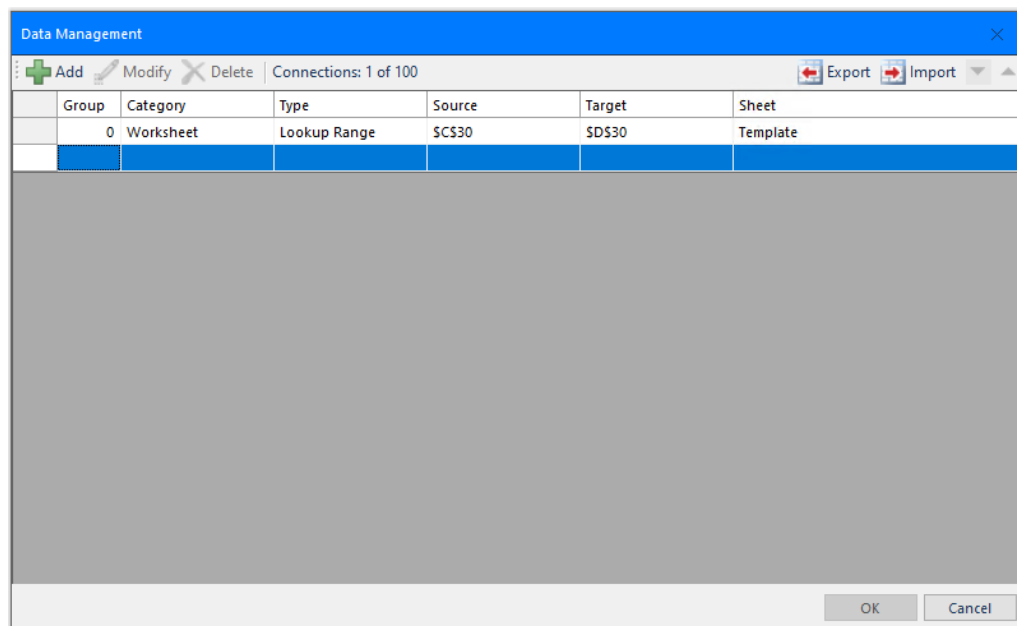# Data Management

Overview

Data Management provides a suite of functions that are applied to report data. They provide numerous features such as handling of dynamic ranges, performing data analysis, and importing/exporting from a workbook.

Usually, the **Manage** connections are applied after the **Data** connections. This ordering can be refined by using the **Group** setting.

Configuration

To configure **Data Management** in a template, open the **Template Studio** and under the **Connect** tab select **Data**, **Manage**.

To add a new management connection click **Add**. To modify an existing connection, click **Modify**.

The **Sheet** and **Group** settings determine which worksheet or **Group** activates the function. With the defaults, *Any Sheet* and a **Group** set to *0*, the update of any worksheet causes the management function to execute.

However, by setting **Sheet** to a specific sheet, the function only activates on the update of that specific sheet. Likewise, by setting a **Group** number greater than zero, the function only activates when an action with that **Group** number is executed.

The available management functions are organized by **Category**. Each **Category** supports a set of functions listed in **Type**.

Apply To/Source/Range

Most management functions operate on a range of data that is determined by the **Apply To (Source** or **Range)** settings where the **Start** cell(s), **Direction** and the **End** condition collectively determine the range at runtime.

- **Start**

    This defines the initial range. It can be a single cell, single row, single column or a range of multiple rows and columns. This range is then expanded based on the Direction and End Conditions.

- **Direction**

  This determines the direction in which the **Start** range is expanded. The following options may be available depending on the management function selected.
    - **None**
      No expansion is done. The **Start** range is used as is.
    - **Down**
      The **Start** range is expanded down based on the **End** criteria.
    - **Across**
      The **Start** range is expanded across based on the **End** criteria.
    - **Down (variable columns)**
      The **Start** range is first expanded across the columns based on the **End** criteria, then expanded down using the same **End** criteria.
    - **Across (variable rows)**
      The **Start** range is first expanded down the rows based on the **End** criteria, then expanded across using the same **End** criteria.
- **End**

  This determines when the expansion of the range stops. Note that if multiple rows or columns are specified in the **Start** range, the **End** criteria is applied starting at the bottom row or rightmost column depending on the **Direction**.
    - **Edge cell is empty**

      The range is expanded until the first empty cell in the leftmost column or topmost row (depending on **Direction**) is found.
    - **All cells are empty**

      The range is expanded until the first entirely empty row or column (depending on **Direction**) is found.
    - **First empty cell**

      The first empty cell in each row (or column) is determined and then the range is expanded to the topmost (or leftmost) cell relative to the range.
    - **Last empty cell**

      The last empty cell in each row (or column) is determined and then the range is expanded to the bottommost (or rightmost) cell relative to the range.

