

Analytics

Overview

Analytics are calculated from live values of the process and can optionally be recorded to a database so that a history of their values is available for reporting purposes.

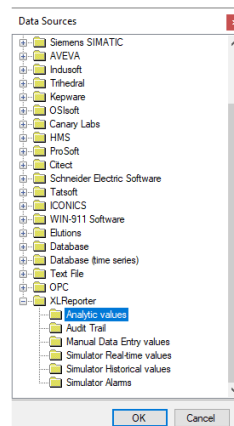
Except for **Snapshot** analytics that only require the **Store** action, analytics are produced in two steps using an **Update** and **Store** action. The first step is to update the value of the analytic periodically and the second step is to store the analytic so that its values are available for use.

Example: To calculate the hourly maximum and minimum of the mixer speed from one minute process values the following steps are required.

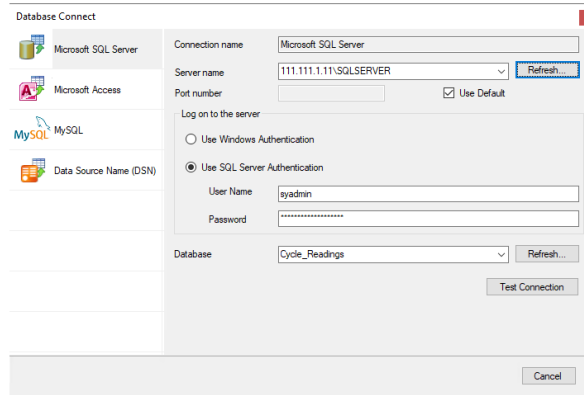
- Step 1: Set the **Update** (see later) of a **Statistic** analytic to one minute to read the process value and update the summary values. Note that the process values themselves are not stored (except for the **Snapshot** analytic).
- Step 2: Set the **Store** (see later) of the **Statistic** analytic to one hour to stop the calculation of the analytic, store it for reporting purposes and start a new calculation.

After a **Store**, the current values of the analytic are available for use using **Variables**.

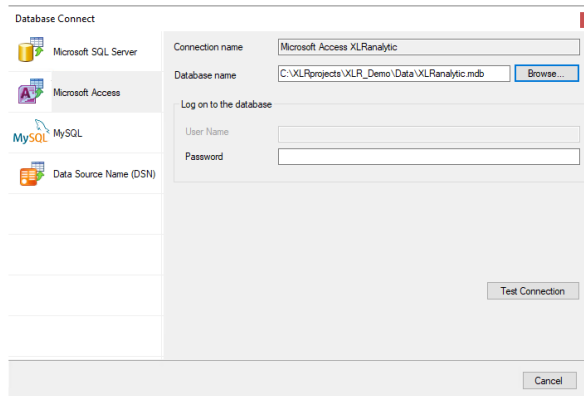
If a history of the analytics is required, an **Analytic Connector** must first be created. From the **Data** tab of the **Project Explorer**, select **Connectors**.



- Choose **XLReporter, Analytic values**
- Click **OK** to open the connector configuration.
- Select the [.] button next to the **Primary Database Type**, this will open the **Database Connect** window.



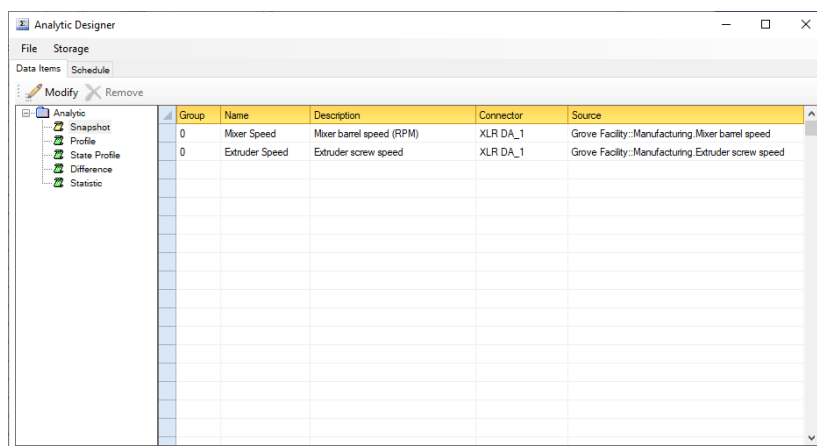
If possible, use a Microsoft SQL Server (including Express) database. Alternatively, a Microsoft Access database is included in the **Data** folder of your project which can be used to store analytic values. Click **Test Connection** to verify database connectivity.



