieves the base template, if there is one. For example, if you have a template, Template2, with a base template called Template1, then you will retrieve both Template1 and Template2 when you specify only Template2. The **BaseTemplateOnly** field indicates if a template is an abstract template. Objects cannot be instantiated directly from abstract templates.

Retrieve all templates of a particular type

Before you can retrieve templates, you need to [Specify a database](#).

You can use PI Builder to retrieve all templates of a particular type from a PI AF database into Microsoft Excel. Specifically, PI Builder can retrieve templates for cases, elements, event frames, models, or transfers.

1. On the **PI Builder** tab, click **Library > Templates** and then click the template type to retrieve all the templates of that type.

For example, click **Library > Templates > Element Templates** to retrieve all the element templates from the current PI AF database.

Note: To retrieve analyses templates, see [Create analyses \(templates\) with PI Builder](#).

2. In the Select Object Types and Column Headers window, select the objects and column headers to include in the worksheet, and then click **OK**.

Note: Use the **Template** field to retrieve attributes from a template. The attributes defined by the selected template are displayed in the **Attributes Columns (from Template 'name')** group in the **Object Types** list.

PI Builder retrieves all the templates of the selected type into the worksheet and fills the selected columns with available data.

Value entry

You can use PI Builder to enter values for PI AF objects.

- Attribute values (except attributes that contain data references)
- Attribute template default values
- Extended property values

Objects that take values

You can use PI Builder to enter and publish values to PI AF for:

- Attribute values (except attributes that contain data references)
- Attribute template default values
- Extended property values

Value types

Topics in this section discuss PI Builder support for the value types of specific PI AF objects.

Supported value types

The following tables list the attribute types or value types that PI Builder supports for attributes, attribute templates, and extended properties. PI Builder also supports the Enumeration Set value type for attributes and attribute templates (corresponds to the *AFEnumerationValue* attribute type in a PI Builder worksheet). See [Value formats](#) for more information.

Supported basic types

Value type in PI System Explorer	Attribute type in PI Builder worksheet
Boolean	Boolean
Byte	Byte
DateTime	DateTime
Double ¹	Double
Guid	Guid
Int16	Int16
Int32	Int32

Int64	Int64
Single ¹	Single
String	String

¹Floating point

Supported array types

Value type in PI System Explorer	Attribute type in PI Builder worksheet
Boolean Array	Boolean[]
Byte Array	Byte[]
DateTime Array	DateTime[]
Double Array ¹	Double[]
Guid Array	Guid[]
Int16 Array	Int16[]
Int32 Array	Int32[]
Int64 Array	Int64[]
Single Array ¹	Single[]
String Array	String[]

¹Floating point

Supported object types

Value type in PI System Explorer	Attribute type in PI Builder worksheet
<Anything> ¹	Object
Attribute	AFAAttribute
Element	AFEElement

¹Supported but not recommended.

Partially supported value types

PI Builder offers limited support for the following value types:

- **Tables**

A retrieved table produces an encoded value. You cannot easily interpret this value, but you can copy and paste it, if you want another attribute with the same table. If you incorrectly edit this value and try to publish back to PI AF, then the Publish Selected Options window shows an error message that indicates an error in the encoded value.

Unsupported value types

PI Builder does not support the following value type for attribute values, attribute template default values, or extended property values:

- **File**

If you retrieve a value of type File, PI Builder puts the file name in the corresponding cell; the progress window includes a message that says values having type File will be ignored. If you try to edit the value and publish it back to PI AF, PI Builder skips the new value; the progress window includes a message that says values of type File are not yet supported.

Value formats

Accepted formats vary with value type. The following list contains value types and accepted formats.

Note: PI Builder reformats many cells as text. To use formulas or text concatenation in these cells, you must first change the cell format back to General.

- **Dates and times**

If the value type is DateTime, you can type the time in any string format that is supported by PI AF (including PI time formats) or the .NET DateTime object. By default, PI Builder displays times in local time. Some examples of valid entries:

**-5d*

May 12, 2009

07 06 2010 10:00:00 AM

09 14 2008 14:00:00

Note: PI Builder resolves the PI time format and sends the resulting date and time to PI AF when publishing. For, example, you could enter * to specify the date and time of the publishing.

- **Arrays**

When entering arrays, separate array values with a list-separation character. The list-separation character depends on your specified locale settings. For US-English, the list-separation character is the comma (,).

For example, if you retrieve an attribute of value type Double Array, then the type cell in Excel will be set to *Double[]*. If that array has three members, say, 1.1, 2.2, and 3.3, then the value cell in Excel will contain:

1.1,2.2,3.3

- **Numbers with units of measures**

You can enter floating-point values (double and single) with a unit of measure (UOM), provided the definition of the attribute or attribute template specifies a UOM of the same class:

1.4 m

36.5 degC

Note: To indicate degrees (°), either spell out the word degree and unit or to use the degree abbreviation. For example, you can spell out degree Celsius or use degC; and you can spell out degree Fahrenheit or use degF.

- **Strings**

Enter strings without quotes. For example:

My Sample String

If you include quotes, the quotes will be part of the string.

Note: If you have a string value that Excel might interpret as different type, then preface the string with a single quote. For example, Excel will convert a string of 00045 to 45. A leading single quote informs Excel that the value is a string and its format should not be changed.

- **Data references**

If the attribute has a data reference, then the AttributeValue column is empty and the data reference is specified by a configuration string in the AttributeDataReference column (see [Attribute-specific columns for data references](#)). For data references in attribute columns, a data-reference value has a specific format (see [Data references in attribute columns](#)).

- **Characters in PI AF object names**

In PI AF, the following restrictions apply to object names:

- For all names, except contacts, you cannot use control characters or the following characters: * ? ; { } [] | \ ' " " " "
- Leading or trailing spaces will be removed. A blank name is not allowed.
- Maximum name length is 259 characters.

- **Anything**

For an attribute whose value type is Anything, the value cell should begin with the type name, followed by a blank and then the value. For example:

double 1.4

Note: Though allowed, the Anything value type is not recommended.

- **Enumeration sets**

If the value type of an attribute is an enumeration set, then to set the attribute value, you must specify both the enumeration set and the value from the set to use: Enter AFEnumerationValue in the **AttributeType** column, the name of the enumeration set in the **AttributeTypeQualifier** column, and the enumeration value in the **AttributeValue** column.

For example, suppose you have the following enumeration set, named Materials:

To specify an attribute value of WX12000 from the set, you could use either of the following settings:

In both cases, the value of the **AttributeType** column must be AFEnumerationValue and the value of the **AttributeTypeQualifier** column must be Materials.

Null values

If you publish an empty cell for an attribute with a value type that accepts null values, PI Builder sets the value to null.

PI Builder can set values to null for attributes and attribute templates when the value type accepts null values. To set a value to null, clear the value in Microsoft Excel and then publish the object to PI AF.

If you publish an object with an empty cell and the value type for the object does not accept null values (including arrays), PI Builder does not make a change; it ignores the empty cell.

The following value types accept null values:

- Anything
- Element
- Attribute
- Enumeration set
- String

For strings, the new value will be the empty string ("").

Create reference types in PI Builder

You can use PI Builder to create, retrieve, edit, and delete PI AF reference types with Microsoft Excel.

Retrieve all reference types

You can use PI Builder to retrieve all reference types from a PI AF database into Microsoft Excel.

Prerequisite: Before you can retrieve reference types, you need to [Specify a database](#).

1. On the **PI Builder** tab, click **Library > Reference Types > All Reference Types**.
2. In the Select Object Types and Column Headers window, select the objects and column headers to include in the worksheet, and then click **OK**.

PI Builder retrieves the reference types into the worksheet and fills the selected columns with available data.

Retrieve selected reference types

Before you can retrieve reference types, you need to [Specify a database](#).

You can use PI Builder to retrieve selected reference types from a PI AF database into Microsoft Excel.

1. On the **PI Builder** tab, click **Library > Reference Types > Find Reference Types** to open the Reference Type Selection window.
2. If desired, filter the list of reference types further:
 - a. From the **Actions** list, select the search criteria:
 - Select one type of filter: **Contains, Exact Match, Starts With, or Ends With**.
 - Select one or more fields to search for matches: **Name, Child Name, Parent Name, Strength, Category, Allowed Parent Template, Allowed Child Template**.
 - b. In the **Filter** field, type the text that you want to search for and press Enter
 - Select one or more fields to search for matches: **Name, Child Name, Parent Name, Strength, Category, Allowed Parent Template, Allowed Child Template**.
3. Select one or more reference types to retrieve and click **OK**.
4. In the Select Object Types and Column Headers window, select the objects and column headers to include in the worksheet, and then click **OK**.

PI Builder retrieves the selected reference types into the worksheet and fills the selected columns with available data.

Digital states in PI Builder

You can use PI Builder to create, edit, and delete digital state sets and digital states from any connected Data Archive server.

Create digital states

Before you create digital states, you need to [Specify a Data Archive server](#).

With PI Builder, you can enter the specification for new digital state sets and digital states in a Microsoft Excel worksheet, and then publish the worksheet to Data Archive to create the digital states sets and digital states. With the auto-fill features in Excel, you can easily create multiple digital state sets with similar specifications.

1. Add columns to the worksheet for digital state sets.

See [Set column headers in a worksheet](#). Do not include the UniqueID column. Data Archive automatically generates a value when creating new digital state sets.

Note: To base new digital state sets on existing digital state sets, retrieve those existing digital state sets into your worksheet, and then change the names.

2. Specify the values for the new digital state sets and digital states.

- To create a new digital state set, specify a row in the worksheet with the ObjectType column set to DigitalStateSet and the Name column set to the name of the digital state set.
- To create new digital state for a digital state set, specify a row in the worksheet with the following values set:

Column	Value
Parent	Name of digital state set
Name	Text that identifies the state
ObjectType	DigitalState
Value	Unique integer for the digital state set. Values must be sequential integers, starting with 0.

3. Set the Selected(x) column to X for any digital state set or digital state that you want to create.

4. Publish the new digital state sets and digital states to Data Archive:

- a. Click **Publish** to open the Publish Options window.
- b. From the **Edit Mode** list, select **Create Only**.

With this choice, PI Builder will only create new digital states and digital state sets. If digital state or digital state set already exists with the same name, PI Builder generates an error. You can also select **Create and Edit**; then, PI Builder will edit existing digital states and create any digital states that do not already exist.

- c. Click **OK**.

PI Builder creates the digital state sets and digital states in Data Archive. The Publish Selected Objects window shows the operations completed.

- d. Click **Close**.

Retrieve all digital states

Before you retrieve all digital states, you need to [Specify a Data Archive server](#).

You can use PI Builder to retrieve all the digital state sets and digital states from Data Archive into Microsoft Excel.

1. On the **PI Builder** tab, click **PI Points > All Digital States**.
2. In the Select Object Types and Column Headers window, select the objects and column headers to include in the worksheet, and then click **OK**.

PI Builder retrieves all the digital state sets along with their digital states into the worksheet and fills the selected columns with available data.

Retrieve selected digital states

Before you can retrieve digital states, you need to [Specify a Data Archive server](#).

You can use PI Builder to retrieve selected digital state sets and their digital states from Data Archive into Microsoft Excel.

1. On the **PI Builder** tab, click **PI Points > Find Digital States** to open the State Set Selection window, which lists the digital state sets in the connected Data Archive server.
2. If desired, filter the list of digital state sets further:

- a. From the Actions list, select the search criteria:
 - Select one type of filter: **Contains**, **Exact Match**, **Starts With**, or **Ends With**.
 - Select one or more fields to search for matches: **Name** and **Description**.
- b. In the Filter field, type the text that you want to search for and press Enter.

PI Builder returns the digital state sets that match the selected criteria.

3. Select one or more digital state sets to retrieve into the worksheet and click **OK**.
4. In the Select Object Types and Column Headers window, select the objects and column headers to include in the worksheet, and then click **OK**.

PI Builder retrieves the selected points into the worksheet and fills the selected columns with available data.

Edit digital states

Before you can edit digital states, you need to [Retrieve selected digital states](#).

After you retrieve digital state sets and digital states into Microsoft Excel with PI Builder, you can edit the digital state sets and digital states and then publish those changes to Data Archive.

1. If necessary, add additional columns that correspond to values that you want to change and click **Retrieve** to retrieve current values.

See [Set column headers in a worksheet](#).

2. Optional: Clear all values from the Selected(x) column in the worksheet.

You want to mark only the rows that contain edits with an X. Clearing the column before you begin can help you track which rows changed.

3. Edit any values that you want to change.

To change the digital state set name or digital state name, include the NewName column and enter the new name in that column.

4. Set the Selected(x) column to X for any row where you edited a value.

5. Publish the changes to Data Archive:

- a. On the **PI Builder** tab, click **Publish** to open the **Publish Options** window.
- b. From the **Edit Mode** list, select **Edit Only** to guard against mistakenly creating new objects.
- c. Click **OK** to publish the changes to Data Archive.

If any of the selected objects do not already exist, PI Builder generates an error.

Delete digital states

Enable the **Delete** button. See [Configure build settings](#).

After you retrieve digital state sets into Microsoft Excel, you can use PI Builder to delete selected digital state sets or digital states from Data Archive.

1. [Retrieve selected digital states](#).

2. For digital states or digital state sets that you want to delete, enter X in the Selected(x) column; clear the column for any digital state or digital state set that you want to retain.

To delete single digital states, you must delete those with higher enumeration values before those with lower enumeration values. On the other hand, if you delete a digital state set, you delete all digital states in that set.

3. On the **PI Builder** tab, in the **Build** group, click **Delete**.

4. At the confirmation prompt, click **Yes**.

PI Builder deletes the selected digital states or digital state sets from Data Archive. The Delete Selected Objects window shows the operations completed.

Enumeration sets

You can use PI Builder to create, retrieve, edit, and delete PI AF enumeration sets with Microsoft Excel. Enumeration sets map an ordered set of user-defined constant values to a string, and promote consistent nomenclature throughout your databases.

When creating templates, you can use enumeration sets to ensure users assign only predefined attribute values from a list when a new element is created in PI System Explorer. For example, you could create an enumeration set for all pump vendors and then add it to an element template as an attribute. Each time a new pump is created, users can only assign one of the vendor names from a predefined list.

See also

[Create an enumeration set](#)

[Edit PI AF objects](#)

[Delete PI AF objects](#)

Create an enumeration set

You can create an enumeration set to establish predefined values for an attribute template. When you configure element attributes based on the template, users can only assign one of these values to the attribute from a pre-populated list.

To use PI Builder to create enumeration sets, you create the enumeration set, assign enumeration values to it, and then publish the worksheet to PI AF. With the auto-fill features in Excel, you can easily create multiple enumeration sets with similar specifications.

1. [Specify a database.](#)
2. On the PI Builder Ribbon, click **Headers** in the Resources group.
The Select Object Types and Column Headers window opens.
3. From the **Object Type** list, select **EnumerationSet**.
The **Object Types** list updates to show the available columns for an enumeration set object.
4. Select the desired column headers for the worksheet, then click **OK**. At a minimum, select the **Description** and **Value** column headers.
5. In row 2, create the enumeration set:
 - a. In the **Selected(x)** field, ensure an X appears.
 - b. In the **Name** field, enter a name for the enumeration set .
 - c. In the **ObjectType** field, ensure EnumerationSet appears.
 - d. In the **Description** field, enter a description for the enumeration set.
6. In row 3, add predefined values to the enumeration set:
 - a. Enter an X in the **Selected(x)** field.

- b. In the **Parent** field, enter the name of the enumeration set you entered in step 5b.
 - c. In the **Name** field, enter a descriptive name for the predefined value.
 - d. In the **ObjectType** field, enter EnumerationValue.
 - e. In the **Description** field, enter a description for the enumeration value.
 - f. In the **EnumerationValue** field, enter a value.
7. Repeat step 6 to assign more predefined values to the enumeration set.

Note: If you do not specify values for other column headers, PI AF will set those attributes to their default values.

8. Publish to PI AF:
 - a. Click **Publish** to open the Publish Options window.
 - b. From the **Edit Mode** list, select **Create Only**.
 With this choice, PI Builder will only create a new enumeration set. If a selected object with the same name already exists, PI Builder generates an error. You can also select **Create and Edit**; then, PI Builder will modify existing objects and create any objects that do not already exist. PI Builder uses the **Name** column to find existing objects with the same name.
 - c. If you specified an attribute that references a category that does not yet exist, select the **Automatically create missing categories** check box to request that PI Builder automatically create the needed categories.
 If you do not select this check box and one or more categories do not exist, PI Builder will generate an error during publication.
 - d. Click **OK** to publish the objects to PI AF.
 PI Builder automatically checks in the changes. The Publish Selected Objects window shows the operations completed.
 - e. Click **Close**.

Retrieve all enumeration sets

Before you can retrieve enumeration sets, you need to [Specify a database](#).

You can use PI Builder to retrieve all enumeration sets from a PI AF database into Microsoft Excel.

1. On the **PI Builder** tab, click **Library > Enumeration Sets > All Enumeration Sets**.
2. In the Select Object Types and Column Headers window, select the objects and column headers to include in the worksheet, and then click **OK**.

PI Builder retrieves the enumeration sets into the worksheet and fills the selected columns with available data.

Retrieve selected enumeration sets

Before you can retrieve enumeration sets, you need to [Specify a database](#).

You can use PI Builder to retrieve selected enumeration sets from a PI AF database into Microsoft Excel.

1. On the **PI Builder** tab, click **Library > Enumeration Sets > Find Enumeration Sets** to open the Enumeration Set Selection window.
2. If desired, filter the list of enumeration sets further:
 - a. From the **Actions** list, select the search criteria:
 - Select one type of filter: **Contains**, **Exact Match**, **Starts With**, or **Ends With**.
 - Select one or more fields to search for matches: **Name** and **Description**.
 - b. In the **Filter** field, type the text that you want to search for and press Enter

PI Builder returns the enumeration sets that match the selected criteria.

3. Select one or more enumeration sets to retrieve and click **OK**.
4. In the Select Object Types and Column Headers window, select the objects and column headers to include in the worksheet, and then click **OK**.

PI Builder retrieves the selected enumeration sets into the worksheet and fills the selected columns with available data.

Models, event frames, and transfers

The topics in this chapter explain how to retrieve models, event frames, and transfers into your Excel spreadsheets using PI Builder.

Models

You can use PI Builder to create, retrieve, edit, and delete PI AF models with Microsoft Excel.

Retrieve all models

Before you can retrieve models, you need to [Specify a database](#).

You can use PI Builder to retrieve all models from a PI AF database into a worksheet.

1. On the **PI Builder** tab, click **Elements > All Models**.
2. In the Select Object Types and Column Headers window, select the objects and column headers to include in the worksheet, and then click **OK**.

Note: Use the **Template** field to retrieve attributes from a template. The attributes defined by the selected template are displayed in the **Attributes Columns (from Template 'name')** group in the **Object Types** list.

PI Builder retrieves all the models from your database into the worksheet and fills the selected columns with available data.

Retrieve selected models

Before you can retrieve models, you need to [Specify a database](#).

You can use PI Builder to retrieve selected models from a PI AF database into Microsoft Excel.

1. On the **PI Builder** tab, click **Elements > Find Models** to open the Model Selection window, which lists the models in the connected database.
2. If desired, filter the list of models further:
 - a. From the **Actions** list, select the search criteria:
 - Select one type of filter: **Contains**, **Exact Match**, **Starts With**, or **Ends With**.
 - Click **Set Maximum Query Size** to open the window where you can specify the maximum number of models to return.
 - Select **Include Children** to search and return children-level models.
 - Select one or more fields to search for matches: **Name**, **Path**, **Description**, **Category**, **Type**, and **Template**.
 - b. In the **Filter** field, type the text that you want to search for and press Enter
PI Builder returns the models that match the selected criteria.