For example: A history data group connection placed in $B$4 provides a date/time and 4 columns. If a border is required around the report data, then the **Apply To** settings are *$B$4:$F$4*, *Down*, *All cells are empty.*

Placement

Management functions that produce output, such as *Copy Range*, require a **Placement** to determine where the output is placed.

The **Cell** location determines the placement. The **Type** indicates how the placement is performed.

The following **Types** are available:
- **Direct**

  The output of the function is placed directly into the cell given by the **Cell**.
- **Offset**

  The output of the function is placed in a row or column (see **Direction**) relative to the **Cell** according to the value of the **Offset**. The **Offset** can be an **XLReporter** counter variable (e.g., *CR000*) or a time-based calculation (e.g., *mM/15*, 15-minute offset of the month).
- **Append**

  The output of the function is appended onto the end of the existing data in the row or column relative to the **Cell** according to the **Direction**.
- **Insert At Start**

  The output of the function is inserted at the **Cell** in the specified **Direction**. Any content below or to the right of the insertion is moved down or across.

- **Insert At End**

  The output of the function is inserted at the end of the existing data in the row or column relative to the **Cell** according to the **Direction**. Any content below or to the right of the insertion is moved down or across.

- **Insert At Start (full)**

  The output of the function is inserted at the **Cell** in the specified **Direction** by inserting <u>entire</u> rows or columns (depending on **Direction**). Any content below the **Cell** row or to the right of the **Cell** column of the insertion is moved down or across.

- **Insert At End (full)**

  The output of the function is inserted at the end of the existing data by inserting <u>entire</u> rows or columns in the row or column relative to the **Cell** according to the **Direction**. Any content in rows below the **Cell** row or to the right of the **Cell** column is moved down or across.

Cell References

In the above, the **Cell** determined the placement. This can be expressed in two ways.

- **Absolute Cell Reference**

  The setting can be either fixed text or a cell reference, the cell reference must be an absolute reference (e.g., *$A$1*).

- **Named Cells/Ranges**

  For any cell reference setting, a **Named Cell/Range** can be used. The advantage of using a named cell or range is that if rows or columns are inserted or deleted from the worksheet, the named cell or range is shifted accordingly.

  For more information on how to configure named cells and ranges, see the **Named Cell/Range** section of the **Template Studio** document under the **DESIGN** category in the **Document Library**.

Variables and Name Types

Any function setting that supports a hard coded value can also be set with a **Variable** or **Name Type**.

Order of Operations

By default, management connections are updated after the data connections so that the management connections can operate on the data brought in by the data connections.

To change order in which connections are updated, use the **Group** setting for both the data and management connections and then configure the *Update Group* actions accordingly.

Data Management Reference

Worksheet

This set of **Data Management** functions are when *dynamic* ranges are used i.e., when the number of data rows/columns cannot be predicted. Dynamic ranges are commonly found in discrete reports, reports over a batch, or on-demand reports where the user specifies the report parameters.

The handling of dynamic ranges can be achieved by using an *Insert* **Placement** of a data connection, but these functions provide more custom functionality.

AutoFit Range

The **AutoFit Range** function adjusts either the column widths or row heights of the range determined by the **Apply To** settings based on the content of the cells in the range. This can be very useful if the report contains a data group which brings in either headers or textual data that can vary in size.

Settings

    AutoFit

- *Column Width*
  Each column in the range is widened based on the cell in the column with the largest amount of data (e.g., the cell with the most characters).
- *Row Height*
  Each row in the range is adjusted in height based on the cell in the row with the largest amount of data (e.g., the cell with the most characters).
  This setting is most effective if the cells are formatted to wrap text.

Example

A report template is designed to allow the user to select tags which are displayed in the report. Since tag names will vary in length it is difficult to size the column widths ahead of time. Instead, an **AutoFit Range** management function is configured to run after the data is retrieved.