On the **OK** of the data connector configuration, the analytic tables will be created in the database.

Analytic Designer

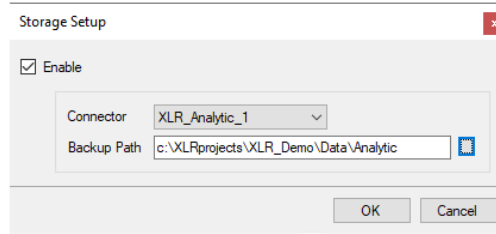
The **Analytic Designer** is used to configure Analytics and optionally set them up to save their values to a database. The designer is opened from the **Data** tab of the **Project Explorer** by selecting **Analytics**.



The display consists of the two tabs **Data Items** and **Schedule**.

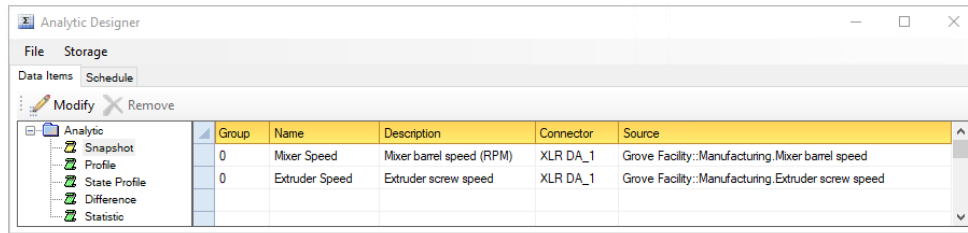
To save changes click **File, Save**. If the **Scheduler** is running, it is automatically reloaded with any changes.

The **Storage** option is only enabled if an **Analytic** connector has been defined.



The **Backup Path** is used to cache analytic history in the event of communication failure. When communication is re-established, the cache is forwarded to the database of the **Connector**.

Data Items



The left view of the **Analytic Designer** displays the analytic categories. Select a category to display the configured analytics in the grid.

- **Group** is the group number for the analytic. This number can be used to manage analytics so that they can be updated and/or stored at the same time or on the same event. For example, if the average of the Mixer temperature is required every hour but the maximum Mixer pressure is required every day, the analytic for the Mixer temperature would be configured for **Group 1** while the Mixer pressure would be configured for **Group 2**.

By default, the group number 0 has a “global” group meaning in that any update or store on any other analytic will affect them.

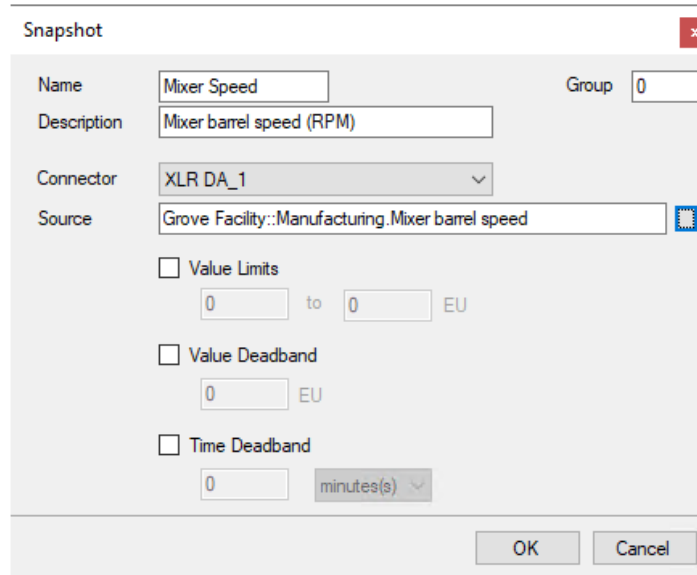
- **Name** is the name of the analytic. This name will be displayed when browsing for analytic values during the setup of a template.
- **Description** is a description of the variable. This description will appear in the analytic browser.
- **Connector** and **Source** collectively define the process value used to calculate the analytic.

To add/modify an item, select a row and double-click, click the **Modify** menu option or select **Modify** from a right click.

To remove an item, select a row and press the **Delete** key, click the **Remove** button, or select **Remove** from a right click.

Snapshot

A **Snapshot** stores the current value of numeric values from the process.



The screenshot shows a dialog box titled "Snapshot" with a close button (X) in the top right corner. The dialog contains the following fields and options:

- Name:** Mixer Speed
- Group:** 0
- Description:** Mixer barrel speed (RPM)
- Connector:** XLR DA_1 (dropdown menu)
- Source:** Grove Facility::Manufacturing.Mixer barrel speed
- Value Limits:** 0 to 0 EU
- Value Deadband:** 0 EU
- Time Deadband:** 0 minutes(s)

At the bottom of the dialog are "OK" and "Cancel" buttons.