3. Select one or more models to retrieve and click **OK**.
4. In the Select Object Types and Column Headers window, select the objects and column headers to include in the worksheet, and then click **OK**.

Note: Use the **Template** field to retrieve attributes from a template. The attributes defined by the selected template are displayed in the **Attributes Columns (from Template 'name')** group in the **Object Types** list.

PI Builder retrieves the selected models into the worksheet and fills the selected columns with available data.

Event frames

You can use PI Builder to create, retrieve, edit, and delete event frames.

Retrieve event frames by searching

Before you can retrieve event frames, you need to [Specify a database](#).

You can use PI Builder to search a PI AF database for specific event frames and retrieve them into Microsoft Excel.

1. On the **PI Builder** tab, click **Event Frames > Find Event Frames** to open the Event Frame Search window.
2. Set the Event Frame Search window to find the desired event frame or event frames in the PI AF database.

Note: If you specify values for multiple criteria, the search returns only those event frames that match all the specified criteria.

3. From the **Actions** list, select the type of filter to apply: **Contains**, **Exact Match**, **Starts With**, or **Ends With**.
4. Choose from the following actions:

To ...	Do this ...
Type one or more filter conditions directly into the Enter Event Frame Criteria field	<ul style="list-style-type: none"> • Use the : or := operator to select elements that match a name, description, template, primary element name, or category. • Use special characters as needed. For more information, see Special characters in name searches. • Enclose strings that contain spaces or special characters with the " character. • Separate filter conditions with a whitespace, for example: Category:"Processing Plants" Name:Cracking Beginning with PI AF 2018 SP2, you can use OR conditions when typing directly. For example: • "Name:'EventFrameName' (Attribute1:>5 OR Attribute2:<2)" • "Description:'TestDescription' OR Name:'TestName'"
Filter event frames under Criteria	Enter values in the following fields as needed. Click Add Criteria to enter criteria for additional fields.

- **Search**

Select the method you want to use to specify when the desired event frames occurred. The window shows the appropriate fields for the selected method.

For example, select **Active Between** to specify a start time and end time, and find event frames active any time during that period. Select **Starting After** to specify only a start time, and find event frames that start after that time.

- **In Progress**

If available, select this check box to further restrict matching event frames to those that have not yet finished.

- **Search start**

A PI time expression that specifies the start of the time period used to search for event frames.

- **Search end**

A PI time expression that specifies the end of the time period used to search for event frames.

Optional. From the list next to this field, select a defined time to automatically fill in the **Search start** and **Search end** fields.

- **All Descendants**

Select this check box to search all levels of the event frame hierarchy below the specified root for matching event frames.

- **Name**

Enter the name of the event frame to retrieve, based on the filter type. You can enter special characters to match part of a name. See Special characters in name searches.

- **Element Name**

Enter a PI AF element that must be the parent of any retrieved event frames. You can enter special characters to match part of a name. See Special characters in name searches.

- **Category**

Select the category that retrieved event frames must match.

- **Results per Page**

Enter the maximum number of event frames to show on a single page of the search results.

- **Template**

Select the template that retrieved event frames must be based on. After you select a template, you can add criteria to find elements by attribute value.




- **Analysis Name**

Enter the name of the analysis that retrieved event frames were generated from. You can use wildcards as needed.

- **Attribute Value**



You can specify up to three conditions for an attribute value. For each condition, specify an attribute name, operator, and attribute value, such as Temperature >= 98.

- In versions prior to PI AF 2018, only available when you specify a template. For more details, see Configure search conditions for attribute values when a template is specified.

- In PI AF 2018 and later versions, you can specify attribute values without needing to specify a template. For more details, see [Configure search conditions for attribute values when no template is specified](#).
- **Duration**
Select an operator and enter a value, which can include a PI time abbreviation. For example, select `>=` and enter `1d` to retrieve events that last at least one day. You can select **Duration** a second time and filter the search for results between two values. For example, select `<=` and enter `2d` to retrieve events that lasted between one and two days.
- **Event Frame Search Root**
Enter the event frame that you want to use as the root or base level for the event frame search. Type the exact name or click Browse  to open the Event Frame Browser window, where you can view the event frame hierarchy and select an event frame. You cannot include wildcard characters in the entered name. If you do not specify an event frame, you set the main level of the event frame hierarchy as the root. Depending on the complexity of your PI AF hierarchy, specifying an event frame in the **Event Frame Search Root** field can improve search performance.
- **Can Be Acknowledged**
(PI AF 2016 or later versions.) Set to `True` to retrieve event frames that can be acknowledged. The ability to acknowledge event frames is determined in the template on which the event frame is based.
- **Is Acknowledged**
(PI AF 2016 or later versions.) Set to `True` to retrieve event frames that have been acknowledged. Set to `False` to retrieve only event frames that have not been acknowledged.
- **Is Annotated**
(PI AF 2016 or later versions.) Set to `True` to retrieve only event frames that have annotations. Set to `False` to retrieve only event frames that do not have annotations.
- **Severity**
(PI AF 2016 or later versions.) Select an operator and select a severity setting from the list. For example, select `>=` `Minor` to retrieve event frames that have at least a `Minor` severity setting. You can select **Severity** a second time and filter the search for results between two severity settings. For example, select `<=` `Critical` to retrieve event frames that have `Minor`, `Major` and `Critical` severity settings.
- **Creation Date**
(PI AF 2017 or later versions.) Select an operator and enter a date or a PI time abbreviation (`>=` `*-30d` is the default) to retrieve event frames that were created in the specified period. You can also click  to select a date in the Date and Time Picker window. You can select **Creation Date** a second time and filter the search for results between two values (`< *+1d` is the default).
- **Modify Date**
(PI AF 2017 or later versions.) Select an operator and enter a date or a PI time abbreviation (`>=` `*-30d` is the default) to retrieve event frames that were modified in the specified period. You can also click  to select a date in the Date and Time Picker window. You can select **Modify Date** a second time and filter the search for results between two values (`< *+1d` is the default).

Note: An event frame's modify date is updated whenever a capture value, an annotation, or a child event frame is added, as well as when a change to its configuration is checked into the database. Most template changes, or any modification to an attribute value that is not a configuration item, will not affect an event frame's modify date.

5. Optional. Specify how you want results to be displayed in the **Results** table.

To ...	Do this ...
Group by template	Select the Template check box.
Group by category	Select the Category check box.
Change column selections	<ul style="list-style-type: none"> a. Right-click the column heading in the Results table or white space below. b. Click Column Visibility. c. Select or clear column selections as needed.
Display attributes as columns	<ul style="list-style-type: none"> d. Click  and click Select Attributes. e. In the Select Attributes window, use standard Windows keystrokes to highlight contiguous (SHIFT+<click>) or non-contiguous (CTRL+<click>) attributes. f. Click . g. Click OK.
Display full paths of event frames	<ul style="list-style-type: none"> h. Right-click the column heading in the Results table or white space below. i. Click Show Full Paths.
Conceal full paths of event frames	<ul style="list-style-type: none"> j. Right-click the column heading in the Results table or white space below. k. Click Hide Full Paths.

6. Click **Search** to retrieve the matching event frames into the **Results** table.
7. In the **Results** table, select the event frames you want to retrieve into the worksheet and click **OK**.

Tip: Select none of the event frames, and then click **OK** to retrieve all of the event frames from the **Results** table into the worksheet. Beginning with PI Builder 2018, this also overrides the **Results per Page** setting and returns all results that match your search criteria.

8. In the Select Object Types and Column Headers window, select the column headers to include in the worksheet, and then click **OK** to retrieve the event frames.

Note: Use the **Template** field to retrieve attributes from a template. The attributes defined by the selected template are displayed in the **Attributes Columns (from Template 'name')** group in the **Object Types** list.

Retrieve event-frame attributes by searching

Before you can retrieve event-frame attributes, you need to [Specify a database](#).

You can use PI Builder to search for event-frame attributes in a PI AF database, and then retrieve them into Microsoft Excel.

1. On the **PI Builder** tab, click **Event Frames > Find Event Frame Attributes** to open the Event Frame Attribute Search window.
2. Specify which attributes you want to find and in which event frames to look, and then click **Search** to retrieve the matching event-frame attributes into the **Search results** table.
3. In the **Search results** table, select the event-frame attributes to retrieve into Excel, and then click **OK**.
4. In the Select Object Types and Column Headers window, select the column headers to include in the worksheet, and then click **OK** to retrieve the event-frame attributes.

Note: Use the **Template** field to retrieve attributes from a template. The attributes defined by the selected template are displayed in the **Attributes Columns (from Template 'name')** group in the **Object Types** list.

Retrieve event frames from saved searches

Before you can retrieve event frames, you need to [Specify a database](#).

You can use PI Builder to find event frames in a PI AF database using a search previously saved in PI System Explorer, and then retrieve those event frames into Microsoft Excel.

1. On the **PI Builder** tab, click **Event Frames > Saved Event Frame Searches** to open the Saved Search Selection window.
The window lists searches saved in PI System Explorer.
2. In the **Saved Event Frame Searches** table, select the search you want to run and click **Search**.
PI Builder returns the event frames in the **Search Results** table.
3. If desired, sort the event frames:
 - Select the **Category** check box to group the event frames by category.
 - Select the **Template** check box to group the event frames by template.
4. In the **Search Results** table, select the event frames you want to retrieve into Excel and click **OK**.
5. In the Select Object Types and Column Headers window, select the column headers to include in the worksheet, and then click **OK** to retrieve the event frames.

Note: Use the **Template** field to retrieve attributes from a template. The attributes defined by the selected template are displayed in the **Attributes Columns (from Template 'name')** group in the **Object Types** list.

Transfers in PI Builder

You can use PI Builder to create, retrieve, edit, and delete transfers with Microsoft Excel.

Retrieve transfers by searching

Before you can retrieve transfers, you need to [Specify a database](#).

You can use PI Builder to search a PI AF database for transfers and retrieve them into Microsoft Excel.

1. On the **PI Builder** tab, click **Event Frames > Find Transfers** to open the Transfer Search Criteria window.
2. Specify which transfers you want to find, and then click **Search**.
3. In the **Search results** table, select the transfers to retrieve into Excel, and then click **OK**.

Note: Select none of the transfers, and then click **OK** to retrieve all of the transfers from the **Search results** table into the worksheet.

4. In the Select Object Types and Column Headers window, select the column headers to include in the worksheet, and then click **OK** to retrieve the transfers.

Note: Use the **Template** field to retrieve attributes from a template. The attributes defined by the selected template are displayed in the **Attributes Columns (from Template 'name')** group in the **Object Types** list.

Retrieve transfer attributes by searching

Before you can retrieve transfers, you need to [Specify a database](#).

You can use PI Builder to search a PI AF database for transfer attributes and retrieve them into Microsoft Excel.

1. On the **PI Builder** tab, click **Event Frames > Find Transfer Attributes** to open the Transfer Attribute Search window.
2. Specify which attributes you want to find and in which transfers to look, and then click **Search**.
3. In the **Search results** table, select the transfer attributes to retrieve into Excel, and then click **OK**.
4. In the Select Object Types and Column Headers window, select the column headers to include in the worksheet, and then click **OK** to retrieve the transfer attributes.

Note: Use the **Template** field to retrieve attributes from a template. The attributes defined by the selected template are displayed in the **Attributes Columns (from Template 'name')** group in the **Object Types** list.

Retrieve transfers from saved searches

Before you can retrieve transfers, you need to [Specify a database](#).

You can use PI Builder to find transfers in a PI AF database with a search previously saved in PI System Explorer, and then retrieve those transfers into Microsoft Excel.

1. On the **PI Builder** tab, click **Event Frames > Saved Transfer Searches** to open the Saved Search Selection window.
The window lists searches saved in PI System Explorer.
2. In the **Saved Transfer Searches** table, select the search you want to run, and then click **Search**.
3. In the **Search Results** table, select the transfers you want to retrieve into Excel, and then click **OK**.
4. In the Select Object Types and Column Headers window, select the column headers to include in the worksheet, and then click **OK** to retrieve the transfers.

Note: Use the **Template** field to retrieve attributes from a template. The attributes defined by the selected template are displayed in the **Attributes Columns (from Template 'name')** group in the **Object Types** list.

Categories, UOMs, and contacts

These topics in this chapter explain how to retrieve categories, units of measure (UOMs), and contacts into your Excel spreadsheets using PI Builder.

Categories

You can use PI Builder to create, retrieve, edit, and delete PI AF categories with Microsoft Excel.

Retrieve all categories

You can use PI Builder to retrieve all categories from a PI AF database into Microsoft Excel.

Prerequisite: Before you can retrieve categories, you need to [Specify a database](#).

1. On the **PI Builder** tab, click **Library > Categories > All Categories**.
2. In the Select Object Types and Column Headers window, select the objects and column headers to include in the worksheet, and then click **OK**.

PI Builder retrieves all the categories from the current PI AF database into the worksheet and fills the selected columns with available data.

Retrieve selected categories

Before you retrieve categories, you need to [Specify a database](#).

You can use PI Builder to retrieve selected categories from a PI Builder database into Microsoft Excel.

1. On the **PI Builder** tab, click **Library > Categories > Find Categories** to open the Category Selection window.
2. From the **Type** list, select the type of category that you want to retrieve.

Select **<All>** to see all the categories in the database.

PI Builder shows the categories for the selected type.

3. If desired, filter the list of categories further:
 - a. From the **Actions** ▼ list, select the search criteria:
 - Select one type of filter: **Contains**, **Exact Match**, **Starts With**, or **Ends With**.
 - Select one or more fields to search for matches: **Name** and **Description**.
 - b. In the **Filter** field, type the text that you want to search for and press Enter
PI Builder returns the categories that match the filter in any of the selected fields.
4. Select one or more categories to retrieve and click **OK**.
5. In the Select Object Types and Column Headers window, select the objects and column headers to include in the worksheet, and then click **OK**.

PI Builder retrieves the selected categories into the worksheet and fills the selected columns with available data.

Retrieve all categories of a particular type

Before you can retrieve categories, you need to [Specify a database](#).

You can use PI Builder to retrieve all categories of a particular type from a PI AF database into Microsoft Excel. Specifically, you can retrieve categories of analyses, attributes, elements, reference types, or tables.

1. On the **PI Builder** tab, click **Library > Categories** and then click the category type.
For example, to retrieve all the element categories, click **Library > Categories > Element Categories**.
2. In the **Select Object Types and Column Headers** window, select the objects and column headers to include in the worksheet, and then click **OK**.
PI Builder retrieves all the categories of the selected type from the current PI AF database into the worksheet and fills the selected columns with available data.

Units of measure

You can use PI Builder to create, retrieve, edit, and delete PI AF units of measure with Microsoft Excel.

Note: You must have proper permissions in the UOM database to create, edit, or delete units of measure.

Retrieve all units of measure

Before you can retrieve units of measure, you need to [Specify a database](#).

You can use PI Builder to retrieve all units of measure from a PI AF database into Microsoft Excel.

1. On the **PI Builder** tab, click **Library > Units of Measure > UOM Database**.
2. In the **Select Object Types and Column Headers** window, select the objects and column headers to include in the worksheet, and then click **OK**.
For example, from the **Object Types** list, select the **UOMClass** and **UOM** check boxes to retrieve all the unit-of-measure classes and the units of measures in the database.
PI Builder retrieves all of the selected objects into the worksheet and fills the selected columns with available data.

Retrieve units of measure for selected UOM classes

Before you can retrieve units of measure, you need to [Specify a database](#).

You can use PI Builder to retrieve the units of measure (UOM) for selected UOM classes from a PI AF database into Microsoft Excel.

1. On the **PI Builder** tab, click **Library > Units of Measure > Find UOM Classes** to open the Unit-of-Measure Class Selection window.
The **Class** list shows all the UOM classes in the PI AF database.

2. If desired, filter the list of UOM classes further:
 - a. From the **Filter** list, select one type of filter: **Contains, Exact Match, Starts With, Ends With**.
 - b. In the **Filter** field, type the text that you want to search for and press Enter.

PI Builder returns the UOM classes that match the selected criteria.
 3. Select one or more classes to retrieve and click **OK**.
 4. In the Select Object Types and Column Headers window, select the objects and column headers to include in the worksheet, and then click **OK**.
- For example, from the **Object Types** list, select the **UOMClass** and **UOM** check boxes to retrieve both the selected UOM classes and their UOMs into the worksheet.
- PI Builder retrieves the selected objects into the worksheet and fills the selected columns with available data.

Note: PI Builder also retrieves the base class of selected UOM classes. For example, if you select the Area class, PI Builder also retrieves the Length class.

Edit UOM group mappings

Before you can edit UOM group mappings, you need to [Specify a database](#).

Beginning with PI AF 2017 R2, units of measure that are included as part of PI AF are mapped to UOM groups, such as **Metric** and **US Customary**. Once you have selected which UOM group you prefer to use at your location, you can display all attribute values with units of measure mapped to that UOM group rather than the default UOMs that are defined in attribute templates.

You can use PI Builder to create additional UOM groups, as well as edit UOM group mappings in Microsoft Excel and then publish the changes to PI AF.

1. On the **PI Builder** tab, click **Library > Units of Measure > UOM Database**.
2. In the Select Object Types and Column Headers window, select the objects and column headers to include in the worksheet, and then click **OK**.

For example, from the **Object Types** list, select the **UOMClass** and **UOM** check boxes to retrieve all the unit-of-measure classes and the units of measures in the database.

Note: If not already selected, select the **UOMGroup** check box.

PI Builder retrieves all of the selected objects into the worksheet and fills the selected columns with available data.

- UOM groups are identified by square brackets in the column heading, for example, **[Metric]** and **[US Customary]**.
 - Mappings specified for each UOM in a given UOM group are shown at the intersection of the UOM's row and the UOM group's column.
3. Choose from the following actions:
 - You can rename, change descriptions of existing UOM groups, as well as add and delete them. When you add a UOM group, ensure the name is encased in square brackets.
 - You can add, edit, and delete UOM definitions and mappings.
 4. On the **PI Builder** tab, click **Publish**.

5. In the Publish Options window, select **Create and Edit** from **Edit Mode** list and click **OK**.

Contacts

You can use PI Builder to create, retrieve, edit, and delete contacts for use with notifications.

Retrieve all contacts

Before you can retrieve contacts, you need to [Specify a database](#).

You can use PI Builder to retrieve all contacts from a PI AF database into Microsoft Excel.

1. On the **PI Builder** tab, click **Library > Contacts > All Contacts**.
2. In the Select Object Types and Column Headers window, select the objects and column headers to include in the worksheet, and then click **OK**.

PI Builder retrieves the contacts into the worksheet and fills the selected columns with available data.

Retrieve selected contacts

Before you can retrieve contacts, you need to [Specify a database](#).

You can use PI Builder to retrieve selected contacts into Microsoft Excel. You can search contacts in Active Directory in addition to those defined in the PI AF database. You search contacts by name, description, or department.

1. On the **PI Builder** tab, click **Library > Contacts > Find Contacts** to open the Find Contacts window.
2. Choose one of the following search criteria:
 - **Name**
 - **Description**
 - **Department**
3. To include Active Directory contacts in the search results, select the **Include Active Directory** check box.
4. Click **Search**.
5. If desired, filter the list of contacts further:
 - a. From the **Actions** list, select the search criteria:
 - Select one type of filter: **Contains**, **Exact Match**, **Starts With**, or **Ends With**.
 - Select one or more fields to search for matches: **Name**, **Description** and **Department**.
 - b. In the **Filter** field, type the text that you want to search for
 - Select one or more fields to search for matches: **Name**, **Description** and **Department**.

PI Builder returns the contacts that match the selected criteria as you type.
6. Choose one of the following actions.
 - To retrieve all search results, click **OK**.
 - To select one or more contacts, use standard Windows selection keystrokes (such as **SHIFT**+<click> and **CTRL**+<click>) to select contiguous and non-contiguous contacts and then click **OK**.