If the report data is configured for cell *$B$8* with an additional 12 columns, the **AutoFit Range** function is configured as:

Apply To	*$B$8:$N$8, Down, All cells are empty*
Setting	
AutoFit	*Column Width*

Border Range

The **Border Range** function draws a border around the outside (and optionally inside) of the **Apply To** range.

Settings

    Thickness

The thickness of the border to draw.

    Color

The color of the border to draw. This can either be *Automatic* (based on the theme of the template), a specific color listed or a numeric color in the *R,G,B* format. For example, the *RGB* of a gray border is *128,128,128*.

Line Style

The style of the border lines drawn which can be *Continuous* for single lines or *Double* for double lines.

Inside Border

This determines if inside borders are applied to the range. These can be applied just the *Columns* of the range, *Rows* of the range or *Both* rows and columns in the range.

Example

A batch report template is created to retrieve 1-minute samples over the duration of the batch from historical data. A border should be drawn around the data for completeness. Since batches run at different durations, the border cannot be drawn on the template. This function is used to draw this border after the data is retrieved. Data starts on *$B$8:$H$8*. The settings for the function are:

Apply To	*$B$8:$H$8, Down, All cells are empty*
Setting	
Thickness	*Thin*
Color	*Automatic*
Line Style	*Continuous*
Inside Border	*None*

Chart Range

The **Chart Range** function adjusts chart settings, such as data series ranges, of an existing chart in the workbook using the **Source**.

If the data series ranges do not need to be adjusted but the chart needs its X or Y axis to be adjusted, use the **Chart Enhancement** function under the **Placement** category.

Settings

Chart Name

The name of the chart to apply the function to. The browse button (…) opens a list of every configured chart within the workbook to select from. The list is in the format:

Chart Name – Sheet!Range of the chart

If a chart is selected in the list, the worksheet for the chart is activated and the range of the chart is selected to highlight the chart itself.

The chart name is not visible and is typically not set by the user. When a chart is inserted into a worksheet it is given a default name (*Chart X* where *X* is a number that starts at 1). However, if the worksheet is copied to another sheet, if the default name is left it can be changed on the new worksheet. To combat this, charts in the template are renamed to a fixed name (*xlrX* where *X* is a number that starts at 1) so that chart names are consistent between worksheets.

Note that only charts configured to worksheets are listed. Charts configured on a Chart Sheet cannot be used with this function.

Add/Remove Series

If set to *Yes*, when the function is executed, it will ensure that the number of series in the chart match the number of columns (or rows depending on **Direction**) in the **Source** range.

If there are more series configured than there are columns (or rows) in the **Source** range, the extra series are removed.

If there are less series configures than there are columns (or rows) in the **Source** range, those series are added to chart. The series properties like color, weight, thickness, etc. are determined by the defaults of the Design Studio.

The rule of thumb here is that if you want total control over the formatting of every series set up the chart for the worst case and let this function remove unused series. Otherwise just set up the first series and let this function add the others as needed.

X-Axis Ticks

The number of tick marks and labels displayed on the X-axis of the chart. Set this to *0* to automatically determine the number of tick marks and labels.

Adjust Y-Axis

The scaling of the Y-axis of the chart. Set to *None* to use the default scaling set for the chart, *Automatic* to determine the minimum and maximum as the minimum/maximum of the values of the series plus +/- 1% or *Custom* to use cell values for the minimum and maximum.

Y-Axis Minimum

If **Adjust Y-Axis** is set to *Custom* this setting must be set to a cell reference containing the minimum scale value for the Y-Axis.

If the chart has a secondary axis, the minimum scale value for it can be specified as a range of two cells either horizontally or vertically. E.g., *$B$4:$B$5* means that the minimum for the primary axis comes from cell *$B$4* and the minimum for the secondary axis comes from cell *$B$5*. Conversely a range of *$B$4:$C$4* means that the minimum for the primary axis comes from cell *$B$4* and for the secondary comes from cell *$C$4*.

If the cell is not on the **Active By** sheet, the sheet must be specified, e.g., *Sheet1!$B$5*.

Y-Axis Maximum

If **Adjust Y-Axis** is set to *Custom* this setting must be set to a cell reference containing the maximum scale value for the Y-Axis.

If the chart has a secondary axis, the maximum scale value for it can be specified as a range of two cells either horizontally or vertically. E.g., *$C$4:$C$5* means that the maximum for the primary axis comes from cell *$C$4* and the maximum for the secondary axis comes from cell *$C$5*. Conversely a range of *$C$4:$D$4* means that the maximum for the primary axis comes from cell *$C$4* and for the secondary comes from cell *$D$4*.