The **Snapshot** is saved with a timestamp and current value of the process using the **Store** action.

The analytic supports compression limits which will reduce the quantity of data stored:

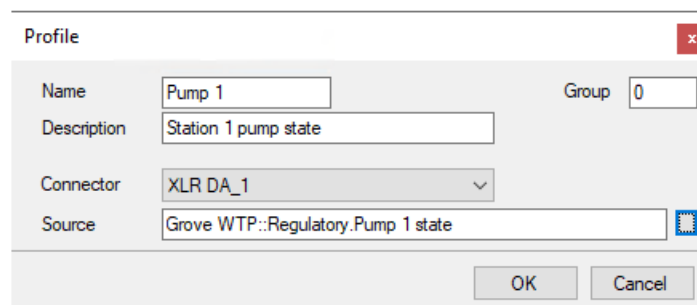
- **Value Limits**
If enabled, the value must be within the limits specified (inclusive) for it to be stored.
- **Value Deadband**
If enabled, the value must change from the previous value by the deadband (specified in engineering units) for it to be stored.
- **Time Deadband**
If enabled, the value is stored if the period has elapsed since the time of the last store.

The **Snapshot** analytic provides the following **Fields**:

- **:Std** (data and time)
- **:Cval** (current value)
- **:Qlty** (value quality, 1 = good)

Profile

A **Profile** analytic calculates metrics from discrete process values, such as on /off counts and on/off durations. The process value is regarded as being in the “off state” if its value is between +/-0.5 otherwise it is in the “on state”.



The screenshot shows a dialog box titled "Profile" with a close button (X) in the top right corner. The dialog contains the following fields and options:

- Name:** Pump 1
- Group:** 0
- Description:** Station 1 pump state
- Connector:** XLR DA_1 (dropdown menu)
- Source:** Grove WTP::Regulatory.Pump 1 state

At the bottom of the dialog are "OK" and "Cancel" buttons.

A **Profile** is updated on an **Update** and is available for reporting on a **Store**.

The Profile analytic provides the following **Fields**:

- **:Std** (start date and time)
- **:End** (end date and time)
- **:Durn** (difference between the start and end in days)
- **:Onct** (on count)
- **:Onse** (on duration in secs)
- **:Ondy** (on duration in days)
- **:Onpt** (on duration as a percent)
- **:Ofct** (off count)
- **:Ofse** (off duration in secs)
- **:Ofdy** (off duration in days)
- **:Ofpt** (off duration as a percent)
- **:Gcnt** (count of good samples)
- **:Bcnt** (count of bad samples)

State Profile

A **State Profile** calculates metrics on how long and how often process values have occurred within specified by data ranges.

The screenshot shows a dialog box titled "State Profile" with a close button (X) in the top right corner. The dialog contains the following fields and options:

- Name:** Reactor Temp
- Group:** 0
- Description:** Reactor tank temperature
- Connector:** XLR DA_1 (dropdown menu)
- Source:** Grove Facility::Manufacturing.Reactor tank temperature
- State:** Four rows, each with a checked checkbox, a state number (1-4), a low value, "to", and a high value:
 - State 1: 10 to 50
 - State 2: 50 to 120
 - State 3: 120 to 80
 - State 4: 80 to 10
- States are sequential
- Buttons:** OK and Cancel

A **State Profile** is updated on an **Update** and is available for reporting on a **Store**.

Up to four **State** ranges can be configured. The **Source** is compared to each state and, if the value is in the data range, the count and duration of that state is updated. If **States are Sequential** is checked then the calculation is performed in a state until the **Source** value takes it to the next state.

The State Profile analytic provides the following **Fields**:

- **:Std** (start date and time)
- **:End** (end date and time)
- **:Durn** (difference between the start and end in days)
- **:Cnt(1 to 4)** (state count)
- **:Dns(1 to 4)** (state duration in secs)
- **:Dnd(1 to 4)** (state duration in days)
- **:Lov(1 to 4)** (state low value)
- **:Hiv(1 to 4)** (state high value)
- **:Gcnt** (count of good samples)

- **:Bcnt** (count of bad samples)

Difference

A **Difference** calculates metrics on the difference of an analog value taken at different times. An example would be to calculate the total from a totalizer.