7. In the **Select Object Types and Column Headers** window, select the objects and column headers to include in the worksheet, and then click **OK**.

PI Builder retrieves the selected contacts into the worksheet and fills the selected columns with available data.

Retrieve all notification endpoints

Before you can retrieve notification endpoints, you need to [Specify a database](#).

You can use PI Builder to retrieve all notification endpoints from a PI AF database into Microsoft Excel. Notification endpoints can be delivery endpoints, groups, or escalation teams.

1. On the **PI Builder** tab, click **Library > Contacts > All Notification Endpoints**.
2. In the **Select Object Types and Column Headers** window, select the objects and column headers to include in the worksheet, and then click **OK**.

PI Builder retrieves the notification endpoints into the worksheet and fills the selected columns with available data.

Retrieve selected notification endpoints

Before you can retrieve notification endpoints, you need to [Specify a database](#).

You can use PI Builder to retrieve selected notification endpoints from a PI AF database into Microsoft Excel. Notification endpoints can be delivery endpoints, groups, or escalation teams.

1. On the **PI Builder** tab, click **Library > Contacts > Find Notification Endpoints** to open the Notification Endpoint Selection window.
2. If desired, filter the list of notification endpoints further:
 - a. From the **Actions** list, select the search criteria:
 - Select one type of filter: **Contains**, **Exact Match**, **Starts With**, or **Ends With**.
 - Select one or more fields to search for matches: **Name**, **Contact Type** and **Description**.
 - b. In the **Filter** field, type the text that you want to search for and press Enter.

PI Builder returns the notification endpoints that match the selected criteria.

3. Select one or more notification endpoints to retrieve and click **OK**.
4. In the **Select Object Types and Column Headers** window, select the objects and column headers to include in the worksheet, and then click **OK**.

PI Builder retrieves the selected notification endpoints into the worksheet and fills the selected columns with available data.

Security

You can use PI Builder to create, retrieve, edit, and delete PI identities and mappings, in addition to PI AF identities and mappings.

Retrieve all PI identities

Before you can retrieve PI identities, you need to [Specify a Data Archive server](#).

You can use PI Builder to retrieve all PI identities from a Data Archive into Microsoft Excel.

1. On the **PI Builder** tab, click **Security > Data Server > All PI Identities**.
2. In the **Select Object Types and Column Headers** window, select the objects and column headers to include in the worksheet, and then click **OK**.

PI Builder retrieves all the PI identities from the current Data Archive into the worksheet and fills the selected columns with available data.

Retrieve selected PI identities

Before you can retrieve PI identities, you need to [Specify a Data Archive server](#).

You can use PI Builder to retrieve selected PI identities from a Data Archive into Microsoft Excel.

1. On the **PI Builder** tab, click **Security > Data Server > Find Security Identities** to open the PIIdentity Selection window.
2. From the **Type** list, select the PI identities that you want to retrieve.
3. If desired, filter the list of PI identities further:

- a. From the **Actions** ▼ list, select the search criteria:

- Select one type of filter: **Contains**, **Exact Match**, **Starts With**, or **Ends With**.
- Select one or more fields to search for matches: **Name**, **Description**, **Identity Type**, and **Enabled**.

- b. In the **Filter** field, type the text that you want to search for and press Enter.

PI Builder returns the PI identities that match the filter in any of the selected fields.

4. Select one or more PI identities to retrieve and click **OK**.

PI Builder retrieves the selected PI identities into the worksheet and fills the selected columns with available data.

Retrieve all PI identity mappings

Before you can retrieve PI identity mappings, you need to [Specify a Data Archive server](#).

You can use PI Builder to retrieve all PI identity mappings from a Data Archive into Microsoft Excel.

1. On the **PI Builder** tab, click **Security > Data Server > All PI Identity Mappings**.
2. In the Select Object Types and Column Headers window, select the objects and column headers to include in the worksheet, and then click **OK**.
PI Builder retrieves all the PI identity mappings from the current Data Archive into the worksheet and fills the selected columns with available data.

Retrieve selected PI identity mappings

Before you retrieve PI identity mappings, you need to [Specify a Data Archive server](#).

You can use PI Builder to retrieve selected PI identity mappings from a Data Archive into Microsoft Excel.

1. On the **PI Builder** tab, click **Security > Data Server > Find Security Mappings** to open the PIIdentityMapping Selection window.
2. From the **Type** list, select the PI identity mappings that you want to retrieve.
3. If desired, filter the list of PI identity mappings further:
 - a. From the **Actions** ▼ list, select the search criteria:
 - Select one type of filter: **Contains**, **Exact Match**, **Starts With**, or **Ends With**.
 - Select one or more fields to search for matches: **Name**, **Description**, **Mapping**, **Mapping Type**, **Identity**, and **Enabled**.
 - b. In the **Filter** field, type the text that you want to search for and press Enter.
4. Select one or more PI identity mappings to retrieve and click **OK**.
5. In the Select Object Types and Column Headers window, select the objects and column headers to include in the worksheet, and then click **OK**.

PI Builder retrieves the selected PI identity mappings into the worksheet and fills the selected columns with available data.

Retrieve all security identities

Before you can retrieve security identities, you need to [Specify a database](#).

You can use PI Builder to retrieve all security identities from a PI AF database into Microsoft Excel.

1. On the **PI Builder** tab, click **Security > Asset Server > All Security Identities**.
2. In the Select Object Types and Column Headers window, select the objects and column headers to include in the worksheet, and then click **OK**.
PI Builder retrieves all the security identities from the current PI AF database into the worksheet and fills the selected columns with available data.

Retrieve selected security identities

Before you can retrieve security identities, you need to [Specify a database](#).

You can use PI Builder to retrieve selected security identities from a PI AF database into Microsoft Excel.

1. On the **PI Builder** tab, click **Security > Asset Server > Find Security Identities** to open the Identity Selection window.
2. From the **Type** list, select the identities that you want to retrieve.
3. If desired, filter the list of identities further:
 - a. From the **Actions** ▼ list, select the search criteria:
 - Select one type of filter: **Contains, Exact Match, Starts With, or Ends With.**
 - Select one or more fields to search for matches: **Name, Description, and Enabled.**
 - b. In the **Filter** field, type the text that you want to search for and press Enter.
4. Select one or more identities to retrieve and click **OK**.
5. In the **Select Object Types and Column Headers** window, select the objects and column headers to include in the worksheet, and then click **OK**.

PI Builder retrieves the selected identities into the worksheet and fills the selected columns with available data.

Retrieve all security mappings

Before you retrieve security mappings, you need to [Specify a database](#).

You can use PI Builder to retrieve selected security mappings from a PI AF database into Microsoft Excel.

1. On the **PI Builder** tab, click **Security > Asset Server > All Security Mappings**.
2. In the **Select Object Types and Column Headers** window, select the objects and column headers to include in the worksheet, and then click **OK**.

PI Builder retrieves all the security mappings from the current PI AF database into the worksheet and fills the selected columns with available data.

Retrieve selected security mappings

Before you can retrieve security mappings, you need to [Specify a database](#).

You can use PI Builder to retrieve selected security mappings from a PI AF database into Microsoft Excel.

1. On the **PI Builder** tab, click **Security > Asset Server > Find Security Mappings** to open the Mapping Selection window.
2. From the **Type** list, select the mappings that you want to retrieve.
3. If desired, filter the list of mappings further:
 - a. From the **Actions** list, select the search criteria:
 - Select one type of filter: **Contains, Exact Match, Starts With, or Ends With.**
 - Select one or more fields to search for matches: **Name, Description, Identity, and Account.**
 - b. In the **Filter** field, type the text that you want to search for and press Enter.

PI Builder returns the mappings that match the filter in any of the selected fields.

4. Select one or more mappings to retrieve and click **OK**.
5. In the Select Object Types and Column Headers window, select the objects and column headers to include in the worksheet, and then click **OK**.

PI Builder retrieves the selected mappings into the worksheet and fills the selected columns with available data.

Column reference

Available columns in PI Builder differ for each PI AF object type.

This section lists the columns available in PI Builder. For each object type, a table lists the available columns and indicates whether the column is required in the worksheet and whether PI Builder can write data from that column to PI AF or Data Archive.

Note: The order of columns in your worksheet may vary depending on the current worksheet or previous selections.

Case template columns

Case templates

PI Builder can display several columns for PI AF case templates. Some columns are required, and you can only change values in certain columns.

The following table lists the columns available for PI AF case templates in PI Builder:

Column name	Comment	Required in PI Builder	Can be changed in PI AF
Selected(x)	Enter an x to have PI Builder act on the row when you click Publish , Delete , or Retrieve .	yes	n/a
Parent		yes	n/a
Name	To change the name, enter a new name in the New Name column.	yes	n/a
ObjectType	Set to CaseTemplate for primary objects. One of the following values may be present for children of the case template: <ul style="list-style-type: none"> AttributeTemplate TemplateExtendedProperty 	yes	n/a
Error	If an error occurs during a delete, publish, or retrieve operation for a specific row in the worksheet, PI Builder displays the error message for that row in the Error column cell. The error continues to be displayed until you clear it or perform the next delete, publish, or retrieve operation.	no	no

Description		no	yes
DefaultAttribute		no	yes
Categories		no	yes
CreationDate		no	no
ModifyDate		no	no
SecurityString		no	yes
NewName	Enter a new name to change the name in PI AF.	no	yes
UniqueID		no	no
BaseTemplate		no	yes
AllowElementToExtend		no	yes
NamingPattern		no	yes
ExtendedPropertyType	Possible values: <ul style="list-style-type: none"> • Boolean / Boolean[] • Byte / Byte[] • DateTime / DateTime[] • Double / Double[] • Guid / Guid[] • Int16 / Int16[] • Int32 / Int32[] • Int64 / Int64[] • Single / Single[] • String / String[] • AFAttribute • AFElement • AFFile 	no	yes
ExtendedPropertyValue		no	yes
AttributesHidden		no	yes

AttributesManualDataEntry		no	yes
AttributeTrait	<p>Possible values:</p> <p>For Limit traits:</p> <ul style="list-style-type: none"> • Minimum • LoLo • Lo • Target • Hi • HiHi • Maximum <p>For Location traits:</p> <ul style="list-style-type: none"> • Latitude • Longitude • Altitude <p>Forecast</p>	no	yes
AttributesConfigurationItem		no	yes
AttributesExcluded		no	yes
AttributeDefaultUOM		no	yes
AttributeType	<p>Possible values:</p> <ul style="list-style-type: none"> • Boolean / Boolean[] • Byte / Byte[] • DateTime / DateTime[] • Double / Double[] • Guid / Guid[] • Int16 / Int16[] • Int32 / Int32[] • Int64 / Int64[] • Single / Single[] • String / String[] • AFAttribute 	no	yes

	<ul style="list-style-type: none"> • AFElement • AFFile • AFEnumerationValue (AttributeTypeQualifier contains the enumeration set from which values are selected) • Object 		
AttributeTypeQualifier	If the AttributeType column contains AFEnumerationValue, then the AttributeTypeQualifier column contains the name of an enumeration set and the AttributeDefaultValue column contains the name of an enumeration value from the specified enumeration set.	no	yes
AttributeDataReference	Possible values: <ul style="list-style-type: none"> • Formula • PI Point • PI Point Array • String Builder • Table Lookup • URI Builder • (The name of a custom data reference) 	no	yes
AttributeConfigString		no	yes
AttributeDisplayDigits		no	yes
AttributeNewParent	Enter the name of a new parent to move the object in the PI AF hierarchy.	no	yes
AttributeIsIndexed		no	yes
AttributeDefaultValue		no	yes

Category columns

Categories

PI Builder can display several columns for PI AF categories. Some columns are required, and you can only change values in certain columns.

The following table lists the columns available for PI AF categories in PI Builder.

Column name	Comment	Required in PI Builder	Can be changed in PI AF
Selected(x)	Enter an x to have PI Builder act on the row when you click Publish , Delete , or Retrieve .	yes	n/a
Parent		yes	n/a
Name	To change the name, enter a new name in the NewName column.	yes	n/a
ObjectType	Possible values: <ul style="list-style-type: none"> • CategoryAnalysis • CategoryAttribute • CategoryElement • CategoryNotificationRule • CategoryReferenceType • CategoryTable 	yes	n/a
Error	If an error occurs during a delete, publish, or retrieve operation for a specific row in the worksheet, PI Builder displays the error message for that row in the Error column cell. The error continues to be displayed until you clear it or perform the next delete, publish, or retrieve operation.	no	no
Description		no	yes
CreationDate		no	no
ModifyDate		no	no
SecurityString		no	yes
NewName	Enter a new name to change the name as it appears in PI AF.	no	yes
UniqueID		no	no

Contact columns

Elements

The following table lists the columns available for PI AF contacts in PI Builder:

Column name	Comment	Required in PI Builder	Can be changed in PI AF
Selected(x)	Enter an x to have PI Builder act on the row when you click Publish , Delete , or Retrieve .	yes	n/a
Parent		yes	n/a
Name	To change the name, enter a new name in the NewName column.	yes	n/a
ObjectType	Set to Contact.	yes	n/a
Error	If an error occurs during a delete, publish, or retrieve operation for a specific row in the worksheet, PI Builder displays the error message for that row in the Error column cell. The error continues to be displayed until you clear it or perform the next delete, publish, or retrieve operation.	no	no
NewName	Enter a new name to change the name as it appears in PI AF.	no	yes ¹
UniqueID		no	no
CanonicalName		no	yes ¹
ContactType	Possible values: <ul style="list-style-type: none"> User Group 	no	no
Description		no	yes ¹
FromAD	Indicates whether the contact is defined in Active Directory.	no	no
Department		no	yes ¹
Manager		no	yes ¹

Email		no	yes ¹
BusinessPhone		no	yes ¹
HomePhone		no	yes ¹
MobilePhone		no	yes ¹
IPPhone		no	yes ¹
FaxNumber		no	yes ¹
PagerNumber		no	yes ¹
IMAddress		no	yes ¹
PostalAddress		no	yes ¹
PreferredLanguage		no	yes ¹

¹ You can only modify if the contact is not defined in Active Directory.

Digital state set columns

Digital state sets

The following table lists the available columns for digital state sets in PI Builder:

Column name	Comment	Required in PI Builder	Can be changed in PI AF
Selected(x)	Enter an x to have PI Builder act on the row when you click Publish , Delete , or Retrieve .	yes	n/a
Parent		yes	n/a
Name	To change the name, enter a new name in the NewName column.	yes	n/a
ObjectType	Set to DigitalStateSet for primary objects. The following value may be present for children of the digital state set: <ul style="list-style-type: none"> DigitalState 	yes	n/a
Error	If an error occurs during a delete, publish, or retrieve operation for a specific row in the worksheet, PI Builder displays	no	no

	ys the error message for that row in the Error column cell. The error continues to be displayed until you clear it or perform the next delete, publish, or retrieve operation.		
NewName	Enter a new name to change the name in PI AF.	no	yes
UniqueID		no	no
Value		no	yes

Element columns

Elements

The following table lists the columns available for PI AF elements in PI Builder.

Column name	Comment	Required in PI Builder	Can be changed in PI AF ¹
Selected(x)	Enter an x to have PI Builder act on the row when you click Publish , Delete , or Retrieve .	yes	n/a
Parent	The name of the object owning this object.	yes	no ²
Name	To change the name, enter a new name in the NewName column.	yes	n/a
ObjectType	Set to Element for primary objects. One of the following values may be present for children of the element: <ul style="list-style-type: none"> Attribute ExtendedProperty Analysis AnalysisExtendedProperty AnalysisRule NotificationRule DeliveryFormat DeliveryFormatProperty NotificationRuleSubscriber Port Element Reference 	yes	n/a
Error	If an error occurs during a delete, publish, or retrieve operation for a specific row in the worksheet, PI Builder di	no	no

	splays the error message for that row in the Error column cell. The error continues to be displayed until you clear it or perform the next delete, publish, or retrieve operation.		
Description	The object description	no	yes
CreationDate	Date and time the object was created.	no	no
ModifyDate	Date and time the object was last modified.	no	no
SecurityString	Represents the security descriptor's access rules for the associated object.	no	yes
NewName	Enter a new name to change the name as it appears in PI AF.	no	yes
UniqueID	The unique identifier (Guid) of the object.	no	no
NewParent	Enter the name of a new parent to move the object in the PI AF hierarchy.	no	yes
ReferenceType	Possible values: <ul style="list-style-type: none"> • Parent-Child • Composition • Weak Reference • Name of a custom reference type 	no	yes ¹⁰
Template	The template that the object is derived from or based on.	no	no ²
DefaultAttribute	Cannot be changed if element is based on a template.	no	no
DefaultInputPort	The default input port for the object.	no	yes
DefaultOutputPort	The default output port for the object.	no	yes
DefaultUndirectedPort	The default undirected port for the object.	no	yes
Categories	List of categories of which the object is a member.	no	yes ¹
IsAnnotated	Indicates whether the object has annotations.	no	no ⁷
VersionID	Unique identifier (Guid) of the version object.	no	no

VersionCreationDate	The date and time when the version of the owning object was created.	no	no
VersionModifyDate	The date and time when the version of the owning object was last modified.	no	no
VersionModifier	The user who last modified the version of the owning object.	no	no ³
VersionComment	The comment associated with the version of the owning object.	no	yes
VersionEffectiveDate	The date and time when the version of the owning object goes into effect.	no	yes
VersionObsoleteDate	The date and time when the version of the owning object becomes obsolete.	no	yes
ExtendedPropertyType	Possible values: <ul style="list-style-type: none"> • Boolean / Boolean[] • Byte / Byte[] • DateTime / DateTime[] • Double / Double[] • Guid / Guid[] • Int16 / Int16[] • Int32 / Int32[] • Int64 / Int64[] • Single / Single[] • String / String[] • AFAttribute • AFElement • AFFile 	no	yes
ExtendedPropertyValue	The value of the extended property.	no	yes
AttributeIsHidden	Indicates if the attribute is hidden. If true, the attribute is not returned in searches and will not be visible in some applications, but it can still return a value.	no	yes ⁴
AttributeIsManualDataEntry	Indicates if the attribute is used for manual data entry.	no	yes ⁴

AttributeTrait	<p>Possible values:</p> <p>For Limit traits:</p> <ul style="list-style-type: none"> • Minimum • LoLo • Lo • Target • Hi • HiHi • Maximum <p>For Location traits:</p> <ul style="list-style-type: none"> • Latitude • Longitude • Altitude <p>Forecast</p> <p>For Health traits:</p> <ul style="list-style-type: none"> • HealthScore • HealthStatus 	no	yes ⁴
AttributeIsConfigurationItem	Indicates if the attribute is a configuration item.	no	yes ^{1,5}
AttributeIsExcluded	Indicates if the attribute is excluded. If true, the attribute is not returned in searches and will not return a value. It will not be shown in most applications.	no	yes
AttributeDefaultUOM	The default unit of measure used for the attribute.	no	yes ^{1,5}
AttributeType	<p>Possible values:</p> <ul style="list-style-type: none"> • Boolean / Boolean[] • Byte / Byte[] • DateTime / DateTime[] • Double / Double[] • Guid / Guid[] • Int16 / Int16[] • Int32 / Int32[] • Int64 / Int64[] • Single / Single[] 	no	yes ^{1,5}