If the cell is not on the **Active By** sheet, the sheet must be specified, e.g., *Sheet1!$B$5*.

Example

An On-Demand report template is created where the user can select the time period and up to 8 tags to display both the data and as series on a line chart. Because of the variability of both the length of each series as well as the number of series (e.g., if only 4 tags are selected only 4 series should be shown), the chart cannot be fully configured ahead of time in the template. Instead, the chart is configured for 8 series where the range for each series in set to just the top row where the data is written. A Chart Range function is used to both adjust the range of each series as well as remove series that are not used. If the data starts in *$B$8:$J$8*, the settings for this function are:

Source	*$B$8, Down (variable columns), All cells are empty*
Setting	
Chart Name	*xlr1*
Add/Remove Series	*Yes*
X-Axis Ticks	*0*
Adjust Y-Axis	*No*

Clear Range

The **Clear Range** function clears various elements of the **Apply To** range.

Settings

    Clear

- *All*
  Everything the range is cleared including content and any applied formatting.
- *Contents*
  The content of every cell in the range is cleared. This is the equivalent of highlighting a range of cells and pressing the *Delete* key.
- *Formats*
  All formatting including font size, style, color as well as background color and any conditional formatting is cleared from the cell. The content in the cells remains.
- *Errors*
  This option clears cells containing the error #REF or #DIV/0! In the case of #DIV/0 the cell content is cleared. In the case of #REF the part of the formula that is causing the #REF is removed to correct it. For example, if cell contains the equation =$A$3+$A$4+#REF then it will become =$A$3+$A$4. If the formula cannot be corrected, then it is cleared.

Example

A live dashboard template is configured which always shows the last 10 temperature readings from a tank with the most recent value on top and the previous 9 below. The data connection that brings in the temperature is set up to *Insert At Start* with a **Direction** of *Down*. Since 10 values need to be shown the report cannot be overwritten every time but once 10 rows are filled, for every update the 11th value should "drop off" leaving the last 10. This can be accomplished using a Clear Range function. If the value starts in cell *$B$4* the 10th value is in *$B$13*. The settings for the function are:

Apply To	*$B$14, None*
Setting	
Clear	*All*

Collapse Range

The **Collapse Range** function removes empty columns from the **Apply To** range. Before collapsing, any cells containing *#REF* that cannot be corrected are also cleared.

Settings

    Extend Rows

This extends the rows of the **Apply To** range before determining if the column is empty and therefore removed. The syntax is: *Rows Above, Rows Below*, e.g., *2, 1* to extend the **Apply To** range *2* rows above and *1* row below what is initially determined.

    Adjust Column Widths

If set to *Yes*, after collapsing the remaining columns widths are adjusted to fit the data in the column.

    Border Range

This setting allows for an outside border to be drawn around the range after it is collapsed.

The border is a thin, continuous (single line) border using the Automatic color.

Example

A plant has 3 production lines. Line 1 has 3 mixers and 3 extruders. Line 2 has 4 mixers and 2 extruders. Line 3 has 2 mixers and 4 extruders.

Instead of creating a template for each line, create a single template for the worst-case scenario (4 mixers and 4 extruders).

Date/Time	Mixer Speed				Extruder Speed			
	Mixer 1	Mixer 2	Mixer 3	Mixer 4	Extruder 1	Extruder 2	Extruder 3	Extruder 4

When the report is generated for Line 1 the header is placed in row 1, data is placed in row 3 and empty columns for Mixer 4 and Extruder 4 (since this line does not have these assets):