The screenshot shows a configuration window titled "Difference". It contains the following fields and values:

- Name: Well1 TotalFlow
- Description: Well 1 flow current total
- Group: 0
- Connector: XLR DA_1
- Source: Grove WTP::Regulatory.Well 1 flow current total
- Type: decrement
- Rollover: 0
- Scale: 1

Buttons for "OK" and "Cancel" are located at the bottom right of the dialog.

A **Difference** is updated on an **Update** (which updates the start timestamp) and is made available for reporting on a **Store** (which updates the end timestamp).

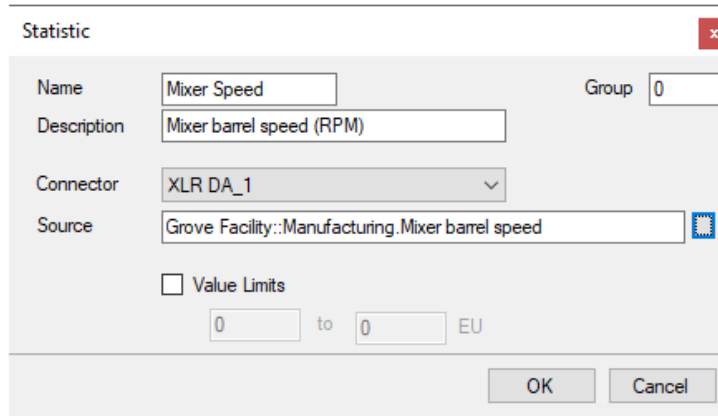
The signal **Type** is either *increment* (the **Source** increments such as a flow totalizer) or *decrement* (the **Source** decrements such as a weigh scale). If the **Source** rolls over at a certain value then this is accounted for by specifying the **Rollover** (0 means no rollover). The **Scale** value is constant used as a scaling factor of the result.

The Difference analytic provides the following **Fields**:

- **:StdT** (start date and time)
- **:EndT** (end date and time)
- **:Durn** (difference between the start and end in days)
- **:Dfsd** (date and time of start sample)
- **:Dfsv** (value of start sample)
- **:Dfed** (date and time of end sample)
- **:Dfev** (value of end value)
- **:Dfcv** (difference between the start value and end value)
- **:Dfsc** (difference between the start time and end time in secs)
- **:Dfdy** (difference between the start time and end time in days)
- **:Type** (difference type)
- **:Roll** (rollover value)
- **:Conv** (scaling factor)
- **:Gcnt** (count of good samples)
- **:Bcnt** (count of bad samples)

Statistic

A **Statistic** calculates statistical summaries for a process value. The values used in the calculation can be filtered by value limits.



The screenshot shows a dialog box titled "Statistic" with a close button (X) in the top right corner. The dialog contains the following fields and controls:

- Name:** Text input field containing "Mixer Speed".
- Description:** Text input field containing "Mixer barrel speed (RPM)".
- Group:** Text input field containing "0".
- Connector:** Dropdown menu showing "XLR DA_1".
- Source:** Text input field containing "Grove Facility::Manufacturing.Mixer barrel speed".
- Value Limits:** A checkbox labeled "Value Limits" is currently unchecked. Below it are two text input fields, both containing "0", separated by the word "to", followed by the unit "EU".
- Buttons:** "OK" and "Cancel" buttons are located at the bottom right of the dialog.

A **Statistic** is updated on an **Update** and is available for reporting on a **Store**.

The **Source** value is not considered unless it satisfies the compression limits:

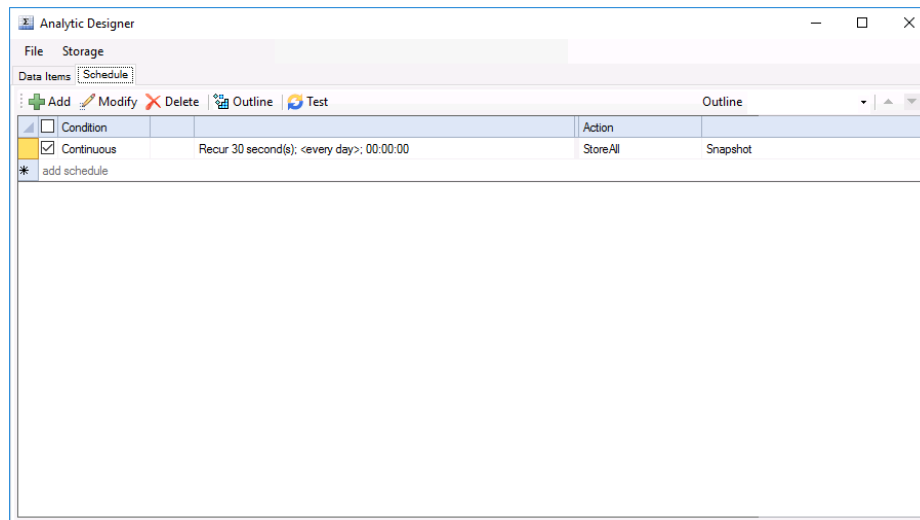
- **Value Limits**
If enabled, the value must be within the limits specified.