	<ul style="list-style-type: none"> • String / String[] • AFAttribute • AFElement • AFFile • AFEnumerationValue (AttributeTypeQualifier contains the enumeration set from which values are to be selected) • Object 		
AttributeTypeQualifier	If the AttributeType column contains AFEnumerationValue, then the AttributeTypeQualifier column contains the name of an enumeration set and the AttributeValue column contains the name of an enumeration value from the specified enumeration set.	no	yes ^{1,5}
AttributeValue	Enter a new value to change the value as it appears in PI AF.	no	yes, if not linked to a data reference.
AttributeDataReference	Possible values: <ul style="list-style-type: none"> • Formula • PI Point • PI Point Array • String Builder • Table Lookup • URI Builder • Name of a custom data reference 	no	yes
AttributeConfigString	Configuration string for the data reference for the attribute.	no	yes
AttributeDisplayDigits	DisplayDigits value of the attribute.	no	yes
AnalysisOutputTime	The analysis output time offset. The time is expressed in a format understood by AFTIME parsing (e.g. *-3h).	no	yes
AnalysisStatus	To enable or disable an analysis, enter appropriate text and publish the element to PI AF.	no	yes

AnalysisRuleDefinedByTemplate	Indicates if the configuration of the analysis rule is defined by the analysis template. If the analysis has no template, the value will be false.	no	no
AnalysisRule	Name of the analysis rule.	no	yes ⁶
AnalysisRuleConfigString	If the analysis rule comes from a template and the Show simplified configuration strings option is selected, <Defined by template> is shown in this column. Otherwise, this column displays the expression used to perform calculations on a group of elements.	no	yes ⁶
AnalysisRuleVariableMapping	If the analysis rule comes from a template and the Show simplified configuration strings option is selected, <Defined by template> is shown. When the object type is an analysis template, this column shows the name of the mapped output where calculation history is stored.	no	yes ⁶
TimeRuleDefinedByTemplate	Indicates if the configuration of the time rule is defined fully from the analysis template. If the analysis has no template, the value will be false.	no	no
TimeRule	Name of the time rule.	no	yes
TimeRuleConfigString	Configuration string used by the time rule.	no	yes
ResetRule	Use this column to specify that a notification rule's properties should be reset to its default templated values.	no	yes ⁸
Status	To enable or disable a notification rule, enter appropriate text and publish the notification rule to PI AF.	no	yes
MultiTriggerEventOption	Possible values: <ul style="list-style-type: none"> • HighestSeverity • HigherSeverity • Any 	no	yes ⁹
ResendInterval	The interval for resending the notification.	no	yes ⁹
NonrepetitionInterval	Non-repetition interval for the notification.	no	yes ⁹
Criteria	The trigger criteria for creating a notification.	no	yes ⁹

ContentExample	Specifies the element, event frame, or element template used as a content example for the notification rule.	no	yes ⁹
DefaultDeliveryFormat	The collection of default delivery format objects for this notification.	no	yes
DeliveryFormatDeliveryChannel	Possible values: <ul style="list-style-type: none"> Email WebService 	no	yes
DeliveryFormatPropertyValue	Value of individual delivery format properties such as subject, attachments, or body.	no	yes
SubscriberRetryInterval	The interval at which the system will attempt to resend a notification to a particular individual subscriber if the prior attempt was not successful.	no	yes ⁹
SubscriberEscalationTimeout	The interval at which the system will attempt to resend a notification to a particular escalation subscriber if the prior attempt was not successful.	no	yes ⁹
SubscriberMaximumRetries	The maximum number of attempts to send a notification to an individual subscriber if the prior attempts were not successful.	no	yes ⁹
SubscriberNotifyOption	Possible values: <ul style="list-style-type: none"> EventStart EventEnd EventStartAndEnd 	no	yes ⁹
SubscriberConfigString	The current configuration of the subscriber's delivery channel as a string suitable for displaying to an end-user. It contains sufficient information to be used to set the configuration of the associated delivery channel.	no	yes ⁹
SubscriberDeliveryFormat	The name of the delivery format to be used in generating notifications for the subscriber.	no	yes ⁹
PortType	Possible values: <ul style="list-style-type: none"> Undirected Input Output 	no	yes ^{1,5}

PortMaxConnections	Specifies the maximum number of connections allowed for the port.	no	yes ^{1,5}
PortAllowedElementTypes	Specifies the types of elements allowed to connect to the port.	no	yes ^{1,5}
PortAllowedElementTemplate	Specifies the element template of the elements which are allowed to connect to the port.	no	yes ^{1,5}

¹ You cannot add attributes or ports, or modify the categories when the element is based on a template unless the template's Allow Extensions check box is selected.

² You cannot change values for these properties. Delete the object (the entire row in the worksheet) and then add the object back in with the property change you want.

³ The modifier cannot be written to, although it will change to the current user if this element is modified during publication.

⁴ You can change this value only if the attribute does not have a template. If the attribute has a template, then you cannot change the value from the attribute; you must change the value from the attribute template.

⁵ You can write changes to values in the DefaultAttribute, DefaultInputPort, DefaultOutputPort, and DefaultUndirectedPort columns only when the element is not derived from a template. Most properties of attributes and ports cannot be changed if they are defined by the template.

⁶ You can write changes to values in the AnalysisRule, AnalysisRuleConfigString, and AnalysisRuleVariableMapping columns only when the analysis is not derived from a template.

⁷ You cannot change the value for this property since it is indirectly set or cleared in PI System Explorer or through client code when annotations are added to an element or all annotations are deleted from an element.

⁸ You can only change this value if a notification rule is derived from a template.

⁹ You can only change this value if a notification rule is not derived from a template.

¹⁰ Beginning with 2018, you can change a reference type to a different one, provided that the reference type is valid and exists.

Element template columns

Element templates

The following table lists the columns available for PI AF element templates in PI Builder:

Column name	Comment	Required in PI Builder	Can be changed in PI AF
Selected(x)	Enter an x to have PI Builder act on the row when you click Publish , Delete , or Retrieve .	yes	n/a
Parent		yes	n/a
Name	To change the name, enter a new name in the NewName column.	yes	n/a
ObjectType	Set to ElementTemplate for primary objects. One of the following values may be present for children of the element template:	yes	n/a

	<ul style="list-style-type: none"> • AttributeTemplate • TemplateExtendedProperty • AnalysisTemplate • AnalysisTemplateExtendedProperty • TemplateAnalysisRule • NotificationRuleTemplate • DeliveryFormat • DeliveryFormatProperty • NotificationRuleSubscriber • TemplatePort 		
Error	If an error occurs during a delete, publish, or retrieve operation for a specific row in the worksheet, PI Builder displays the error message for that row in the Error column cell. The error continues to be displayed until you clear it or perform the next delete, publish, or retrieve operation.	no	no
Description		no	yes
BaseTemplate		no	yes
Type	<p>Possible values:</p> <ul style="list-style-type: none"> • None • Boundary • Flow • Measurement • Node • Other 	no	yes
AllowElementToExtend		no	yes
DefaultAttribute		no	yes
NamingPattern		no	yes
DefaultInputPort		no	yes
DefaultOutputPort		no	yes
DefaultUndirectedPort		no	yes
Categories		no	yes

CreationDate		no	no
ModifyDate		no	no
SecurityString		no	yes
BaseTemplateOnly	<p>Possible values:</p> <ul style="list-style-type: none"> • True • False <p>Only users with an Administrators PI AF Identity can set the value to True. Indicates if the object is a Base Template Only template. This template type serves as a base template for derived templates. It cannot be used to create objects directly.</p>	no	yes
NewName	Enter a new name to change the name as it appears in PI AF.	no	yes
UniqueID		no	no
ExtendedPropertyType	<p>Possible values:</p> <ul style="list-style-type: none"> • Boolean / Boolean[] • Byte / Byte[] • DateTime / DateTime[] • Double / Double[] • Guid / Guid[] • Int16 / Int16[] • Int32 / Int32[] • Int64 / Int64[] • Single / Single[] • String / String[] • AFAttribute • AFElement • AFFile 	no	yes
ExtendedPropertyValue		no	yes
AttributeIsHidden		no	yes

AttributesManualDataEntry		no	yes
AttributeTrait	<p>Possible values:</p> <p>For Limit traits:</p> <ul style="list-style-type: none"> • Minimum • LoLo • Lo • Target • Hi • HiHi • Maximum <p>For Location traits:</p> <ul style="list-style-type: none"> • Latitude • Longitude • Altitude • Forecast <p>For Health traits:</p> <ul style="list-style-type: none"> • HealthScore • HealthStatus 	no	yes
AttributesConfigurationItem		no	yes
AttributesExcluded		no	yes
AttributeDefaultUOM		no	yes
AttributeType	<p>Possible values:</p> <ul style="list-style-type: none"> • Boolean / Boolean[] • Byte / Byte[] • DateTime / DateTime[] • Double / Double[] • Guid / Guid[] • Int16 / Int16[] • Int32 / Int32[] • Int64 / Int64[] • Single / Single[] 	no	yes

	<ul style="list-style-type: none"> • String / String[] • AFAttribute • AFElement • AFFile • AFEnumerationValue (AttributeTypeQualifier contains the enumeration set from which values are to be selected) • Object 		
AttributeTypeQualifier	If the AttributeType column contains AFEnumerationValue, then the AttributeTypeQualifier column contains the name of an enumeration set and the AttributeDefaultValue column contains the name of an enumeration value from the specified enumeration set.	no	yes
AttributeDataReference	Possible values: <ul style="list-style-type: none"> • Formula • PI Point • PI Point Array • String Builder • Table Lookup • URI Builder • Name of a custom data reference 	no	yes
AttributeConfigString		no	yes
AttributeDisplayDigits		no	yes
AttributeNewParent	Enter the name of a new parent to move the object in the PI AF hierarchy.	no	yes
AttributeIsIndexed		no	yes
AttributeDefaultValue		no	yes
AnalysisOutputTime		no	yes
AnalysisRule		no	yes
AnalysisRuleConfigString	When the object type is an analysis template, this column displays the expression used to perform calculations on a group of elements.	no	yes

AnalysisRuleVariableMapping	When the object type is an analysis template, this column shows the name of the mapped output where calculation history is stored. If the analysis rule comes from a template and the Show simplified configuration strings option is selected, <Defined by template> is shown.	no	yes
TimeRule		no	yes
TimeRuleConfigString		no	yes
CreateEnabled	Use this column to specify whether notification rules created from this template will be automatically enabled when they are created.	no	yes
MultiTriggerEventOption	Possible values: <ul style="list-style-type: none">• HighestSeverity• HigherSeverity• Any	no	yes
ResendInterval		no	yes
NonrepetitionInterval		no	yes
Criteria		no	yes
ContentExample		no	yes
DefaultDeliveryFormat		no	yes
DeliveryFormatDeliveryChannel	Possible values: <ul style="list-style-type: none">• Email• WebService	no	yes
DeliveryFormatPropertyValue		no	yes
SubscriberRetryInterval		no	yes
SubscriberEscalationTimeout		no	yes
SubscriberMaximumRetries		no	yes

SubscriberNotifyOption	Possible values: <ul style="list-style-type: none"> EventStart EventEnd EventStartAndEnd 	no	yes
SubscriberConfigString		no	yes
SubscriberDeliveryFormat		no	yes
PortType	Possible values: <ul style="list-style-type: none"> Undirected Input Output 	no	yes
PortMaxConnections		no	yes
PortAllowedElementTypes		no	yes ¹
PortAllowedElementTemplate		no	yes

¹ If the object is used in a model, then the value in this column cannot be changed.

Enumeration set columns

Enumeration sets

The following table lists the available columns for PI AF enumeration sets in PI Builder:

Column name	Comment	Required in PI Builder	Can be changed in PI AF
Selected(x)	Enter an x to have PI Builder act on the row when you click Publish , Delete , or Retrieve .	yes	n/a
Parent		yes	n/a
Name	To change the name, enter a new name in the NewName column.	yes	n/a

ObjectType	Set to EnumerationSet for primary objects. The following value may be present for children of the enumeration set: <ul style="list-style-type: none"> EnumerationValue 	yes	n/a
Error	If an error occurs during a delete, publish, or retrieve operation for a specific row in the worksheet, PI Builder displays the error message for that row in the Error column cell. The error continues to be displayed until you clear it or perform the next delete, publish, or retrieve operation.	no	no
Description		no	yes
CreationDate		no	no
ModifyDate		no	no
SecurityString		no	yes
NewName	Enter a new name to change the name as it appears in PI AF.	no	yes
UniqueID		no	no
EnumerationValue		no	yes

Event frame columns

Event frames

The following table lists the columns available for PI AF event frames in PI Builder:

Column name	Comment	Required in PI Builder	Can be changed in PI AF ¹
Selected(x)	Enter an x to have PI Builder act on the row when you click Publish , Delete , or Retrieve .	yes	n/a
Parent		yes	no ²
Name	To change the name, enter a new name in the New Name column.	yes	n/a

ObjectType	Set to EventFrame for primary objects. One of the following values may be present for children of the event frame: <ul style="list-style-type: none"> ExtendedProperty Attribute Element Reference Model Reference EventFrame Reference 	yes	n/a
Error	If an error occurs during a delete, publish, or retrieve operation for a specific row in the worksheet, PI Builder displays the error message for that row in the Error column cell. The error continues to be displayed until you clear it or perform the next delete, publish, or retrieve operation.	no	no
Description		no	yes
ReferenceType	Possible values: <ul style="list-style-type: none"> Parent-Child Composition Weak Reference Name of a custom reference type 	no	yes ¹⁰
Template		no	no ²
DefaultAttribute		no	yes ⁴
Categories		no	yes ¹
IsAnnotated		no	no ⁸
CreationDate		no	no
ModifyDate		no	no
SecurityString		no	yes
NewName	Enter a new name to change the name in PI AF.	no	yes
UniqueID		no	no

NewParent	Enter the name of a new parent to move the object in the PI AF hierarchy.	no	yes
PrimaryReferencedElement	Path from the PI AF database to the event frame's primary referenced element.	no	yes ³
IsLocked		no	no ⁵
AreValuesCaptured		no	yes
StartTime		no	yes
EndTime		no	yes
Severity	Possible values: <ul style="list-style-type: none"> • 0 (or None or 0-None) • 1 (or Information or 1-Information) • 2 (or Warning or 2-Warning) • 3 (or Minor or 3-Minor) • 4 (or Major or 4-Major) • 5 (or Critical or 5-Critical) 	no	yes
CanBeAcknowledged		no	yes
IsAcknowledged		no	yes
AcknowledgedBy		no	no ⁹
AcknowledgedDate		no	no ⁹
ExtendedPropertyType	Possible values: <ul style="list-style-type: none"> • Boolean / Boolean[] • Byte / Byte[] • DateTime / DateTime[] • Double / Double[] • Guid / Guid[] • Int16 / Int16[] • Int32 / Int32[] • Int64 / Int64[] • Single / Single[] • String / String[] 	no	yes

	<ul style="list-style-type: none"> • AFAttribute • AFElement • AFFile 		
ExtendedPropertyValue		no	yes
AttributesHidden		no	yes ⁶
AttributesManualDataEntry		no	yes ⁶
AttributeTrait	<p>Possible values:</p> <p>For Limit traits:</p> <ul style="list-style-type: none"> • Minimum • LoLo • Lo • Target • Hi • HiHi • Maximum <p>For Location traits:</p> <ul style="list-style-type: none"> • Latitude • Longitude • Altitude <p>For Analysis traits:</p> <ul style="list-style-type: none"> • StartTriggerExpression • StartTriggerName • Forecast • Reason 	no	yes ⁶
AttributesConfigurationItem		no	yes ^{1,4}
AttributesExcluded		no	yes
AttributeDefaultUOM		no	yes ^{1,4}
AttributeType	Possible values:	no	yes ^{1,4}

	<ul style="list-style-type: none"> • Boolean / Boolean[] • Byte / Byte[] • DateTime / DateTime[] • Double / Double[] • Guid / Guid[] • Int16 / Int16[] • Int32 / Int32[] • Int64 / Int64[] • Single / Single[] • String / String[] • AFAttribute • AFElement • AFFile • AFEnumerationValue (AttributeTypeQualifier contains the enumeration set from which values are to be selected) • Object 		
AttributeTypeQualifier	If the AttributeType column contains AFEnumerationValue, then the AttributeTypeQualifier column contains the name of an enumeration set and the AttributeValue column contains the name of an enumeration value from the specified enumeration set.	no	yes ^{1,4}
AttributeValue		no	yes ⁷
AttributeDataReference	<p>Possible values:</p> <ul style="list-style-type: none"> • Formula • PI Point • PI Point Array • String Builder • Table Lookup • URI Builder • Name of a custom data reference 	no	yes
AttributeConfigString		no	yes
AttributeDisplayDigits		no	yes

- ¹ You cannot add attributes or modify the categories when the event frame is based on a template unless the template Allow Extensions check box is selected.
- ² You cannot change this property. Delete the object (the entire row in the worksheet) and then add the object back in with the property change you want.
- ³ You can change, but not clear, an event frame's primary referenced element in . If you set the PrimaryReferencedElement column to a blank value, does not modify the current value. The only way to clear the primary referenced element for an event frame in is to retrieve the element reference for the event frame and delete the reference.
- ⁴ You can write changes for the DefaultAttribute column only when the event frame is not derived from a template. The Allow Extensions setting in the template does not affect the behavior. Most properties of attributes cannot be changed if they are defined by the template.
- ⁵ You cannot change this value with . PI System Explorer, however, can lock and unlock event frames.
- ⁶ You can change this value only if the attribute does not have a template. If the attribute has a template, then you cannot change the value from the attribute; you must change the value from the attribute template.
- ⁷ You can change the value of an event-frame attribute if the attribute does not have a data reference. If the attribute does have a data reference and AreValuesCaptured is TRUE, then you can change the value, but writes the changed value only to the internal value cache that the attribute maintains; does not write values to the data source, such as to for data references to PI points.
- ⁸ You cannot change the value for this property since it is indirectly set or cleared in PI System Explorer or through client code when annotations are added to an event frame or all annotations are deleted from an event frame.
- ⁹ You cannot change the value for this property since it is indirectly set when users acknowledge event frames.
- ¹⁰ Beginning with 2018, you can change a reference type to a different one, provided that the reference type is valid and exists.