Date/Time	Mixer Speed				Extruder Speed			
	Mixer 1	Mixer 2	Mixer 3	Mixer 4	Extruder 1	Extruder 2	Extruder 3	Extruder 4
10/1/2020 10:30	25.356	25.67	41.089		18.935	16.323	11.088	
10/1/2020 10:35	44.822	20.425	40.841		37.872	9.388	35.362	
10/1/2020 10:40	11.931	13.91	25.498		40.893	12.712	21.228	
10/1/2020 10:45	37.888	44.335	29.91		39.586	39.256	26.417	
10/1/2020 10:50	42.134	21.221	31.492		23.228	8.291	36.276	
10/1/2020 10:55	8.215	24.354	41.9		27.583	35.223	3.581	
10/1/2020 11:00	10.093	18.184	34.688		35.926	6.736	34.034	
10/1/2020 11:05	15.142	29.891	3.335		42.094	22.015	8.839	
10/1/2020 11:10	32.674	42.881	30.917		9.575	33.423	32.994	
10/1/2020 11:15	34.273	23.753	30.265		6.736	28.58	32.762	
10/1/2020 11:20	27.112	28.514	43.712		22.249	12.769	28.243	
10/1/2020 11:25	22.819	14.194	11.769		20.316	25.306	24.052	
10/1/2020 11:30	13.04	1.086	5.515		26.327	36.817	29.725	
10/1/2020 11:35	5.553	5.973	33.031		8.685	7.953	19.371	
10/1/2020 11:40	17.108	1.644	17.637		43.951	24.692	38.607	
10/1/2020 11:45	24.334	24.434	20.08		19.305	6.777	37.38	

Now apply the collapse range with these settings:

Apply To $B$3:$J$3, Down, All cells are empty

Setting

Extend Rows   *1,0*

Adjust Column Widths   *No*

Border Range   *No*

Date/Time	Mixer Speed			Extruder Speed		
	Mixer 1	Mixer 2	Mixer 3	Extruder 1	Extruder 2	Extruder 3
10/1/2020 10:30	25.356	25.67	41.089	18.935	16.323	11.088
10/1/2020 10:35	44.822	20.425	40.841	37.872	9.388	35.362
10/1/2020 10:40	11.931	13.91	25.498	40.893	12.712	21.228
10/1/2020 10:45	37.888	44.335	29.91	39.586	39.256	26.417
10/1/2020 10:50	42.134	21.221	31.492	23.228	8.291	36.276
10/1/2020 10:55	8.215	24.354	41.9	27.583	35.223	3.581
10/1/2020 11:00	10.093	18.184	34.688	35.926	6.736	34.034
10/1/2020 11:05	15.142	29.891	3.335	42.094	22.015	8.839
10/1/2020 11:10	32.674	42.881	30.917	9.575	33.423	32.994
10/1/2020 11:15	34.273	23.753	30.265	6.736	28.58	32.762
10/1/2020 11:20	27.112	28.514	43.712	22.249	12.769	28.243
10/1/2020 11:25	22.819	14.194	11.769	20.316	25.306	24.052
10/1/2020 11:30	13.04	1.086	5.515	26.327	36.817	29.725
10/1/2020 11:35	5.553	5.973	33.031	8.685	7.953	19.371
10/1/2020 11:40	17.108	1.644	17.637	43.951	24.692	38.607
10/1/2020 11:45	24.334	24.434	20.08	19.305	6.777	37.38

Condense Range

The **Condense Range** function condenses a table of data based on a column and a **Group Method**.

Settings

Group

The cell that defines the column within the **Apply To** range used to condense the data in the other columns.

Group Method

The method by which to group the data in the **Group** column. The **Group** column can contain text, numbers, or timestamps. Text can be grouped with or without case sensitivity.

For numbers, grouping can be done on the **Cell Value** or the **Cell Text** (case is not considered here).

- **Cell Value**
  Grouping is based on the underlying value in the cell, to the accuracy of the cell value
- **Cell Text**
  Grouping is based on the cell value displayed (and formatted).

For example, if the **Group** column has the values *2.11* and *2.12* and formatted for 1 decimal place, **Cell Value** would treat these as different whereas the **Cell Text** would treat them the same.

For timestamps, the **Group Method** can be *Second*, *Minute*, *Hour*, *Day*, *Month* or *Year* in multiples of the **Interval**.

Condense To

This defines how to condense the data in the columns in the range outside the **Group** column. The following options are available:

- *First Value*
  The value corresponding to the first row of the group.
- *Last Value*
  The value corresponding to the last row of the group.
- *Average*
  The average of all the rows of the group.
- *Maximum*
  The maximum value of all the rows in the group.
- *Minimum*
  The minimum value of all the rows in the group.
- *Total*
  The total of all the rows of the group.
- *Count*
  The count of all the non-blank rows of the group.

Interval

This setting can be a fixed number, a variable, or a single cell reference. If **Interval** does not evaluate to a number, it is set to 0.

The value of **Group Method** and **Interval** influence how the grouping is performed.

- **Cell Value**
  - **Interval = 0**
    Rows are condensed for each unique value in the **Group** column.