The variable provides the following **Fields**:

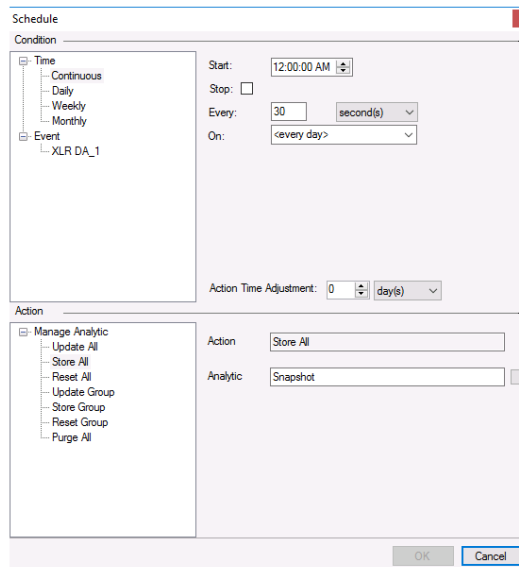
- **:Std** (start date and time)
- **:End** (end date and time)
- **:Durn** (difference between the start and end in days)
- **:Totl** (total)
- **:Maxm** (maximum)
- **:Mxd** (time of maximum)
- **:Minm** (minimum)
- **:Mnd** (time of minimum)
- **:Rnge** (range)
- **:Avge** (average)
- **:Devn** (deviation)
- **:Gcnt** (count of good samples)
- **:Bcnt** (count of bad samples)

Schedule

The **Schedule** tab determines when **Analytics** are **Updated** and **Stored**.



To add a schedule click **Add**.



In the upper part of the display define the **Condition** on which to trigger the action. In the lower part of the display, specify the **Action** to perform when the **Condition** is met.

Actions

Reset Group, Reset All

These **Actions** reset the analytic value(s). Typically, this is not required as the reset automatically happens on a **Store**.

Update Group, Update All

These **Actions** update the value of the analytic value(s) using the process value assigned to the analytic. This is supported for every analytic except **Snapshot**.

Store Group, Store All

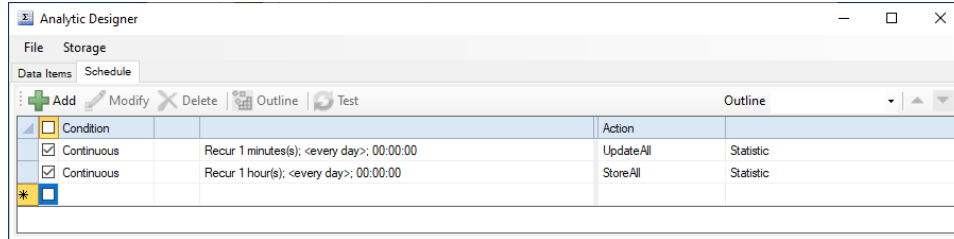
These **Actions** store the value of the analytic value(s) so that they can be used in a report. If historical **Storage** is enabled, they are also saved to a database.

Purge

These **Actions** purge old records from the historical database that are older than **Older (days)**.

Example: Using a **Statistic** analytic variable (seen in **Data Items, Statistic**), calculate the hourly maximum and minimum of the mixer speed from one minute process values.

To achieve this, an **Update** action is run every 1 minute to collect sample values. A **Store** action is run every 1 hour for the resulting metric values to be available for reporting.



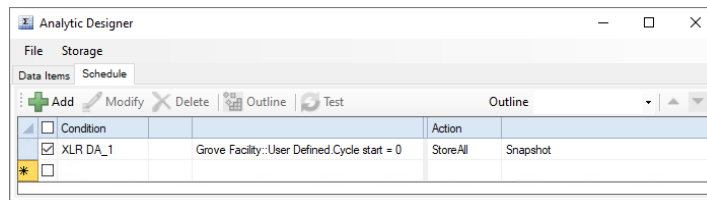
Condition	Action	Outline
<input checked="" type="checkbox"/> Continuous	Recur 1 minutes(s); <every day>; 00:00:00	UpdateAll Statistic
<input checked="" type="checkbox"/> Continuous	Recur 1 hours(s); <every day>; 00:00:00	StoreAll Statistic

When two conditions happen at the same time, for instance every hour in the example above, they are processed sequentially top to bottom.