Event frame template columns

Event-frame templates

The following table lists the columns available for PI AF event-frame templates in PI Builder:

Column name	Comment	Required in PI Builder	Can be changed in PI AF
Selected(x)	Enter an x to have PI Builder act on the row when you click Publish , Delete , or Retrieve .	yes	n/a
Parent		yes	n/a
Name	To change the name, enter a new name in the NewName column.	yes	n/a
ObjectType	Set to EventFrameTemplate for primary objects. One of the following values may be present for children of the event frame template: <ul style="list-style-type: none"> AttributeTemplate TemplateExtendedProperty 	yes	n/a
Error	If an error occurs during a delete, publish, or retrieve operation for a specific row in the worksheet, PI Build	no	no

	er displays the error message for that row in the Error column cell. The error continues to be displayed until you clear it or perform the next delete, publish, or retrieve operation.		
Description		no	yes
NewItem	Enter a new name to change the name in PI AF.	no	yes
UniqueID		no	no
BaseTemplate		no	yes
AllowElementToExtend		no	yes
BaseTemplateOnly	<p>Possible values:</p> <ul style="list-style-type: none"> • True • False <p>Only users with an Administrators PI AF Identity can set the value to True. Indicates if the object is a Base Template Only template. This template type serves as a base template for derived templates. It cannot be used to create objects directly.</p>	no	yes
DefaultAttribute		no	yes
NamingPattern		no	yes
Categories		no	yes
CreationDate		no	no
ModifyDate		no	no
SecurityString		no	yes
Severity	<p>Possible values:</p> <ul style="list-style-type: none"> • 0 (or None or 0-None) • 1 (or Information or 1-Information) • 2 (or Warning or 2-Warning) • 3 (or Minor or 3-Minor) • 4 (or Major or 4-Major) • 5 (or Critical or 5-Critical) 	no	yes

CanBeAcknowledged		no	yes
ExtendedPropertyType	<p>Possible values:</p> <ul style="list-style-type: none"> • Boolean / Boolean[] • Byte / Byte[] • DateTime / DateTime[] • Double / Double[] • Guid / Guid[] • Int16 / Int16[] • Int32 / Int32[] • Int64 / Int64[] • Single / Single[] • String / String[] • AFAttribute • AFElement • AFFile 	no	yes
ExtendedPropertyValue		no	yes
AttributesHidden		no	yes
AttributesManualDataEntry		no	yes
AttributeTrait	<p>Possible values:</p> <p>For Limit traits:</p> <ul style="list-style-type: none"> • Minimum • LoLo • Lo • Target • Hi • HiHi • Maximum <p>For Location traits:</p> <ul style="list-style-type: none"> • Latitude • Longitude 	no	yes

	<ul style="list-style-type: none"> Altitude <p>For Analysis traits:</p> <ul style="list-style-type: none"> StartTriggerExpression StartTriggerName Forecast Reason 		
AttributesConfigurationItem		no	yes
AttributesExcluded		no	yes
AttributesIndexed		no	yes
AttributeDefaultUOM		no	yes
AttributeType	<p>Possible values:</p> <ul style="list-style-type: none"> Boolean / Boolean[] Byte / Byte[] DateTime / DateTime[] Double / Double[] Guid / Guid[] Int16 / Int16[] Int32 / Int32[] Int64 / Int64[] Single / Single[] String / String[] AFAAttribute AFAElement AFFile AFAEnumerationValue (AttributeTypeQualifier contains the enumeration set from which values are to be selected) Object 	no	yes
AttributeTypeQualifier	If the AttributeType column contains AFAEnumerationValue, then the AttributeTypeQualifier column contains the name of an enumeration set and the AttributeD	no	yes

	efaultValue column contains the name of an enumeration value from the specified enumeration set.		
AttributeDefaultValue		no	yes
AttributeDataReference	Possible values: <ul style="list-style-type: none"> • Formula • PI Point • PI Point Array • String Builder • Table Lookup • URI Builder • Name of a custom data reference 	no	yes
AttributeConfigString		no	yes
AttributeDisplayDigits		no	yes
AttributeNewParent	Enter the name of a new parent to move the object in the PI AF hierarchy.	no	yes

Model columns

Models

The following table lists the columns available for PI AF models in PI Builder:

Column name	Comment	Required in PI Builder	Can be changed in PI AF ¹
Selected(x)	Enter an x to have PI Builder act on the row when you click Publish , Delete , or Retrieve .	yes	n/a
Parent		yes	no ²
Name	To change the name, enter a new name in the New Name column.	yes	n/a
ObjectType	Set to Model for primary objects. One of the following values may be present for children of the model:	yes	n/a

	<ul style="list-style-type: none"> • Attribute • ExtendedProperty • Layer • Element • Port • Element Reference • Connection 		
Error	If an error occurs during a delete, publish, or retrieve operation for a specific row in the worksheet, PI Builder displays the error message for that row in the Error column cell. The error continues to be displayed until you clear it or perform the next delete, publish, or retrieve operation.	no	no
NewItem	Enter a new name to change the name in PI AF.	no	yes
UniqueID		no	no
NewParent	Enter the name of a new parent to move the object in the PI AF hierarchy.	no	yes
Description		no	yes
Layers		no	yes
ReferenceType	Possible values: <ul style="list-style-type: none"> • Parent-Child • Composition • Weak Reference • Name of a custom reference type 	no	yes
Template		no	no ²
DefaultAttribute	Cannot be changed if model is based on a template.	no	no
DefaultInputPort		no	yes
DefaultOutputPort		no	yes
DefaultUndirectedPort		no	yes

Categories		no	yes ¹
IsAnnotated		no	no ⁶
VersionID		no	no
VersionCreationDate		no	no
VersionModifyDate		no	no
VersionModifier		no	no ³
VersionComment		no	yes
VersionEffectiveDate		no	yes
VersionObsoleteDate		no	yes
CreationDate		no	no
ModifyDate		no	no
SecurityString		no	yes
ExtendedPropertyType	Possible values: <ul style="list-style-type: none"> • Boolean / Boolean[] • Byte / Byte[] • DateTime / DateTime[] • Double / Double[] • Guid / Guid[] • Int16 / Int16[] • Int32 / Int32[] • Int64 / Int64[] • Single / Single[] • String / String[] • AFAttribute • AFElement • AFFile 	no	yes
ExtendedPropertyValue		no	yes

AttributeIsHidden		no	yes ⁴
AttributeIsManualDataEntry		no	yes ⁴
AttributeTrait	<p>Possible values:</p> <p>For Limit traits:</p> <ul style="list-style-type: none"> • Minimum • LoLo • Lo • Target • Hi • HiHi • Maximum <p>For Location traits:</p> <ul style="list-style-type: none"> • Latitude • Longitude • Altitude • Forecast <p>For Health traits:</p> <ul style="list-style-type: none"> • HealthScore • HealthStatus 	no	yes ⁴
AttributeIsConfigurationItem		no	yes ^{1,5}
AttributeIsExcluded		no	yes
AttributeDefaultUOM		no	yes ^{1,5}
AttributeType	<p>Possible values:</p> <ul style="list-style-type: none"> • Boolean / Boolean[] • Byte / Byte[] • DateTime / DateTime[] • Double / Double[] • Guid / Guid[] • Int16 / Int16[] • Int32 / Int32[] 	no	yes ^{1,5}

	<ul style="list-style-type: none"> • Int64 / Int64[] • Single / Single[] • String / String[] • AFAttribute • AFElement • AFFile • AFEnumerationValue (AttributeTypeQualifier contains the enumeration set from which values are to be selected) • Object 		
AttributeTypeQualifier	If the AttributeType column contains AFEnumerationValue, then the AttributeTypeQualifier column contains the name of an enumeration set and the AttributeValue column contains the name of an enumeration value from the specified enumeration set.	no	yes ^{1,5}
AttributeValue	Enter a new value to change the value in PI AF.	no	yes if not linked to a data reference.
AttributeDataReference	Possible values: <ul style="list-style-type: none"> • Formula • PI Point • PI Point Array • String Builder • Table Lookup • URI Builder • Name of a custom data reference 	no	yes
AttributeConfigString		no	yes
AttributeDisplayDigits		no	yes
PortType	Possible values: <ul style="list-style-type: none"> • Undirected • Input • Output 	no	yes ^{1,5}

PortMaxConnections		no	yes ^{1,5}
PortAllowedElementTypes	<p>Possible values:</p> <ul style="list-style-type: none"> Any One or more of the following separated by ';' <ul style="list-style-type: none"> Boundary Flow Measurement Node Other Transfer 	no	yes ^{1,5}
PortAllowedElementTemplate		no	yes ^{1,5}
ConnectionSource	Enter the name of an element or model that is referenced by or is a child of this model.	no	no ²
ConnectionSourcePort	This port must belong to the element or model specified in the ConnectionSource column. The port type of this port must be Output or Undirected. If it is Undirected, then the port type specified in the ConnectionDestinationPort columns must also be Undirected.	no	no ²
ConnectionDestination	Enter the name of an element or model that is referenced by or is a child of this model.	no	no ²
ConnectionDestinationPort	This port must belong to the element or model specified in the ConnectionDestination column. The port type of this port must be Input or Undirected. If it is Undirected, the port type of the ConnectionSourcePort must also be Undirected.	no	no ²

¹ You cannot add attributes or ports, or modify the categories when the model is based on a template unless the template's Allow Extensions check box is selected.

² You cannot change the values of these columns. Delete the object (the entire row in the worksheet) and then add the object back in with the changed value. If you do not do this, you might add new connections rather than change existing connections.

³ The modifier cannot be written to, although it will change to the current user if this model is modified during publication to .

⁴ You can change this value only if the attribute does not have a template. If the attribute has a template, then you cannot change the value from the attribute; you must change the value from the attribute template.

⁵ You can write changes to values of the DefaultAttribute, DefaultInputPort, DefaultOutputPort, and DefaultUndirectedPort columns only when the model is not derived from a template. Most properties of attributes and ports cannot be changed if they are defined by the template.

⁶ You cannot change the value for this property since it is indirectly set or cleared in PI System Explorer or through client code when annotations are added to a model or all annotations are deleted from a model.

Model template columns

Model templates

The following table lists the columns available for PI AF model templates in PI Builder:

Column name	Comment	Required in PI Builder	Can be changed in PI AF
Selected(x)	Enter an x to have PI Builder act on the row when you click Publish , Delete , or Retrieve .	yes	n/a
Parent		yes	n/a
Name	To change the name, enter a new name in the New Name column.	yes	n/a
ObjectType	Set to ModelTemplate for primary objects. One of the following values may be present for children of the model template: <ul style="list-style-type: none"> AttributeTemplate TemplateExtendedProperty TemplatePort 	yes	n/a
Error	If an error occurs during a delete, publish, or retrieve operation for a specific row in the worksheet, PI Builder displays the error message for that row in the Error column cell. The error continues to be displayed until you clear it or perform the next delete, publish, or retrieve operation.	no	no
NewName	Enter a new name to change the name in PI AF.	no	yes
UniqueID		no	no
Description		no	yes
BaseTemplate		no	yes
Type		no	yes
AllowElementToExtend		no	yes

BaseTemplateOnly	<p>Possible values:</p> <ul style="list-style-type: none"> • True • False <p>Only users with an Administrators PI AF Identity can set the value to True. Indicates if the object is a Base Template Only template. This template type serves as a base template for derived templates. It cannot be used to create objects directly.</p>	no	yes
DefaultAttribute		no	yes
NamingPattern		no	yes
DefaultInputPort		no	yes
DefaultOutputPort		no	yes
DefaultUndirectedPort		no	yes
Categories		no	yes
CreationDate		no	no
ModifyDate		no	no
SecurityString		no	yes
ExtendedPropertyType	<p>Possible values:</p> <ul style="list-style-type: none"> • Boolean / Boolean[] • Byte / Byte[] • DateTime / DateTime[] • Double / Double[] • Guid / Guid[] • Int16 / Int16[] • Int32 / Int32[] • Int64 / Int64[] • Single / Single[] • String / String[] • AFAttribute • AFElement 	no	yes

	<ul style="list-style-type: none"> • AFFile 		
ExtendedPropertyValue		no	yes
NewParent	Enter the name of a new parent to move the object in the PI AF hierarchy.	no	yes
AttributeIsHidden		no	yes
AttributeIsManualDataEntry		no	yes
AttributeTrait	<p>Possible values:</p> <p>For Limit traits:</p> <ul style="list-style-type: none"> • Minimum • LoLo • Lo • Target • Hi • HiHi • Maximum <p>For Location traits:</p> <ul style="list-style-type: none"> • Latitude • Longitude • Altitude • Forecast <p>For Health traits:</p> <ul style="list-style-type: none"> • HealthScore • HealthStatus 	no	yes
AttributeIsConfigurationItem		no	yes
AttributeIsExcluded		no	yes
AttributeIsIndexed		no	yes
AttributeDefaultUOM		no	yes
AttributeType	Possible values:	no	yes

	<ul style="list-style-type: none"> • Boolean / Boolean[] • Byte / Byte[] • DateTime / DateTime[] • Double / Double[] • Guid / Guid[] • Int16 / Int16[] • Int32 / Int32[] • Int64 / Int64[] • Single / Single[] • String / String[] • AFAttribute • AFElement • AFFile • AFEnumerationValue (AttributeTypeQualifier contains the enumeration set from which values are to be selected) • Object 		
AttributeTypeQualifier	If the AttributeType column contains AFEnumerationValue, then the AttributeTypeQualifier column contains the name of an enumeration set and the AttributeDefaultValue column contains the name of an enumeration value from the specified enumeration set.	no	yes
AttributeDefaultValue		no	yes
AttributeDataReference	<p>Possible values:</p> <ul style="list-style-type: none"> • Formula • PI Point • PI Point Array • String Builder • Table Lookup • URI Builder • Name of a custom data reference 	no	yes
AttributeConfigString		no	yes

AttributeDisplayDigits		no	yes
PortType	Possible values: <ul style="list-style-type: none"> • Undirected • Input • Output 	no	yes
PortMaxConnections		no	yes
PortAllowedElementTypes	Possible values: <ul style="list-style-type: none"> • Any • One or more of the following separated by ';' <ul style="list-style-type: none"> • Boundary • Flow • Measurement • Node • Other • Transfer 	no	yes ¹
PortAllowedElementTemplate		no	yes

¹ If the object is used in a model, then the value in this column cannot be changed.

Notification endpoint columns

Notification endpoints

The following table lists the columns available for PI AF notification endpoints in PI Builder:

Column name	Comment	Required in PI Builder	Can be changed in PI AF
Selected(x)	Enter an x to have PI Builder act on the row when you click Publish , Delete , or Retrieve .	yes	n/a
Parent		yes	n/a
Name	To change the name, enter a new name in the New Name column.	yes	n/a

ObjectType	Set to NotificationEndpoint for primary objects. The following value may be present for children of the notification endpoint: <ul style="list-style-type: none">NotificationEndpoint Reference	yes	n/a
Error	If an error occurs during a delete, publish, or retrieve operation for a specific row in the worksheet, PI Builder displays the error message for that row in the Error column cell. The error continues to be displayed until you clear it or perform the next delete, publish, or retrieve operation.	no	no
NewName	Enter a new name to change the name as it appears in PI AF.	no	yes
UniqueID		no	no
Description		no	yes
Contact	The name of the contact associated with the notification endpoint.	no ¹	no ¹
ContactID	The unique identifier (GUID) of the contact associated with the notification endpoint.	no ¹	no ¹
ContactType	Possible values: <ul style="list-style-type: none">IndividualGroupEscalation	no	yes
RetryInterval		no	yes
EscalationTimeout		no	yes
MaximumRetries		no	yes
IsInternal		no	yes
DeliveryChannel	Possible values: <ul style="list-style-type: none">EmailWebService	no	yes
ConfigString		no	yes

CreationDate		no	no
ModifyDate		no	no

¹ You can only set a contact and contactID when you are creating a new notification endpoint.

PI point columns

PI points

The following table lists the columns available for PI points in PI Builder. For more information on the PI point attributes listed in this table, see the PI Data Archive topic: [Point classes and attributes](#).

Column name	Comment	Can be changed in Data Archive
Selected(x)	Enter an x to have PI Builder act on the row when you click Publish , Delete , or Retrieve . This column is required in PI Builder and may be named Select(x) to support PI Tag Configurator worksheets.	n/a
Name	To change the name, enter a new name in the NewName or NewTag column. This column is required in PI Builder.	n/a
ObjectType	Set to PIPoint. This column is required in PI Builder.	n/a
Error	If an error occurs during a delete, publish, or retrieve operation for a specific row in the worksheet, PI Builder displays the error message for that row in the Error column cell. The error continues to be displayed until you clear it or perform the next delete, publish, or retrieve operation.	no
NewName	Enter a new name to change the point name in Data Archive. This column may be named NewTag to support PI Tag Configurator worksheets.	yes
Description	This column may be named Descriptor to support PI Tag Configurator worksheets.	yes
digitalset	The name of the digital state set associated with the PI Point. This applies only to PI Points whose point type is digital.	yes
displaydigits	Controls the display formatting of numeric PI Point values on-screen and in reports.	yes

engunits	Describes the engineering units of measurement used for values of the PI Point.	yes
exdesc	Extended descriptor for the PI Point.	yes
future	The 'future' PI Point attribute	no ¹
pointsource	String that associates a PI Point with an interface or PI application.	yes
pointtype	<p>Possible values:</p> <ul style="list-style-type: none"> • Blob • Digital • Float16 • Float32 • Float64 • Int16 • Int32 • Integer • String • TimeStamp 	yes
ptclassname	The name of the point class to which the PI Point belongs.	no
sourcetag	May be used by some interfaces to output PI Point data to other systems. It is also used to specify the name of the PI Point whose value is used to calculate alarm conditions, SQC alarm conditions, and totalizer results.	yes
archiving	Indicates if data is to be archived for the PI Point. A value of '1' indicates that it is and a value of '0' indicates that it is not.	yes
compressing	Indicates if data is to be compressed for the PI Point. A value of '1' indicates that it is and a value of '0' indicates that it is not.	yes
compdev	Compression deviation indicates the number of engineering units the value of a PI Point must change for a new compressed value to be archived.	yes
compmax	Compression maximum time is the maximum allowable time span between compressed archived values for the PI Point. If the time stamp of a value exceeds compmax, it will be archived even if the value does not fall outside compdev or compdevpercent.	yes
compmin	Compression minimum time is the minimum allowable time span between compressed archived values for the PI Point. If the time stamp of a value is	yes

	less than compmin, it will be discarded even if the value falls outside comp dev or compdevpercent.	
compdevpercent	Compression deviation percent specifies the compression deviation as a percent of the PI Point's span rather than absolute deviation in engineering units.	yes
excdev	Exception deviation indicates to the PI Point's interface the number of engineering units the value must change for a new value to be sent to the PI Point's snapshot.	yes
excmax	Exception maximum time indicates to the PI Point's interface the maximum allowable time span between values being sent to the PI Point's snapshot.	yes
excmin	Exception minimum time indicates to the PI Point's interface the minimum allowable time span between values being sent to the PI Point's snapshot.	yes
excdevpercent	Exception deviation percent specifies the exception deviation as a percent of the PI Point's span rather than absolute deviation in engineering units.	yes
scan	May be used by some interfaces to determine whether a PI Point's data should be updated. If the interface uses the flag, a value of '1' indicates that the PI Point's data should be updated and a value of '0' indicates that it should not be updated. Refer to your particular PI interface documentation to determine if it uses this point attribute.	yes
shutdown	Specifies whether shutdown events should be recorded for a PI Point. A value of '1' indicates that shutdown events should be recorded and a value of '0' indicates that they should not be recorded.	yes
span	Specifies the difference between the top and bottom of the range of values used when calculating whether a new value should be archived or discarded based on the exception or compression settings for the PI Point.	yes
step	Specifies whether numeric values should be interpolated when being archived. A value of '0' indicates that they should be linearly interpolated and a value of '1' indicates that the raw, discrete values should be archived.	yes
typicalvalue	This attribute is used to document an example of a reasonable value for a PI Point. For numeric PI Points, it must be greater than or equal to the zero point attribute and less than or equal to the zero plus the span point attributes. Some interfaces use typicalvalue as a default value for their PI Points.	yes
zero	This attribute is used to specify the lowest value possible for a numeric PI Point.	yes
action1	Specifies the digital state that is set when the corresponding test in the Test1 attribute triggers an alarm.	yes

action2	Specifies the digital state that is set when the corresponding test in the Test2 attribute triggers an alarm.	yes
action3	Specifies the digital state that is set when the corresponding test in the Test3 attribute triggers an alarm.	yes
action4	Specifies the digital state that is set when the corresponding test in the Test4 attribute triggers an alarm.	yes
action5	Specifies the digital state that is set when the corresponding test in the Test5 attribute triggers an alarm.	yes
AutoAck	Specifies whether the alarm is automatically acknowledged when it is triggered.	yes
ControlAlg	Reserved for future use.	yes
ControlTag	The name of the PI Point that is used to enable and disable the alarm.	yes
Deadband	Threshold value within the alarm limit that the PI Point must pass after an alarm is triggered before the point is considered to no longer be in alarm.	yes
Options	Used to specify calculation parameters for alarm, SQC alarm, and totalizer PI Points.	yes
ReferenceTag	For alarm PI Points, this is the name of the PI Point whose value is used in the comparisons specified in the Test1-Test5 attributes to determine whether to trigger an alarm. For SQC alarm PI Points, this attribute is present but unused.	yes
srcptid	The unique PI Point id number associated with the PI Point specified in the source tag point attribute.	yes
test1	Specifies a test to be run to determine if an alarm is to be raised. If the condition is true, the digital state used will be the one specified in the Action1 attribute.	yes
test2	Specifies a test to be run to determine if an alarm is to be raised. If the condition is true, the digital state used will be the one specified in the Action2 attribute.	yes
test3	Specifies a test to be run to determine if an alarm is to be raised. If the condition is true, the digital state used will be the one specified in the Action3 attribute.	yes
test4	Specifies a test to be run to determine if an alarm is to be raised. If the condition is true, the digital state used will be the one specified in the Action4 attribute.	yes