State	Temp			State	Temp
1	2			1	4
1	4			3	11
1	6			4	17
3	8			5	22
3	10				
3	12			CONDENSED	
3	14				
4	16				
4	18				
5	20				
5	22				
5	24				
RAW					

In the above example, the *Temp*erature is averaged over each unique *State*.

  - **Interval > 0**
    The rows are condensed in groups that are determined by the value of the first row of the **Group** column plus a multiple of the interval.

State	Temp			State	Temp
1	2			1	4
1	4			2	
1	6			3	11
3	8			4	17
3	10			5	22
3	12				
3	14			CONDENSED	
4	16				
4	18				
5	20				
5	22				
5	24				
RAW					

In the above example the Interval=1 which results in the *Temp*erature averaged over every *State*., leaving blanks in the result e.g., *State=2* does not exist in the raw data.

- **Cell Text**
  - **Interval (not used)**

    Rows are condensed for each unique displayed value in the **Group** column.

- **Time Based**
  - **Interval = 0**

    Rows are condensed for each unique value of the selected time element in the **Group** column. For example, suppose a **Group Method** of *Minute* and an **Interval** of *0*.

DateTime	Speed	Temp		DateTime	Speed	Temp
1/1/2021 11:01:00	1	2		1/1/2021 11:01:00	1	2
1/1/2021 11:02:00	2	4		1/1/2021 11:02:00	2.5	5
1/1/2021 11:02:30	3	6		1/1/2021 11:04:00	4	8
1/1/2021 11:04:00	4	8		1/1/2021 11:05:00	5	10
1/1/2021 11:05:00	5	10		1/1/2021 11:06:00	7.5	15
1/1/2021 11:06:00	6	12		1/1/2021 11:10:00	10	20
1/1/2021 11:06:15	7	14		1/1/2021 11:11:00	11	22
1/1/2021 11:06:30	8	16		1/1/2021 11:12:00	12	24
1/1/2021 11:06:45	9	18				
1/1/2021 11:10:00	10	20		CONDENSED		
1/1/2021 11:11:00	11	22				
1/1/2021 11:12:00	12	24				
	RAW					

In the above example, the raw data is condensed to averages for each unique minute in the **DateTime** column.

  - **Interval > 0**

    The rows are condensed in groups that are determined by the value of the first row of the **Group** column plus a multiple of the Interval of the Group Method selection

    In the following the **Group Method** is *Minute* and the **Interval**=*2*.

DateTime	Speed	Temp		DateTime	State	Temp
1/1/2021 11:01:00	1	2		1/1/2021 11:01:00	2	4
1/1/2021 11:02:00	2	4		1/1/2021 11:03:00	4	8
1/1/2021 11:02:30	3	6		1/1/2021 11:05:00	7	14
1/1/2021 11:04:00	4	8		1/1/2021 11:07:00		
1/1/2021 11:05:00	5	10		1/1/2021 11:09:00	10	20
1/1/2021 11:06:00	6	12		1/1/2021 11:11:00	11.5	23
1/1/2021 11:06:15	7	14				
1/1/2021 11:06:30	8	16		CONDENSED		
1/1/2021 11:06:45	9	18				
1/1/2021 11:10:00	10	20				
1/1/2021 11:12:00	11	22				
1/1/2021 11:12:30	12	24				
	RAW					

In the above example, the raw data is condensed to averages for each 2 Minute interval in the **DateTime** column. In the absence of data in the group, an empty record is displayed e.g., *11:07:00*.

Example

Consider the following table of data:

	A	B	C
1			
2		**Salesperson**	**Sale**
3		Fred	176
4		Fred	175
5		Fred	186
6		Barney	240
7		Barney	137
8		Wilma	235
9		Wilma	231
10		Wilma	214
11		Betty	219
12		Betty	198

To calculate the total sales for each person, use the following settings:

Apply To	*$B$3:$C$3, Down, All cells are empty*
Setting	
Group	*$B$3*
Group Method	*Cell Text (Case Insensitive)*
Condense To	*Total*
Interval	*0*

	A	B	C
1			
2		**Salesperson**	**Sale**
3		Fred	537
4		Barney	377
5		Wilma	680
6		Betty	417
7			

Copy Range

The **Copy Range** function copies the **Source** range and pastes it to the **Placement** using the **Type** operation such as *Direct*, *Offset*, *Append,* and *Insert*.