Schedule Delay

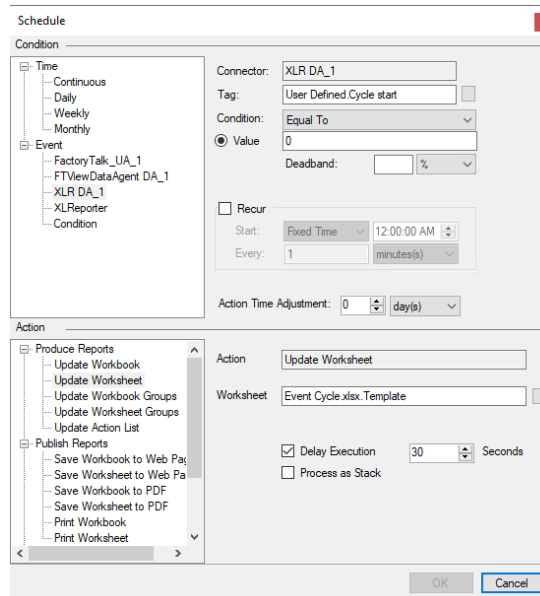
When analytics are **Stored** on time or on an event, it is usual for a report to be produced on the same condition. To make sure the **Store** of the analytic has completed before the report is produced, a **Delay Execution** can be specified in the **Update Worksheet** or **Update Workbook** action.

For example, consider the analytic schedule configuration below that represents a **Snapshot** being **Stored** when a cycle completes:



Condition	Action	Outline
<input checked="" type="checkbox"/> XLR DA_1	Grove Facility::User Defined Cycle start = 0	StoreAll Snapshot

The corresponding schedule action to produce the report would be configured as follows:



Schedule

Condition

- Connector: XLR DA_1
- Tag: User Defined Cycle start
- Condition: Equal To
- Value: 0
- Deadband: %

Recur

Start: Fixed Time 12:00:00 AM

Every: 1 minutes(s)

Action Time Adjustment: 0 day(s)

Action

Update Worksheet

Worksheet: Event Cycle.xlsx.Template

Delay Execution 30 Seconds

Process as Stack

Note that the **Condition** is the same as the analytic **Store** condition. However, a **30 second Delay Execution** setting is used to cause the scheduler to wait 30 seconds after the cycle finishes before it produces the report.

Reporting from Analytics

Overview

There are two options available to report from analytics, either real time or historically (if analytics are configured to store to a database).

Real Time Analytics

The real-time values of analytics are the last **Stored** values and are accessed by **Variables**. The syntax of a variable is **{Name:Field}** where Name is the name of the analytic and **Field** depends on the analytic category (see above).

For example, the maximum value of a **Statistic** analytic called *Mixer* would be referenced by *{Mixer:Maxm}*.

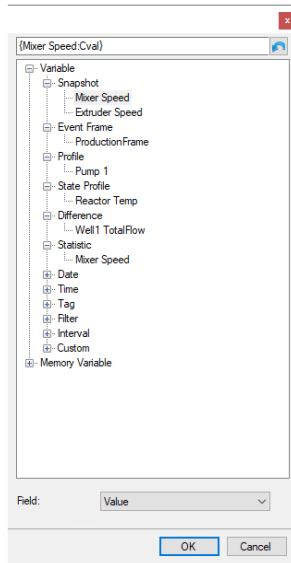
Common usage of **Analytic** variables is in a Report Template or as parameters in data groups.

In a **Report Template**, select the cell that will receive the value and click the **Connect** button on the ribbon to open **Data Connections**.

The screenshot shows the 'Connections' dialog box. It has a 'Save' button at the top left. Below it are 'Data (0)' and 'Manage (0)' tabs. The 'Scope' is set to 'Any Sheet' and 'Group' is '0'. Under the 'Source' section, the 'Connector' dropdown is set to 'Variables'. The 'Name' field has a dropdown arrow and a red box around its selection button. Under the 'Placement' section, the 'Cell' dropdown is set to '\$B\$4' and the 'Type' dropdown is set to 'Direct'.

In Data Connections,

- set the **Connector** dropdown list to *Variables*.
- select the [...] button next to the *Name* field, this will list the available variables configured within the project.



When an analytic is selected, the **Fields** for that analytic are displayed at the bottom.