test5	Specifies a test to be run to determine if an alarm is to be raised. If the condition is true, the digital state used will be the one specified in the Action5 attribute.	yes
txt1	Reserved for future use.	yes
txt2	Reserved for future use.	yes
txt3	Reserved for future use.	yes
txt4	Reserved for future use.	yes
txt5	Reserved for future use.	yes
convers	Conversion factor used for scaling PI Point values.	yes
filtercode	Indicates the time constant of a first-order filter used to smooth incoming data. This affects compressed PI Point data. It doesn't affect exception reporting for PI Point data.	yes
instrumenttag	Used by some interfaces to identify a tag from an external system that is related to the PI Point. Some interfaces use the extended descriptor (exdesc) for this purpose. Refer to your particular PI interface documentation for more details.	yes
location1	An integer used by many interfaces to specify the interface ID number. Refer to your particular PI interface documentation for more details.	yes
location2	An integer parameter whose use is determined by the interface associated with a PI Point. Refer to your particular PI interface documentation for more details.	yes
location3	An integer parameter whose use is determined by the interface associated with a PI Point. Refer to your particular PI interface documentation for more details.	yes
location4	An integer used by many interfaces to specify the scan class of the PI Point. Refer to your particular PI interface documentation for more details.	yes
location5	An integer parameter whose use is determined by the interface associated with a PI Point. Refer to your particular PI interface documentation for more details.	yes
squareroot	Used by some interfaces in conjunction with totalcode to scale data. Refer to your particular PI interface documentation for more details.	yes
totalcode	Used by some interfaces in conjunction with squareroot to scale data. Refer to your particular PI interface documentation for more details.	yes

userint1	User-defined integer value.	yes
userint2	User-defined integer value.	yes
userreal1	User-defined floating point value.	yes
userreal2	User-defined floating point value.	yes
clamp		yes
displaygroup		yes
eventnumb		yes
expressnumb		yes
filternumb		yes
groupsize		yes
nodenumb		yes
offset		yes
period		yes
AutoAck	Specifies whether the alarm is automatically acknowledged when it is triggered.	yes
ChartType	Indicates the type of SQC chart for which alarms are being calculated.	yes
ClearOnLimit Change	Specifies whether active SQC alarms should be cleared and alarm calculations restarted when any control limit tag (UCLTag, CLTag, LCLTag) changes.	yes
ClearOnStart	Specifies whether active SQC alarms should be cleared and alarm calculations restarted on startup or after a change to the SQC alarm point's attributes.	yes
CLTag	Name of the PI Point that is used as the center line for SQC calculations.	yes
CommentTag	Name of the PI Point where comments associated to the SQC alarm are to be stored.	yes
LCLTag	Name of the PI Point that is used as the lower control limit for SQC calculations.	yes
LSLTag	Name of the PI Point that is used as the lower specification limit for SQC calculations.	yes

Mixture	SQC pattern test that raises an SQC alarm when x of y values of the source tag are found on both sides of the centerline and none of these values falls within one sigma.	yes
OneSideOfCL	SQC pattern test that raises an SQC alarm when x of y values of the source tag are on one side of the center line.	yes
OutsideControl	SQC pattern test that raises an SQC alarm when x of y values of the source tag are outside the control limits.	yes
OutsideOneSigma	SQC pattern test that raises an SQC alarm when x of y values of the source tag are outside the one sigma limit.	yes
OutsideTwoSigma	SQC pattern test that raises an SQC alarm when x of y values of the source tag are outside the two sigma limit.	yes
PIProductLimits	Reserved for future use.	yes
ProductTag	Name of the PI Point that designates the current product for which the SQC calculation is being made.	yes
ReferenceTag	For alarm PI Points, this is the name of the PI Point whose value is used in the comparisons specified in the Test1-Test5 attributes to determine whether to trigger an alarm. For SQC alarm PI Points, this attribute is present but unused.	
ResetTag	Name of the PI Point that governs the execution and reset of the SQC alarm calculation.	yes
SQCArmPriority	Integer value that specifies the priority of the SQC alarm.	yes
scriptid	The unique PI Point id number associated with the PI Point specified in the sourcetag point attribute.	
Stratification	SQC pattern test that raises an SQC alarm when x of y values of the source tag are within the one sigma limit.	yes
TestStatusTag	Name of the PI Point to which the SQC alarm system writes values indicating which SQC pattern tests are in alarm.	yes
Trend	SQC pattern test that raises an SQC alarm when x consecutive values of the sourcetag trend either up or down.	yes
UCLTag	Name of the PI Point that is used as the upper control limit for SQC calculations.	yes

USLTag	Name of the PI Point that is used as the upper specification limit for SQC calculations.	yes
WaitOnLimitChange	Reserved for future use.	yes
CalcMode	Used in conjunction with the function point attribute to define the primary behavior of a totalizer PI Point.	yes
CompValue	Used for comparison in the event counting functions.	yes
Conversion	Used to convert the engineering units of the rate point to proper engineering units for the totalization. The raw totalizer results is multiplied by the value of conversion.	yes
EventExpr	Performance equation expression that defines event types used by EventChange and EventTrue options of totalclosemode. It also defines the event times at which the rate point is scanned for ratesamplemode option.	yes
FilterExpr	Mathematical performance equation expression that is used to determine whether point values are to be excluded from totalization.	yes
Function	Used in conjunction with the calcmode point attribute to define the primary behavior of a totalizer PI Point.	yes
MovingCount	Used by NSampleMoving and NSampleBlock options of totalclosemode to determine the number of samples for the accumulation interval.	yes
Offset	Relative time stamp that is used by the Clock option of totalclosemode to determine when to begin the initial accumulation.	
Offset2	Relative time stamp that is used by the Scan1 and Scan2 options of totalclosemode to determine when to start sampling.	yes
Options	Used to specify calculation parameters for alarm, SQC alarm, and totalizer PI Points.	
PctGood	Percent of rate point values that must be good for the output of the totalizer to be marked as good.	yes
Period	Used by the Clock option of totalclosemode to specify the accumulation interval.	
Period2	Used by the Scan1 and Scan2 options of ratesamplemode to specify the sampling rate.	yes
RateSampleMode	Specifies when individual values from the rate point are used in the calculation or are added to the calculation.	yes

ReportMode	Specifies the manner in which the totalizer results are sent to the PI snaps hot.	yes
scriptid	The unique PI Point id number associated with the PI Point specified in the sourcetag point attribute.	
TotalCloseMode	Specifies the accumulation interval of the totalizer calculation.	yes
zerobias	The value of the rate point is considered to be 0 if it is less than this value.	yes
dataaccess	Valid for Data Archive versions earlier than 3.4.380.	yes
datagroup	Valid for Data Archive versions earlier than 3.4.380.	yes
dataowner	Valid for Data Archive versions earlier than 3.4.380.	yes
ptaccess	Valid for Data Archive versions earlier than 3.4.380.	yes
ptgroup	Valid for Data Archive versions earlier than 3.4.380.	yes
ptowner	Valid for Data Archive versions earlier than 3.4.380.	yes
datasecurity	Valid for Data Archive versions 3.4.380 and later.	yes
ptsecurity	Valid for Data Archive versions 3.4.380 and later.	yes
changedate	The read-only date and time when the PI Point was last edited.	no
changer	The read-only name of the user who last edited the PI Point.	no
creationdate	The read-only date and time when the PI Point was created.	no
creator	The read-only name of the user who created the PI Point.	no
pointid	The unique numeric identifier for the PI Point. It is read-only and may not be changed. It should not be confused with the recno PI Point attribute.	no
recno	The primary record number of the PI Point in the data archive. It is read-only and may not be changed. It should not be confused with the pointid PI Point attribute.	no

¹ You can set the value for new PI points, but you cannot change the value for existing points.

Reference type columns

Reference types

The following table lists the columns available for PI AF reference types in PI Builder:

Column name	Comment	Required in PI Builder	Can be changed in PI AF
Selected(x)	Enter an x to have PI Builder act on the row when you click Publish , Delete , or Retrieve .	yes	n/a
Parent		yes	
Name	To change the name, enter a new name in the NewName column.	yes	n/a
ObjectType	Set to ReferenceType.	yes	n/a
Error	If an error occurs during a delete, publish, or retrieve operation for a specific row in the worksheet, PI Builder displays the error message for that row in the Error column cell. The error continues to be displayed until you clear it or perform the next delete, publish, or retrieve operation.	no	no
NewName	Enter a new name to change the name in PI AF.	no	yes
UniqueID		no	no
ChildName		no	yes
ParentName		no	yes
Strength	Possible values are: <ul style="list-style-type: none"> • Composition • Strong • Weak 	no	yes
AllowedParentElementTemplate		no	yes
AllowedChildElementTemplate		no	yes
Categories		no	yes
CreationDate		no	no
ModifyDate		no	no

SecurityString		no	yes
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PI identity columns

PI identities

The following table lists the columns available for PI identities in PI Builder:

Column name	Comment	Required in PI Builder	Can be changed in Data Archive
Selected(x)	Enter an x to have PI Builder act on the row when you click Publish , Delete , or Retrieve .	yes	n/a
Name	To change the name, enter a new name in the NewName column.	yes	n/a
ObjectType	Set to PIIdentity for primary objects. The following value may be present for children of the PIIdentity: <ul style="list-style-type: none"> PIIdentityMapping 	yes	n/a
Error	If an error occurs during a delete, publish, or retrieve operation for a specific row in the worksheet, PI Builder displays the error message for that row in the Error column cell. The error continues to be displayed until you clear it or perform the next delete, publish, or retrieve operation.	no	no
NewName	Enter a new name to change the name in Data Archive.	no	yes
UniqueID		no	no
Description		no	yes
IsEnabled		no	yes
CanDelete		no	yes
AllowMappings		no	yes
AllowTrusts		no	yes
AllowExplicitLogin	This can be set to true only if the IdentityType of the PIIdentity is PIUser.	no	yes

IdentityType	Possible values: <ul style="list-style-type: none"> PIIdentity PIGroup PIUser 	no	yes
MappingIdentity		no	yes
MappingAccount Name	The mapping account name can only be set when creating a new mapping. It cannot be changed after the mapping is created.	no	no

PI identity mapping columns

PI identity mappings

The following table lists the columns available for PI identity mappings in PI Builder:

Column name	Comment	Required in PI Builder	Can be changed in Data Archive
Selected(x)	Enter an x to have PI Builder act on the row when you click Publish , Delete , or Retrieve .	yes	n/a
Name	To change the name, enter a new name in the NewName column.	yes	n/a
ObjectType	Set to PIIdentityMapping.	yes	n/a
Error	If an error occurs during a delete, publish, or retrieve operation for a specific row in the worksheet, PI Builder displays the error message for that row in the Error column cell. The error continues to be displayed until you clear it or perform the next delete, publish, or retrieve operation.	no	no
NewName	Enter a new name to change the name in Data Archive.	no	yes
UniqueID		no	no
Description		no	yes
MappingIdentity		no	yes

MappingAccountName	The mapping account name can only be set when creating a new mapping. It cannot be changed after the mapping is created.	no	no
IsEnabled		no	yes

Security identity columns

Security identities

The following table lists the columns available for PI AF security identities in PI Builder:

Column name	Comment	Required in PI Builder	Can be changed in PI AF
Selected(x)	Enter an x to have PI Builder act on the row when you click Publish , Delete , or Retrieve .	yes	n/a
Name	To change the name, enter a new name in the NewName column.	yes	n/a
ObjectType	Set to SecurityIdentity for primary objects. The following value may be present for children of the SecurityIdentity: <ul style="list-style-type: none">SecurityMapping	yes	n/a
Error	If an error occurs during a delete, publish, or retrieve operation for a specific row in the worksheet, PI Builder displays the error message for that row in the Error column cell. The error continues to be displayed until you clear it or perform the next delete, publish, or retrieve operation.	no	no
NewName	Enter a new name to change the name in PI AF.	no	yes
UniqueID		no	no
Description		no	yes
IsEnabled		no	yes
ModifyDate	Read-only time and date when the identity was last modified.	no	no
MappingIdentity		no	yes

MappingAccountName	The mapping account name can only be set when creating a new mapping. It cannot be changed after the mapping is created.	no	no
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Security mapping columns

Security mappings

The following table lists the columns available for PI AF security mappings in PI Builder:

Column name	Comment	Required in PI Builder	Can be changed in PI AF
Selected(x)	Enter an x to have PI Builder act on the row when you click Publish , Delete , or Retrieve .	yes	n/a
Name	To change the name, enter a new name in the NewName column.	yes	n/a
ObjectType	Set to SecurityMapping.	yes	n/a
Error	If an error occurs during a delete, publish, or retrieve operation for a specific row in the worksheet, PI Builder displays the error message for that row in the Error column cell. The error continues to be displayed until you clear it or perform the next delete, publish, or retrieve operation.	no	no
NewName	Enter a new name to change the name in PI AF.	no	yes
UniqueID		no	no
Description		no	yes
MappingIdentity		no	yes
MappingAccountName	The mapping account name can only be set when creating a new mapping. It cannot be changed after the mapping is created.	no	no
ModifyDate	Read-only time and date when the identity was last modified.	no	no

Transfer columns

Transfers

The following table lists the columns available for PI AF transfers in PI Builder:

Column name	Comment	Required in PI Builder	Can be changed in PI AF ¹
Selected(x)	Enter an x to have PI Builder act on the row when you click Publish , Delete , or Retrieve .	yes	n/a
Parent		yes	no ²
Name	To change the name, enter a new name in the NewName column.	yes	n/a
ObjectType	Set to Transfer for primary objects. One of the following values may be present for children of the transfer: <ul style="list-style-type: none"> • Attribute • ExtendedProperty • Port 	yes	n/a
Error	If an error occurs during a delete, publish, or retrieve operation for a specific row in the worksheet, PI Builder displays the error message for that row in the Error column cell. The error continues to be displayed until you clear it or perform the next delete, publish, or retrieve operation.	no	no
NewItem	Enter a new name to change the name in PI AF.	no	yes
UniqueID		no	no
Description		no	yes
Template		no	no ²
DefaultAttribute		no	yes ³
DefaultInputPort		no	yes ³
DefaultOutputPort		no	yes ³

DefaultUndirectedPort		no	yes ³
Categories		no	yes ¹
IsAnnotated		no	no ⁶
IsLocked		no	no
AreValuesCaptured		no	yes
StartTime		no	yes
EndTime		no	yes
Source	Enter the name of an element or model.	no	yes
SourcePort	This port must belong to the element in the Source column, or the model and its port type must be Output.	no	yes
Destination	Enter the name of an element or model.	no	yes
DestinationPort	This port must belong to the element in the Destination column, or the model and its port type must be Input.	no	yes
CreationDate		no	no
ModifyDate		no	no
ExtendedPropertyType	<p>Possible values:</p> <ul style="list-style-type: none"> • Boolean / Boolean[] • Byte / Byte[] • DateTime / DateTime[] • Double / Double[] • Guid / Guid[] • Int16 / Int16[] • Int32 / Int32[] • Int64 / Int64[] • Single / Single[] • String / String[] • AFAttribute • AFElement 	no	yes

	<ul style="list-style-type: none"> • AFFile 		
ExtendedPropertyValue		no	yes
AttributesHidden		no	yes ⁴
AttributesManualDataEntry		no	yes
AttributeTrait	<p>Possible values:</p> <p>For Limit traits:</p> <ul style="list-style-type: none"> • Minimum • LoLo • Lo • Target • Hi • HiHi • Maximum <p>For Location traits:</p> <ul style="list-style-type: none"> • Latitude • Longitude • Altitude • Forecast • Reason 	no	yes
AttributesConfigurationItem		no	yes ^{1,3}
AttributesExcluded		no	yes
AttributeDefaultUOM		no	yes ^{1,3}
AttributeType	<p>Possible values:</p> <ul style="list-style-type: none"> • Boolean / Boolean[] • Byte / Byte[] • DateTime / DateTime[] • Double / Double[] • Guid / Guid[] • Int16 / Int16[] 	no	yes ^{1,3}

	<ul style="list-style-type: none"> • Int32 / Int32[] • Int64 / Int64[] • Single / Single[] • String / String[] • AFAttribute • AFElement • AFFile • AFEnumerationValue (AttributeTypeQualifier contains the enumeration set from which values are to be selected) • Object 		
AttributeTypeQualifier	If the AttributeType column contains AFEnumerationValue, then the AttributeTypeQualifier column contains the name of an enumeration set and the AttributeValue column contains the name of an enumeration value from the specified enumeration set.	no	yes ^{1,3}
AttributeValue		no	yes ⁵
AttributeDataReference	Possible values: <ul style="list-style-type: none"> • Formula • PI Point • PI Point Array • String Builder • Table Lookup • URI Builder • Name of a custom data reference 	no	yes
AttributeConfigString		no	yes
AttributeDisplayDigits		no	yes
PortType	Possible values: <ul style="list-style-type: none"> • Undirected • Input • Output 	no	yes ^{1,3}

PortMaxConnections		no	yes ^{1,3}
PortAllowedElementTypes		no	yes ^{1,3}
PortAllowedElementTemplate		no	yes ^{1,3}

¹ You cannot add attributes or ports, or modify the categories when the transfer is based on a template unless the template's Allow Extensions check box is selected.

² You cannot change the values in these columns. Delete the object (the entire row in the worksheet) and then add the object back in with the value change you want.

³ You can write changes to values in the DefaultAttribute, DefaultInputPort, DefaultOutputPort, and DefaultUndirectedPort columns only when the transfer is not derived from a template. Most properties of attributes and ports cannot be changed if they are defined by the template.

⁴ You can change this value only if the attribute does not have a template. If the attribute has a template, then you cannot change the value from the attribute; you must change the value from the attribute template.

⁵ You can change the value of an event-frame attribute if the attribute does not have a data reference. If the attribute does have a data reference and AreValuesCaptured is TRUE, then you can change the value, but writes the changed value only to the internal value cache that the attribute maintains; does not write values to the data source, such as to for data references to PI points.

⁶ You cannot change the value for this property since it is indirectly set or cleared in PI System Explorer or through client code when annotations are added to a transfer or all annotations are deleted from a transfer.