If the **Placement Type** is *Insert At Start (full)* or *Insert At End (full)* the entire rows or columns (depending on **Direction**) are copied from the **Source** and pasted.

The **Placement** can be either:

- **Cell**

  Select this option if the placement is to a fixed cell e.g., $B$17

- **Name**

  Select this option if the placement is to a named cell. To name a cell, right click on the desired cell and select **Define Name**.

  Any row/column insertion that happens above or to the left of a named cell will cause name cell location to change accordingly. Special consideration is given to a cell named **LastCell** since a row/column insertion <u>on</u> this name cell causes the location to change by the number of rows/columns inserted.

Settings

   Paste

The **Paste** option determines what is copied to the **Placement** from the **Source**.

- **All**

  Everything from the range including the cell contents (values and formulas), formatting, charts and validation is copied and pasted to the **Placement** cell.

- **All Except Borders**

  Everything from the range except for borders is copied and pasted to the **Placement** cell. Any existing borders in the **Placement** range will remain.

  Note, charts within the **Source** range are not copied and pasted with this setting. The All setting must be used to copy charts.

- **Formulas**

  The content from the range is copied and pasted to the **Placement** cell. Any formulas in the range are pasted. Any existing formatting in the **Placement** range will remain.

- **Formulas and Formats**

  The content and formatting from the range is copied and pasted to the **Placement** cell. Any formulas in the range are pasted.

- **Validation**

  The data validation from the range is copied and pasted to the **Placement** cell. Any existing formatting in the **Placement** range will remain.

- **Validation and Formats**

  The data validation and formatting from the range is copied and pasted to the **Placement** cell.

- **Values**

  The content from the range is copied and pasted to the **Placement** cell. Any formulas in the range are replaced with the result of the formula. Any existing formatting in the **Placement** range will remain.

- **Values and Formats**

  The content and formatting from the range is copied and pasted to the **Placement** cell. Any formulas in the range are replaced with the result of the formula.

- **Formats**

  The formatting from the range is copied and pasted to the **Placement** cell.

Operation

If the copy is performed to a **Placement** that already contains values, the **Operation** determines how the copy will occur. Set the **Operation** to **None** to copy the **Source** over the **Placement** whereas the selection of an arithmetic **Operation** combines the values from the **Source** and **Placement** ranges.

Transpose

Setting **Transpose** to *Yes* transposes the **Source** before it copied to the **Placement**. In this case the **Source** and **Placement** cannot overlap, or this function generates an error. Note, when **Placement** is set to *Yes*, no charts are pasted if the **Paste** option is set to *All*.

Skip Blanks

Setting **Skip Blanks** to *Yes* prevents empty cells in the **Source** overwriting cells in the **Placement**.

For example: Copying cells *D5:F5* with *E5 empty* to the range *A1* to *C1* does not overwrite the value in cell *B1* (since E5 is empty).

Clear Data

The **Clear Data** setting can be set to clear the **Source** range after it is pasted. The following options are available:

- *No*

  Nothing is cleared from the **Source** range.

- *All*

  Everything is cleared from the **Source** range. This includes any values, formulas, and formats.

- *Contents*

  The content of every cell in the **Source** range is cleared. This is equivalent of highlighting a range of cells and pressing the Delete key.

Adjust Column Widths

If set to *Yes*, the column widths of the **Placement** range are adjusted to match the **Source** range.

Example

To copy a number of rows of data starting at *$A$2:$D$2*, paste them to the next empty cell at or beneath *$F$4*.

Use the settings:

Source   *$A$2:$D$2, Down, All cells are empty*

Placement *$F$2, Append, Down*

Setting

Paste	*All*
Operation	*None*
Transpose	*No*
Skip Blanks	*No*
Clear Data	*No*
Adjust Column Widths	*No*

Copy Sub Report Range

The **Copy Sub Report Range** function behaves like the **Copy Range** function in that the content of the **Source** range is copied and pasted to the **Placement** defined. This includes any content, formatting, formulas, charts, column widths, row heights and outlining.

This function also copies any data connections in the **Source**, either **Data** or **Manage**.

Example

A template workbook is configured with two sheets: **Template** and **Report**.

The **Template** has a content in a range of cells in *B4:F6* with a history connection in cell *$B$6* (assigned to Group 1).

The *Mixer Data* history group in this example is defined to return 24 rows.