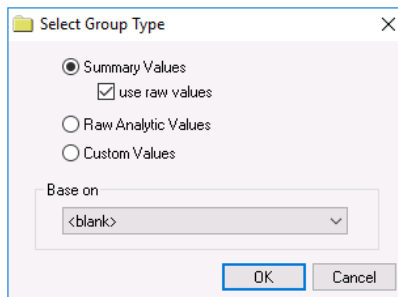
Historical Analytics

Analytics can be configured to **Store** to a database and retrieved using an **Analytic Group** in the report template.

Analytic Group

The **Analytic Group** is similar to the **History Group** and so detailed information can be found in the **History Group** documentation.

To report on data from historical analytics, an analytic group must be configured. One way to do this is directly from the project explorer using **Tools, Connector Groups** or from within a template using **Data Connections**.



The following group types are available:

Summary Values

This group type retrieves values in the database and provides additional summary calculations.

By default, the summary values are time-weighted and values are propagated based on the last known value. To change this so that summary values are calculated strictly on the data returned, check **use raw values**.

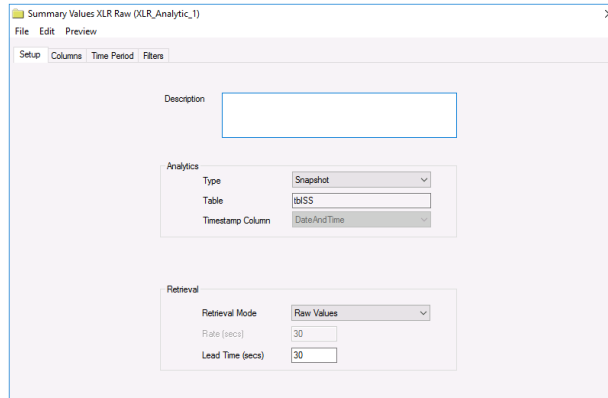
Raw Analytic Values

This group retrieves the values in the database.

Custom Values

This option opens the **Database Group** builder where a query can be configured to retrieve data from any table in the database.

Group Settings Setup Tab



Analytics

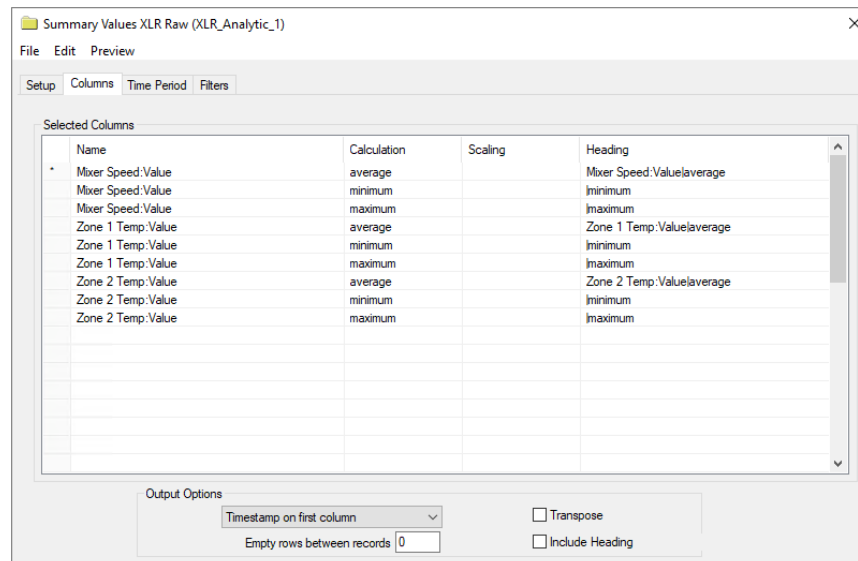
This section defines which Analytic **Type** is used for the selected **Columns**.

Retrieval (Summary Values Group)

The **Retrieval** settings define how much data is retrieved for the calculations selected for the summary calculation. The following settings are available:

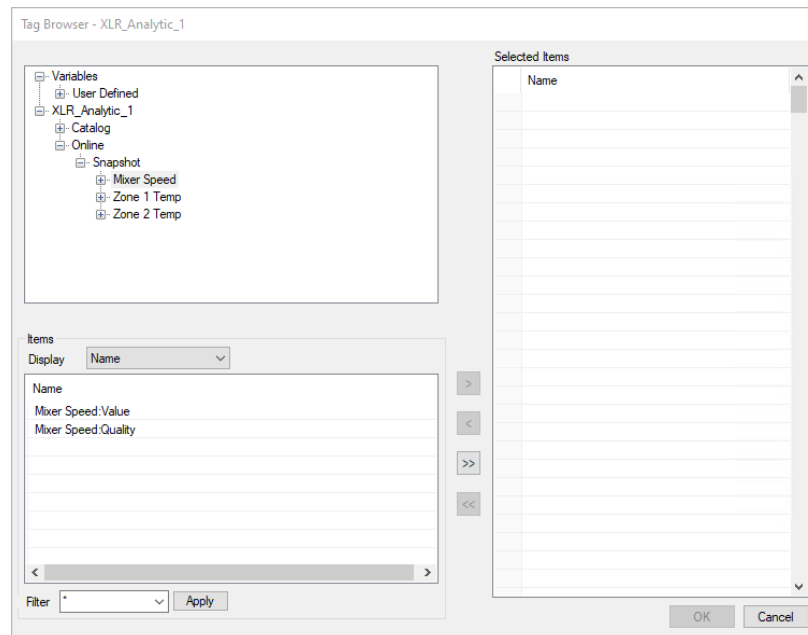
- **Retrieval Mode**
This setting defines how data is retrieved from the historian. For Analytics, only *Raw Values* is available.
- **Lead Time**
The amount of time (in seconds) to retrieve data before the start time of the group (see Time Period tab).

Columns Tab



The **Columns** tab defines which analytics are used by the group.

To add an item, select a cell in the **Name** column, and click the browse button (...) to open the item browser.



In the top left, a **Name** is selected which can be one of three choices:

- **Literal**
A **Literal** is the given *Name* of the item (as configured in the **Analytic Designer**).
- **Variable**
A **Variable** (displayed in { }) provides a way to assign the item names externally, e.g., when the group is used on-demand, the item name is selected. Variable names can be selected from the **Variables** branch of the item browser and can be a **User-Defined** or a **Register** variable. User defined variables are not limited to the *{Tag X}* syntax – these can be assigned to any expression, e.g. *{Temperature}* or *{Pressure}* by typing in the name.
- **Static**
A **Static** (displayed in *{ }) is considered fixed text for display only and is not used for data retrieval. In the item browser, select **Treat As Text** to configure.

Grid rows are moved relative to each other, **Inserted** or **Deleted** by right clicking on the left most column or using the up/down and insert/delete keys on the keyboard.

When empty rows are set between two items, the output of the group will contain empty rows/columns. Use empty rows to prevent calculations in the template from being overwritten by the output of the group.

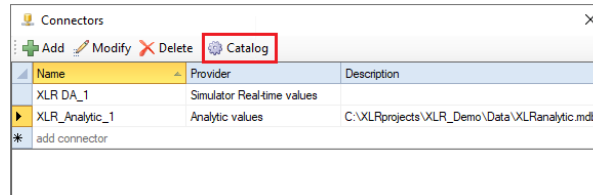
Please refer to the **History Data Group** documentation for more information on the remaining settings.

Web Portal

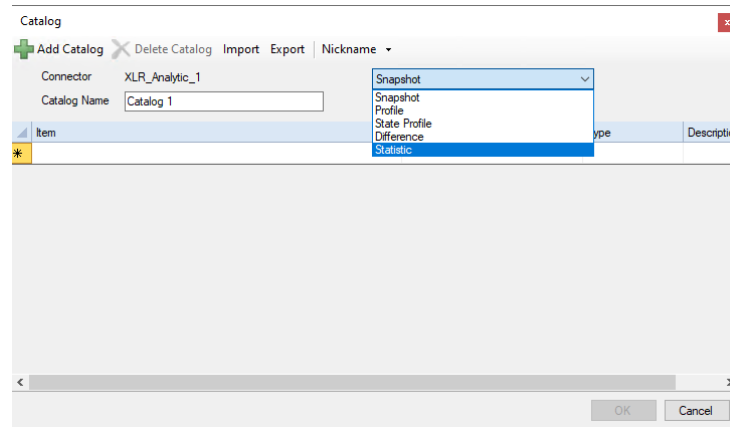
The web portal is provided with the **Distributed** edition of the product. It gives access to produce reports on-demand, complete forms and view scheduled reports from windows and web clients across the network.

If a template is used from a client that requires process tag names, a **Connector Catalog** is required to provide the tag information.

To create a catalog, navigate to the **Data** tab and open **Connectors**. In Connectors, select the Analytic Database connector and then select **Catalog**.



In the **Catalog Builder**, select **Add Catalog**. Give the new catalog a name and select the analytic type from the dropdown list on the right.



Click the [...] button in the **Item** column to open the Tag Browser. Select the analytic items and fields required for this catalog. Click **OK** when finished to save.

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