Transfer template columns

Transfer templates

The following table lists the columns available for PI AF transfer templates in PI Builder:

Column name	Comment	Required in PI Builder	Can be changed in PI AF
Selected(x)	Enter an x to have PI Builder act on the row when you click Publish , Delete , or Retrieve .	yes	n/a
Parent		yes	n/a
Name	To change the name, enter a new name in the NewName column.	yes	n/a
ObjectType	Set to TransferTemplate for primary objects. One of the following values may be present for children of the transfer template: <ul style="list-style-type: none"> AttributeTemplate TemplateExtendedProperty 	yes	n/a

	<ul style="list-style-type: none"> TemplatePort 		
Error	If an error occurs during a delete, publish, or retrieve operation for a specific row in the worksheet, PI Builder displays the error message for that row in the Error column cell. The error continues to be displayed until you clear it or perform the next delete, publish, or retrieve operation.	no	no
NewItem	Enter a new name to change the name in PI AF.	no	yes
UniqueID		no	no
Description		no	yes
BaseTemplate		no	yes
AllowElementToExtend		no	yes
BaseTemplateOnly	<p>Possible values:</p> <ul style="list-style-type: none"> True False <p>Only users with an Administrators PI AF Identity can set the value to True. Indicates if the object is a Base Template Only template. This template type serves as a base template for derived templates. It cannot be used to create objects directly.</p>	no	yes
DefaultAttribute		no	yes
NamingPattern		no	yes
DefaultInputPort		no	yes
DefaultOutputPort		no	yes
DefaultUndirectedPort		no	yes
Categories		no	yes
CreationDate		no	no
ModifyDate		no	no

SecurityString		no	yes
ExtendedPropertyType	Possible values: <ul style="list-style-type: none"> • Boolean / Boolean[] • Byte / Byte[] • DateTime / DateTime[] • Double / Double[] • Guid / Guid[] • Int16 / Int16[] • Int32 / Int32[] • Int64 / Int64[] • Single / Single[] • String / String[] • AFAttribute • AFElement • AFFile 	no	yes
ExtendedPropertyValue		no	yes
AttributeNewParent	Enter the name of a new parent to move the object in the PI AF hierarchy.	no	yes
AttributesHidden		no	yes
AttributesManualDataEntry		no	yes
AttributeTrait	Possible values: For Limit traits: <ul style="list-style-type: none"> • Minimum • LoLo • Lo • Target • Hi • HiHi • Maximum For Location traits: <ul style="list-style-type: none"> • Latitude 	no	yes

	<ul style="list-style-type: none"> • Longitude • Altitude • Forecast • Reason 		
AttributesConfigurationItem		no	yes
AttributesExcluded		no	yes
AttributesIndexed		no	yes
AttributeDefaultUOM		no	yes
AttributeType	<p>Possible values:</p> <ul style="list-style-type: none"> • Boolean / Boolean[] • Byte / Byte[] • DateTime / DateTime[] • Double / Double[] • Guid / Guid[] • Int16 / Int16[] • Int32 / Int32[] • Int64 / Int64[] • Single / Single[] • String / String[] • AFAttribute • AFElement • AFFile • AFEnumerationValue (AttributeTypeQualifier contains the enumeration set from which values are to be selected) • Object 	no	yes
AttributeTypeQualifier	If the AttributeType column contains AFEnumerationValue, then the AttributeTypeQualifier column contains the name of an enumeration set and the AttributeDefaultValue column contains the name of an enumeration value from the specified enumeration set.	no	yes

AttributeDefaultValue		no	yes
AttributeDataReference	Possible values: <ul style="list-style-type: none"> • Formula • PI Point • PI Point Array • String Builder • Table Lookup • URI Builder • Name of a custom data reference 	no	yes
AttributeConfigString		no	yes
AttributeDisplayDigits		no	yes
PortType	Possible values: <ul style="list-style-type: none"> • Undirected • Input • Output 	no	yes
PortMaxConnections		no	yes
PortAllowedElementTypes		no	yes ¹
PortAllowedElementTemplate		no	yes

¹ If the object is used in a model, then the value in this column cannot be changed.

UOM database columns

UOM databases

The following table lists the columns available for PI AF database classes and units of measures (UOMs) in PI Builder:

Column name	Comment	Required in PI Builder	Can be changed in PI AF
Selected(x)	Enter an x to have PI Builder act on the row when you click Publish , Delete , or Retrieve .	yes	n/a
Parent		yes	
Name	To change the name, enter a new name in the NewName column.	yes	n/a
ObjectType	Set to UOMDatabase for primary objects. One of the following values may be present for children of the UOM database: <ul style="list-style-type: none"> • UOMClass • UOM 	yes	n/a
Error	If an error occurs during a delete, publish, or retrieve operation for a specific row in the worksheet, PI Builder displays the error message for that row in the Error column cell. The error continues to be displayed until you clear it or perform the next delete, publish, or retrieve operation.	no	no
NewItem	Enter a new name to change the name in PI AF.	no	yes
UniqueID		no	no
Description		no	yes
CreationDate		no	no
ModifyDate		no	no
SecurityString		no	yes
CanonicalUOM		no	yes ¹
CanonicalAbbr		no	yes ¹
BaseUnits		no	yes
Abbreviation		no	yes
Origin	Possible values:	no	no

	<ul style="list-style-type: none"> • Unknown • The origin of how the UOM was defined is unknown. • SystemDefined • The UOM is system-defined and has not been modified. • SystemModified • The UOM was system-defined but the Name and/or Description fields have been modified. • SystemReplaced • The UOM retains its original system-defined abbreviation and canonical UOM values but other fields besides Name and Description have been modified. • UserDefined • The UOM was created by the user. 		
RefUOM		no	yes
RefFactor		no	yes
RefOffset		no	yes
RefFormulaFrom		no	yes
RefFormulaTo		no	yes

¹ Cannot be changed on an existing UOM class.

UOM class columns

UOM classes

The following table lists the columns available for PI AF units of measures (UOMs) and UOM classes in PI Builder:

Column name	Comment	Required in PI Builder	Can be changed in PI AF
Selected(x)	Enter an x to have PI Builder act on the row when you click Publish , Delete , or Retrieve .	yes	n/a
Parent		yes	
Name	To change the name, enter a new name in the NewName column.	yes	n/a

ObjectType	Set to UOMClass for primary objects. The following value may be present for children of the UOM class: <ul style="list-style-type: none"> • UOM 	yes	n/a
Error	If an error occurs during a delete, publish, or retrieve operation for a specific row in the worksheet, PI Builder displays the error message for that row in the Error column cell. The error continues to be displayed until you clear it or perform the next delete, publish, or retrieve operation.	no	no
NewName	Enter a new name to change the name in PI AF.	no	yes
UniqueID		no	no
Description		no	yes
CanonicalUOM		no	yes ¹
CanonicalAbbr		no	yes ¹
BaseUnits		no	yes
Abbreviation		no	yes
Origin	Possible values: <ul style="list-style-type: none"> • Unknown • The origin of how the UOM was defined is unknown. • SystemDefined • The UOM is system-defined and has not been modified. • SystemModified • The UOM was system-defined but the Name and/or Description fields have been modified. • SystemReplaced • The UOM retains its original system-defined abbreviation and canonical UOM values but other fields besides Name and Description have been modified. • UserDefined • The UOM was created by the user. 	no	no

RefUOM		no	yes
RefFactor		no	yes
RefOffset		no	yes
RefFormulaFrom		no	yes
RefFormulaTo		no	yes
Metric		no	yes
US Customary		no	yes

¹ Cannot be changed on an existing UOM class.

PI Builder tutorial

This tutorial contains three exercises that introduce you to PI Builder. The exercises demonstrate the most common use cases and features. After completing the exercises, you will understand the PI Builder basics.

Create multiple elements linked to new PI points


Follow this exercise to create multiple elements that link to new PI points. In this exercise, you will use PI System Explorer to create templates for heat pumps, and then you will use PI Builder to create pump elements and PI points from those templates. Finally, you will verify the results in PI System Explorer.

Create the heat pump templates

Before you create the templates, decide which PI AF server and which PI AF database will store the templates. In PI AF, templates provide a structure that you can use to create objects. You can use PI System Explorer to create templates. Follow this procedure to use PI System Explorer to create an element template for a heat pump and an attribute template to store the speed of the pump. The attribute template references a point from the PI Random Simulator interface.

1. Open PI System Explorer. (Click **Start** > **All Programs** > **PI System** > **PI System Explorer**.)
2. Select a database to use for the tutorial:
 - a. In the PI System Explorer toolbar, click **Database**.
 - b. From the **Asset server** list, select the PI AF server that stores your database.
 - c. From the **Databases** list, select your database.
 - d. Click **OK**.
3. Create a new element template:
 - a. In the navigation pane, click **Library**.
 - b. In the database tree, expand **Templates**, right-click **Element Templates**, and click **New Template**.
 - c. On the **General** tab, in the **Name** field, enter Heat Pump Template.
4. Create a new attribute template:
 - a. On the **Attribute Templates** tab, in the empty template table, click **New Attribute Template**.
 - b. In the **Name** field, enter PumpSpeed.
5. Configure a data reference for the attribute template:
 - a. From the **Data Reference** list, select **PI Point**.
 - b. Click **Settings** to open the PI Point Data Reference window.
 - c. In the **Data server** list, leave the default value: %Server%.

The value %Server% is a substitution parameter. When creating an attribute from this template, PI AF sets the Data Archive to the default Data Archive of the element's PI AF database.

- d. In the **Tag name** field, leave the default tag name: %Element%.%Attribute%.
The values %Element% and %Attribute% are substitution parameters. When creating an attribute from this template, PI AF sets the data reference to a PI point named *ElementName.AttributeName*.
- e. Select the **Tag Creation** check box and then click  adjacent to the **Tag Creation** field.
The Tag Creation Settings window opens.
- f. From the **Point Class** list, select **classic**.
- g. From the **Point Type** list, select **Float32**.
- h. Enter the following point attribute values:

Attribute	Value
zero	1100
span	200
pointsource	R
location4	1
location5	2

For the other attributes, leave the default values.

Note: These settings create a point that references the default PI Random Simulator interface. If this interface is not installed on your system, this point will have no values.

- i. Click **OK**.
 - j. On the PI Point Data Reference window, click **OK**.
6. Check in the templates:
- a. Click **File > Check In**.
 - b. On the Check In window, click **Check In**.
- PI AF checks in the new template and makes it available for use.

Create the heat pump elements

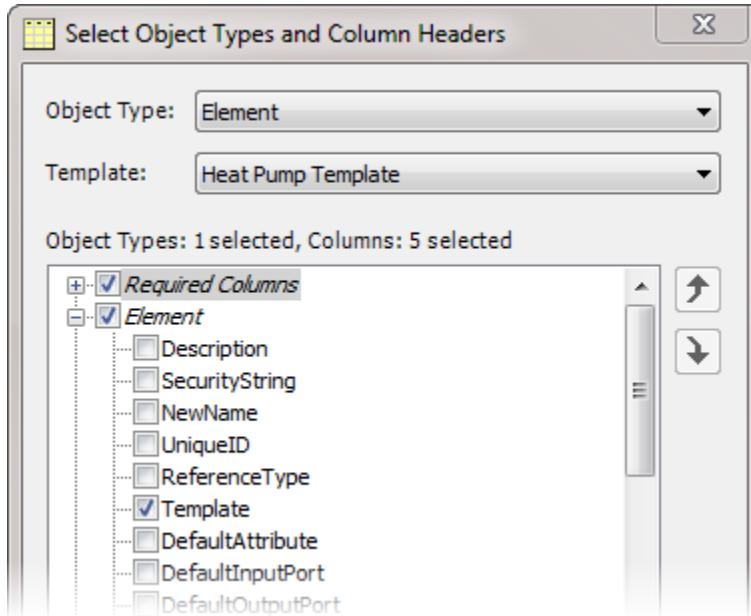
Before you create heat pump elements, you need to [Create the heat pump templates](#).

PI AF elements are objects that represent assets. Follow this procedure to create a parent element, Heat Pumps, and ten child elements, Pump1 through Pump10, with PI Builder. The parent element is a container element that provides structure in your overall framework, and the child elements contain information about individual pumps. You will use the element template that you created in the previous procedure.

1. Open a new Microsoft Excel worksheet and click the **PI Builder** tab.
2. In the **Connections** group, open the database in which you created the template:
 - a. From the **Asset Server** list, select the PI AF server that contains your database.
 - b. From the **Database** list, select the database.

3. Add the needed column headers to the worksheet:

- In the **Resources** group, click **Headers** to open the Select Object Types and Column Headers window.
- From the **Object Type** list, select **Element**.
- Click **Clear All** to clear selected object types except those in the **Required Columns** group (you cannot clear the required columns).
- In the **Object Types** list, expand the **Element** group, and select the **Template** check box.



- Click **OK** to add the selected column headers to the worksheet.

	A	B	C	D	E	F
1	Selected(x)	Parent	Name	ObjectType	Template	
2	x			Element		
3						

4. Define a parent element and its children elements in the worksheet:

- In the second row of the worksheet, in the Name column, type Heat Pumps.
- In the third row, enter the following values for a new element:

Column	Value
Selected	x
Parent	Heat Pumps
Name	Pump1
ObjectType	Element
Template	Heat Pump Template

The worksheet should look like this:

	A	B	C	D	E
1	Selected(x)	Parent	Name	ObjectType	Template
2	x		Heat Pumps	Element	
3	x	Heat Pumps	Pump1	Element	Heat Pump Template
4					

Note: The Heat Pumps element is the parent element for the other elements. PI Builder creates the elements in the order they appear in the worksheet, so you must enter parent elements above their child elements.

- c. Select cells A3 through E3, and then drag the fill handle to cell E12.

Excel copies the selected cells and fills in the pump name with sequential values. The worksheet should look like this:


	A	B	C	D	E
1	Selected(x)	Parent	Name	ObjectType	Template
2	x		Heat Pumps	Element	
3	x	Heat Pumps	Pump1	Element	Heat Pump Template
4	x	Heat Pumps	Pump2	Element	Heat Pump Template
5	x	Heat Pumps	Pump3	Element	Heat Pump Template
6	x	Heat Pumps	Pump4	Element	Heat Pump Template
7	x	Heat Pumps	Pump5	Element	Heat Pump Template
8	x	Heat Pumps	Pump6	Element	Heat Pump Template
9	x	Heat Pumps	Pump7	Element	Heat Pump Template
10	x	Heat Pumps	Pump8	Element	Heat Pump Template
11	x	Heat Pumps	Pump9	Element	Heat Pump Template
12	x	Heat Pumps	Pump10	Element	Heat Pump Template
13					

5. Publish the objects to create the elements in PI AF:
 - a. Click **Publish** to open the Publish Options window.
 - b. From the **Edit Mode** list, select **Create Only** (you could also select **Create and Edit**).
 - c. Select the **Create or update PI points** check box to automatically create the PI point referenced by the attribute of each element.
If you do not select this check box, you must create the corresponding PI points in PI System Explorer.
 - d. Click **OK**.
PI Builder creates the elements in the database. The Publish Selected Objects window shows the operations completed. PI Builder automatically checks in the changes.
 - e. Click **Close**.

Verify creation of heat pump elements

Before you verify create of heat pump elements, you need to [Create the heat pump elements](#).

You can use PI System Explorer to verify that PI Builder created the expected elements and attributes. Follow this procedure to verify that PI Builder created the heat pump elements and corresponding attributes with automatically generated PI points.

1. Open PI System Explorer. (Click **Start** > **All Programs** > **PI System** > **PI System Explorer**.)
2. Select the database used for the exercise:
 - a. In the PI System Explorer toolbar, click **Database**.
 - b. From the **Asset server** list, select the PI AF server that stores your database.
 - c. From the **Databases** list, select your database.
 - d. Click **OK**.
3. In the navigation pane, click **Elements**.
4. Expand **Heat Pumps** to see the created pump elements.
If PI System Explorer was already open, you might need to click **Refresh**  to see the changes.
5. Click a child element, such as **Pump4**, to see details for that element.
6. Click the **Attributes** tab and verify that the data reference is correct.
 - Under **Settings**, the configuration string should show the default Data Archive and point name, such as: `\MyServer\Pump4.PumpSpeed`.
 - In the **Value** field, a value should appear.

Note: After PI Builder creates a PI point, it might take some time before the specified interface writes values to Data Archive. Until then, the value Pt. Created appears.

Create multiple elements linked to existing PI points

Follow this exercise to create multiple elements that link to existing PI points that you create. Using PI Builder, you will create PI points for ten reactors, create templates for the reactors, create elements from those templates, and then configure the created attributes to reference the existing PI points that you already created.

Create PI points for reactors

You can use PI Builder to create PI points. Follow this procedure to create PI points that collect data for ten different reactors. These points store data from the PI Random Simulator interface.

1. Open a new Microsoft Excel worksheet and click the **PI Builder** tab.
2. In the **Connections** group, from the **Data server** list, select the Data Archive where you want to create the points.
3. Add the appropriate column headers to your worksheet:
 - a. In the **Resources** group, click **Headers** to open the Select Object Types and Column Headers window.
 - b. From the **Object Type** list, select **PI Point**.
 - c. Click **Clear All** to clear selected object types except those in the **Required Columns** group (you cannot clear the required columns).
 - d. Under the **General** group, select the **pointsource** and **pointtype** check boxes.
 - e. Under the **Classic** group, select the **location2**, **location4**, and **userint1** check boxes.
 - f. Click **OK** to add the selected column headers to the worksheet.
4. In the second row, fill in the following values to specify the point for the first reactor:

Column	Value
Selected(x)	x
Name	Data_React1
ObjectType	PIPoint
pointsource	R
pointtype	Float32
location2	2
location4	1
userint1	7200

5. Prepare the worksheet to define ten points based on the values that you entered:
 - a. Select the first four columns in the second row and drag the fill handle across the next nine rows to create ten rows with sequentially named points.
 - b. Copy the values from the last four columns in the second row to the next nine the rows.

	A	B	C	D	E	F	G	H
1	Selected(x)	Name	ObjectType	pointsource	pointtype	location2	location4	userint1
2	x	Data_React1	PIPoint	R	Float32	2	1	7200
3	x	Data_React2	PIPoint	R	Float32	2	1	7200
4	x	Data_React3	PIPoint	R	Float32	2	1	7200
5	x	Data_React4	PIPoint	R	Float32	2	1	7200
6	x	Data_React5	PIPoint	R	Float32	2	1	7200
7	x	Data_React6	PIPoint	R	Float32	2	1	7200
8	x	Data_React7	PIPoint	R	Float32	2	1	7200
9	x	Data_React8	PIPoint	R	Float32	2	1	7200
10	x	Data_React9	PIPoint	R	Float32	2	1	7200
11	x	Data_React10	PIPoint	R	Float32	2	1	7200
12								

6. Publish the new points to the selected Data Archive:
 - a. Click **Publish** to open the Publish Options window.
 - b. From the **Edit Mode** list, select **Create Only**.
With this choice, PI Builder will only create new points. PI Builder will generate an error if any existing points have the same names.
 - c. Click **OK**.
PI Builder creates the points on Data Archive. The Publish Selected Objects window shows the operations completed.
 - d. Click **Close**.

Create the reactor templates

Before you create reactor templates, decide which PI AF server and which PI AF database will store the templates.

In PI AF, templates provide a structure that you can use to create objects. You can use PI Builder to create templates. Follow this procedure to create an element template for a reactor and an attribute template to store temperature for reactors.

1. Open a new Microsoft Excel worksheet and click the **PI Builder** tab.
2. In the **Connections** group, select a database:
 - a. From the **Asset Server** list, select the PI AF server that stores your database.
 - b. From the **Database** list, select your database.
3. Add the appropriate column headers to your worksheet:
 - a. In the **Resources** group, click **Headers** to open the Select Object Types and Column Headers window.
 - b. From the **Object Type** list, select **Element Template**.
 - c. Click **Clear All** to clear selected object types except those in the **Required Columns** group (you cannot clear the required columns).
 - d. Under the **Attribute Template** object type, select the **DefaultUOM** and **DataReference** check boxes.
 - e. Click **OK** to add the selected column headers to the worksheet.
4. In the second row of the worksheet, in the Name column, type Reactor Template.
5. In the third row, fill in the following values to specify an attribute template:

Column	Value
Selected(x)	x
Parent	Reactor Template
Name	Temperature Attribute
Object Type	AttributeTemplate
AttributeDefaultUOM	degC
AttributeDataReference	PI Point

The worksheet should look like this:

	A	B	C	D	E	F
1	Selected(x)	Parent	Name	ObjectType	AttributeDefaultUOM	AttributeDataReference
2	x		Reactor Template	ElementTemplate		
3	x	Reactor Template	Temperature Attribute	AttributeTemplate	degC	PI Point
4						

The AttributeDefaultUOM and AttributeDataReference column headers might not be in the same worksheet columns as they appear in the illustration.

6. Publish the data to PI AF:

- a. Click **Publish** to open the Publish Options window.
- b. From the **Edit Mode** list, select **Create Only** (you could also select **Create and Edit**).
- c. Click **OK**.

PI Builder creates the template in the database. The Publish Selected Objects window shows the operations completed. PI Builder automatically checks in the changes.

- d. Click **Close**.

If desired, you can view the template in PI System Explorer.

Create the reactor elements

Before you create reactor elements, you need to [Create the reactor templates](#).

PI AF elements are objects that represent assets. Follow this procedure to create a parent element, Reactors, and ten child elements, React1 through React10, with PI Builder. The parent element is a container element that provides structure in your overall framework, and the child elements contain information about individual reactors. You will use the reactor template that you created in the previous procedure.

Add needed column headers to the worksheet

Before you add column headers, you need to [Create the reactor templates](#).

To create elements, PI Builder requires specific column headers. Follow this procedure to add the worksheet column headers that PI Builder requires to create the reactor elements.

1. Open a new Microsoft Excel worksheet and click the **PI Builder** tab.
2. In the **Resources** group, click **Headers** to open the Select Object Types and Column Headers window.
3. From the **Object Type** list, select **Element**.
4. Click **Clear All** to clear selected object types except those in the **Required Columns** group (you cannot clear the required columns).
5. In the **Object Types** list, expand the **Element** group, and select the **Template** check box.
6. Add Temperature Attribute as an available attribute column:
 - a. From the **Template** list, select **Reactor Template**.
 - b. In the **Object Types** list, expand the **Attribute Columns (from Reactor Template)** group, and select the **Temperature Attribute** check box.
7. Click **OK**.

PI Builder adds the column headers that you selected to the worksheet, including the Temperature Attribute column.

	A	B	C	D	E	F
1	Selected(x)	Parent	Name	ObjectType	Template	Temperature Attribute
2	x			Element		
3						

Define elements in the worksheet

[Add needed column headers to the worksheet.](#)

To create elements with PI Builder, you must define element values in the worksheet. Follow this procedure to define the elements and an organizing parent element for ten reactors.

1. Define the parent element:
 - a. In the second row of the worksheet, in the Name column, type Reactors.
 - b. Verify that an X appears in the Selected(x) column and Element appears in the ObjectType column. This parent element does not need a template.

Note: PI Builder creates the elements in the order they appear in the worksheet; therefore, you must enter parent elements above their child elements.

2. Define the ten reactors as child elements:
 - a. In rows 3 through 12 of the worksheet, enter the following values:

Column	Value
Selected(x)	x
Parent	Reactors
Object Type	Element
Template	Reactor Template

- b. In row three, in the Name column, type React1.
 - c. Select the React1 cell and drag the fill handle across the remaining cells in the column to name the other elements sequentially.

	A	B	C	D	E	F
1	Selected(x)	Parent	Name	ObjectType	Template	Temperature Attribute
2	x		Reactors	Element		
3	x	Reactors	React1	Element	Reactor Template	
4	x	Reactors	React2	Element	Reactor Template	
5	x	Reactors	React3	Element	Reactor Template	
6	x	Reactors	React4	Element	Reactor Template	
7	x	Reactors	React5	Element	Reactor Template	
8	x	Reactors	React6	Element	Reactor Template	
9	x	Reactors	React7	Element	Reactor Template	
10	x	Reactors	React8	Element	Reactor Template	
11	x	Reactors	React9	Element	Reactor Template	
12	x	Reactors	React10	Element	Reactor Template	
13						
14						

Publish the objects to create the elements in PI AF


Before you can publish objects, you need to [Define elements in the worksheet.](#)

After you define elements in your worksheet, publish them to create the elements in PI AF.

1. On the **PI Builder** tab, click **Publish** to open the Publish Options window.
2. From the **Edit Mode** list, select **Create and Edit**.
3. Click **OK**.

PI Builder creates the elements in the database. The Publish Selected Objects window shows the operations completed. PI Builder automatically checks in the changes.

4. Click **Close**.

You can view the elements in PI System Explorer. If PI System Explorer is already open, click **Refresh**  to see the changes.

Configure data references for the temperature attribute

In PI AF, data references link a PI AF attribute to a PI point. Follow this procedure to configure data references for the temperature attribute of the reactor elements that you created previously. The procedure uses the reactor points that you created. Alternatively, you can use sample points or other existing points on your server.

Retrieve the reactor elements

Before you can retrieve reactor elements, you need to [Create the reactor elements](#).

To edit PI AF elements with PI Builder, retrieve those elements into your worksheet. Follow this procedure to retrieve the reactor elements into a worksheet.

1. Open a new Microsoft Excel worksheet and click the **PI Builder** tab.
2. In the **Attribute Data References** group, clear the **Show Values in Columns** check box.

Because you have not yet defined any PI point data references for the temperature attribute, you do not want PI Builder to retrieve values for those data references.

3. Click **Elements > Find Elements** to open the Element Search window.
4. Find all the elements that use the template named *Reactor Template*:
 - a. From the **Template** list, select **Reactor Template**.
 - b. From the **All Descendants** list, select **True**.
 - c. Click **Search**.

PI Builder retrieves the elements that use the template named Reactor Template in the **Results** table.

5. Select all the elements in the **Results** table and click **OK**.
 - a. Click **Clear All** to clear any previously selected columns.
 - b. In the **Attribute Columns (from Reactor Template)** group, select the **Temperature Attribute** check box.
6. In the Select Object Types and Column Headers window, select the objects and column headers that you want to appear in the worksheet.
 - a. Click **Clear All** to clear any previously selected columns.
 - b. In the **Attribute Columns (from Reactor Template)** group, select the **Temperature Attribute** check box.
7. Click **OK** to retrieve the elements into the worksheet.

The Retrieve Selected Objects window shows the operations completed.

8. Click **Close**.

The worksheet should contain 10 rows, which show React1 through React10.

Define data references for the temperature attribute

Before you can define data references, you need to complete the following tasks:

- [Create PI points for reactors.](#)
- [Retrieve the reactor elements.](#)

To create a PI point data reference with PI Builder, you must define an attribute configuration that references the PI point. Follow this procedure to define a data-reference configuration for the temperature attribute of elements in the reactor template. You will reference the PI points you created previously for reactors.

1. In a new worksheet, retrieve the PI points that you created for reactors, and sort the points by name:
 - a. Click **PI Points > Find PI Points** to open the Tag Search window.
 - b. In the text box, type `Data_React*` and click **Search** to retrieve the points into the results table.
 - c. Select the ten points that you created and click **OK**.
 - d. In the Select Object Types and Column Headers window, click **Clear All** to clear all columns other than the required columns, and then click **OK** to retrieve the points into the worksheet.
 - e. Sort the Name column by ascending values.
 - f. Copy the cells that contain the names.
2. In the worksheet with the retrieved reactor elements, add the PI points next to the retrieved columns:
 - a. In rows 2 through 11 of column G, paste the names of the PI points you created for the reactors.
 - b. Leave the column header blank.
 - c. Leave at least one column empty between the retrieved PI AF columns and the points that you added.

The worksheet should look something like this:

	A	B	C	D	E	F	G
1	Selected(x)	Parent	Name	ObjectType	Temperature Attribute		
2	x	Reactors	React1	Element			Data_React1
3	x	Reactors	React10	Element			Data_React10
4	x	Reactors	React2	Element			Data_React2
5	x	Reactors	React3	Element			Data_React3
6	x	Reactors	React4	Element			Data_React4
7	x	Reactors	React5	Element			Data_React5
8	x	Reactors	React6	Element			Data_React6
9	x	Reactors	React7	Element			Data_React7
10	x	Reactors	React8	Element			Data_React8
11	x	Reactors	React9	Element			Data_React9

3. For the first element, define the configuration string of the temperature attribute and link to a point:
 - a. On the **Home** tab, verify that the cell format for cell E2 is set to **General**.
(PI Builder reformats many cells as text.)

- b. In cell E2 (the |Temperature Attribute column of the React1 element), type the configuration string `=\\%Server%\&` and then click cell G2 to link to the point.

Note: `%Server%` is a substitution parameter that PI Builder will replace with the name of the default Data Archive of the PI AF database in which the attribute resides. See [Attribute configuration strings in PI Builder](#) for more information.

- c. Press **Enter**.

The full formula should be:

`=\\%Server%\&"&G2`

4. Click cell E2 and drag the fill handle across the remaining cells in the column to copy the configuration of the first element with the row-relative point reference.

The worksheet will show the appropriate point in each temperature attribute configuration.

	A	B	C	D	E	F	G
1	Selected(x)	Parent	Name	ObjectType	Temperature Attribute		
2	x	Reactors	React1	Element	=\\%Server%\Data_React1		Data_React1
3	x	Reactors	React10	Element	=\\%Server%\Data_React10		Data_React10
4	x	Reactors	React2	Element	=\\%Server%\Data_React2		Data_React2
5	x	Reactors	React3	Element	=\\%Server%\Data_React3		Data_React3
6	x	Reactors	React4	Element	=\\%Server%\Data_React4		Data_React4
7	x	Reactors	React5	Element	=\\%Server%\Data_React5		Data_React5
8	x	Reactors	React6	Element	=\\%Server%\Data_React6		Data_React6
9	x	Reactors	React7	Element	=\\%Server%\Data_React7		Data_React7
10	x	Reactors	React8	Element	=\\%Server%\Data_React8		Data_React8
11	x	Reactors	React9	Element	=\\%Server%\Data_React9		Data_React9
12							

For more information on the format of data references in attribute columns, see [Data references in attribute columns](#).

Publish the objects to create the data references in PI AF


Before you publish objects, you need to [Define data references for the temperature attribute](#).

After you define the data-reference configurations in your worksheet, publish the worksheet to create the data references for the temperature attributes in PI AF.

1. On the **PI Builder** tab, click **Publish** to open the Publish Options window.
2. From the **Edit Mode** list, select **Create and Edit**.
3. Click **OK**.

PI Builder edits the temperature attributes for the reactor elements in the database. PI Builder ignores the PI points in column G because column G has no header. The Publish Selected Objects window shows the operations completed. PI Builder automatically checks in the changes.

4. Click **Close**.

You can view the temperature attributes in PI System Explorer. If PI System Explorer is already open, click **Refresh**  to see the changes.

Edit elements and attributes

Before you edit elements and attributes, you need to [Create multiple elements linked to existing PI points](#).

Follow this exercise to edit existing elements in PI AF. Using PI Builder, you will modify the reactor template to include new attributes, and then edit the elements that use the template to set values for those attributes. Finally, you will use PI Builder to search for elements with specific attribute values.

Edit the reactor template

Before you edit the reactor template, you need to [Create the reactor templates](#).

You can use PI Builder to edit previously created templates. Follow this procedure to edit the reactor template that you created in a previous exercise. You will edit the template to add new attribute templates, including child attribute templates.

1. Open a new Microsoft Excel worksheet and click the **PI Builder** tab.
2. In the **Connections** group, open the database in which you created the reactor template:
 - a. From the **AF Server** list, select the PI AF server that stores the database.
 - b. From the **Database** list, select the database.
3. Retrieve the reactor template:
 - a. Click **Library > Templates > Find Templates** to open the Template Selection window.
 - b. In the table of templates, select **Reactor Template** and click **OK**.
 - c. In the Select Object Types and Column Headers window, click **Clear All**.
 - d. From the **Attribute Template** group, select the **Type** check box.
 - e. Click **OK**.

PI Builder retrieves the template from PI AF and writes the data in the selected columns in your worksheet. The Retrieve Selected Objects window shows the operations completed.

- f. Click **Close**.

The worksheet should look like this:

	A	B	C	D	E
1	Selected(x)	Parent	Name	ObjectType	AttributeType
2	x		Reactor Template	ElementTemplate	
3	x	Reactor Template	Temperature Attribute	AttributeTemplate	Double
4					

Note: If you don't have a reactor template, then create the worksheet illustrated above and publish it to PI AF.

4. Create the new attribute templates:
 - a. Copy the third row and paste it into the next three rows.
 - b. In row four, specify a manufacturer attribute:

Column	Value
Name	Manufacturer
AttributeType	String

- c. In row five, specify a serial-number attribute, which is a child attribute of the manufacturer attribute:

Column	Value
Name	Manufacturer Serial Number
AttributeType	String

Note: Because this is an attribute, the Parent column still must specify Reactor Template. An attribute-relative path in the name indicates the hierarchy.

- d. In row six, specify a maintenance-date attribute, also a child attribute of the manufacturer attribute:

Column	Value
Name	Manufacturer Last Maintained
AttributeType	DateTime

The worksheet should look like this:

	A	B	C	D	E
1	Selected(x)	Parent	Name	ObjectType	AttributeType
2	x		Reactor Template	ElementTemplate	
3	x	Reactor Template	Temperature Attribute	AttributeTemplate	Double
4	x	Reactor Template	Manufacturer	AttributeTemplate	String
5	x	Reactor Template	Manufacturer Serial Number	AttributeTemplate	String
6	x	Reactor Template	Manufacturer Last Maintained	AttributeTemplate	DateTime
7					

5. Publish the modified template:

- Click **Publish** to open the Publish Options window.
- From the **Edit Mode** list, select **Create and Edit**.
- Click **OK**.

PI Builder creates the templates in the database. The Publish Selected Objects window shows the operations completed. PI Builder automatically checks in the changes.

- Click **Close**.

You can view the templates in PI System Explorer. If PI System Explorer is already open, click **Refresh** to see the changes.

Edit the reactor elements to specify new attribute values

Before you can edit the reactor elements, you need to [Edit the reactor template](#).

You can use PI Builder to edit existing elements. Follow this procedure to edit the reactor elements to set values for the new attributes you added in the previous procedure. You will retrieve the elements into a worksheet, edit the values, and publish to PI AF.

1. Open a new Microsoft Excel worksheet and click the **PI Builder** tab.
2. Find the elements that use the reactor template:
 - a. Click **Elements > Find Elements** to open the Element Search window.
 - b. From the **Template** list, select **Reactor Template**.
 - c. From the **All Descendants** list, select **True**.
 - d. Click **Search**.

PI Builder retrieves the elements that use the template named Reactor Template into the **Results** table.

- e. Select all the elements in the **Results** table and click **OK**.
3. In the Select Object Types and Column Headers window, specify the columns to show in the worksheet:
 - a. Click **Clear All** to clear any existing settings.
 - b. In the **Attribute Columns (from Template 'Reactor Template')** group, select three check boxes:
 - **Manufacturer**
 - **Manufacturer|Last Maintained**
 - **Manufacturer|Serial Number**

4. Retrieve the selected elements into the specified columns:

- a. Click **OK**.

PI Builder adds the selected columns to the worksheet and retrieves the selected elements. The Retrieve Selected Objects window shows the operations completed.

- b. Click **Close**.

5. Edit the elements to specify attribute values for manufacturer, serial number, and last-maintained date:

- a. In row two, type in the following values:

Column	Value
Manufacturer	ACME
Manufacturer Last Maintained	15 june 2010 10:00:00
Manufacturer Serial Number	A123456

You can enter date-time values in a variety of formats, including PI time format. See [Value formats](#) for more information.

- b. Select cells E2 through G2, and then drag the fill handle to cell G11.

Excel copies the selected cells and fills in the serial-number and last-maintained columns with sequential values. The cells for the new attributes should look like this (date format depends on your local computer setting):

E	F	G
Manufacturer	Manufacturer Last Maintained	Manufacturer Serial Number
ACME	15-06-2010 10:00	A123456
ACME	16-06-2010 10:00	A123457
ACME	17-06-2010 10:00	A123458
ACME	18-06-2010 10:00	A123459
ACME	19-06-2010 10:00	A123460
ACME	20-06-2010 10:00	A123461
ACME	21-06-2010 10:00	A123462
ACME	22-06-2010 10:00	A123463
ACME	23-06-2010 10:00	A123464
ACME	24-06-2010 10:00	A123465

6. Publish the elements to PI AF:

- Click **Publish** to open the Publish Options window.
- From the **Edit Mode** list, select **Create and Edit**.
- Click **OK**.

PI Builder changes the attribute values in the database. The Publish Selected Objects window shows the operations completed. PI Builder automatically checks in the changes.



- Click **Close**.

You can view the templates in PI System Explorer. If PI System Explorer is already open, click **Refresh** to see the changes.

Retrieve an element with a specific serial number

Before you can retrieve an element, you need to [Edit the reactor elements to specify new attribute values](#).

You can use PI Builder to retrieve elements with specific attribute values into your worksheet. Follow this procedure to retrieve a reactor element with a specific serial number.

- Open a new Microsoft Excel worksheet and click the **PI Builder** tab.
- Click **Elements > Find Elements** to open the Element Search window.
- If the field next to the **Search** button is not blank, then click  to clear the text.
- Under **Criteria**, set the fields to find the desired element:
 - From the **Template** list, select **Reactor Template**.
 - From the **All Descendants** list, select **True**.
 - Click **Add Criteria** and then click **Attribute Value** to add a set of fields that you can use to search by attribute value.
- In the **Attribute Value** field set, configure the query to find elements that have a specific value for the serial-number attribute:
 - Click **Display attribute choices**  and then click **Other Attributes > Manufacturer | Serial Number**.

- b. Leave the operator field set to equal (=).
- c. In the value field (marked <Null>), type A123462.

Attribute Value: ...

6. Click **Search**.

PI Builder returns the *React6* element in the **Results** table.

7. Select the element and click **OK**.

8. In the **Select Object Types and Column Headers** window, select the objects and column headers that you want to appear in the worksheet.

- a. Click **Clear All** to clear any previously selected columns.
- b. In the **Attribute Columns (from Template 'Reactor Template')** group, select the **Manufacturer | Serial Number** check box. Click **OK** to retrieve the element into the worksheet.

9. Click **OK** to retrieve the element into the worksheet

The Retrieve Selected Objects window shows the operations completed.

10. Click **Close**.

The *React6* element appears in the worksheet. In the Manufacturer | Serial Number column, the value should be *A123462*.

Retrieve elements with specific maintenance dates

Before you can retrieve elements, you need to [Edit the reactor elements to specify new attribute values](#).

You can use PI Builder to retrieve elements with specific attribute values into your worksheet. Follow this procedure to retrieve the reactor elements with last-maintained dates earlier than June 19, 2010.

1. Open a new Microsoft Excel worksheet and click the **PI Builder** tab.
2. Click **Elements > Find Elements** to open the Element Search window.
3. If the field next to the **Search** button is not blank, then click to clear the text.
4. Under **Criteria**, set the fields to find the desired element:
 - a. From the **Template** list, select **Reactor Template**.
 - b. From the **All Descendants** list, select **True**.
 - c. Click **Add Criteria** and then click **Attribute Value** to add a set of fields that you can use to search by attribute value.
5. In the **Attribute Value** field set, configure the query to find elements that have specific values in the maintenance-date attribute:
 - a. Click **Display attribute choices** and then click **Other Attributes > Manufacturer | Last Maintained**.
 - b. Set the operator field to the less-than sign (<).
 - c. In the value field (marked <Null>), type 19 June 2010.

6. Click **Search**.

PI Builder returns four elements in the **Results** table.

7. Select all the returned elements and click **OK**.
8. In the **Select Object Types and Column Headers** window, select the objects and column headers that you want to appear in the worksheet.
 - a. Click **Clear All** to clear any previously selected columns.
 - b. In the **Attribute Columns (from Template 'Reactor Template')** group, select the **Manufacturer | Serial Number** check box.
9. Click **OK** to retrieve the elements into the worksheet.

The Retrieve Selected Objects window shows the operations completed.
10. Click **Close**.

The worksheet shows all the reactors that have a last-maintained date earlier than June 19, 2010.



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