A **Copy Sub Report Range** management connection is configured to copy the range *$B$4:$F$6* from the *Template* sheet to the named cell *LastCell* on the *Report* worksheet (assigned to Group 11). .

The **Report Names** are defined with the target worksheet of *Template* is *Report* so any data connection applied to the *Template* sheet is copied to *Report*.

When the **Copy Sub Report Range** function is performed, *$B$4:$F$6* from *Template* is copied to LastCell *$B$2* in *Report* (see the **Placement Name** above).

When the template is processed by an update of **Group** 11 followed by a **Group** 1 the following happens:

- The sub report is copied from the *Template* to the call *Last Cell* in the *Report* (group 11)
- The history data is added to the *Report* (group 1)
- Because the history data is configured to *Insert*, the cell *Last Cell* is moved down in *Report* equal to the number of rows inserted.

If this process is repeated to different sub reports (each with its own connections) and they target *LastCell*, a stacked report of varying sub reports can be achieved.

To initiate the processing from the scheduler, the **Update Worksheet Groups** Action is used with the appropriate group numbers e.g., *11,1*.

From the scheduler this would be:
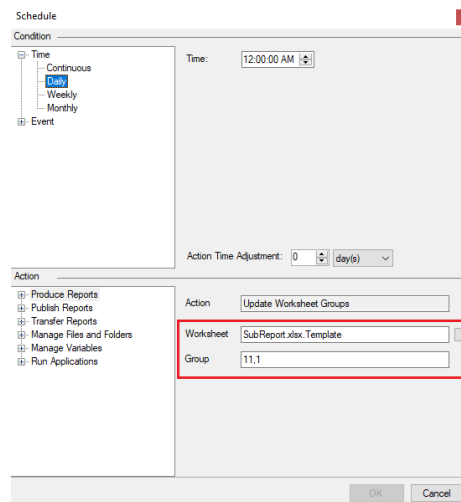
Cut Range

The **Cut Range** function cuts the **Source** range and pastes it to the **Placement Cell** using the **Type** operation such as **Direct**, **Offset**, **Append,** and **Insert**. All formats, formulas and values from the **Source** are pasted to the **Placement**.

Note, charts within the **Source** range are not cut and pasted with this function.

Settings

 Delete Range

 If set to *Yes,* then the **Source** range is deleted after it is cut and pasted rather than just cleared from the worksheet.

 Shift Cells

 If **Delete Range** is set to *Yes*, this determines how the cells are shifted after the range is deleted, either *Up* or *Left*. Otherwise, this setting has no effect.

Example

To cut a number of rows of data starting at *$A$2:$D$2*, paste them to the next empty cell at or beneath *$F$4*.

Source   *$A$2:$D$2*, *Down*, *All cells are empty*

Placement *$F$2, Append, Down*

Setting

 Delete Range   *No*

 Shift Cells   *Up*

Delete Range

The **Delete Range** function deletes the **Apply To** range from the worksheet. The difference between delete and clear is that delete physically removes the cells from the worksheet rather than just clearing them of content and formatting. When a range is deleted, it affects any formulas or charts that may be configured for the range.

Settings

Shift Cells

This determines how the cells are shifted after the range is deleted, either *Up* or *Left*.

Example

A live dashboard template is configured which always shows the last 10 temperature readings from a tank with the most recent value on top and the previous 9 below along with a chart graphically displaying these values. The data connection that brings in the temperature is set up to *Insert At Start* with a **Direction** of *Down*. Since 10 values need to be shown the report cannot be overwritten every time but once 10 rows are filled, for every update the 11th value should "drop off" leaving the last 10.

In this case a Delete Range function must be used rather than a Clear Range so that the range of the chart series does not expand as data is brought into the report. If the value starts in cell *$B$4* the 10[th] value is in *$B$13*. The chart series values are set to *$B$4:$B$5*. The settings for the function are:

Apply To	*$B$14, None*
Setting	
Shift Cells	*Up*

Distinct Range

This function produces a distinct list of values from a row or column of data (depending on the **Apply To Direction** setting).

Note that the list is determined from the content seen in the cell which means that if the values are numeric and formatted to a fixed number of decimal places, multiple values could be considered the same number (even though their decimal value is different).

Settings

Case Sensitive

If the values are textual, this determines if case is considered.

Example

A daily alarm report shows every alarm that occurred over the day. A list of distinct alarms targets focus on what needs attention.

Result

Settings

Duplicate Range

The **Duplicate Range** function performs a duplication of layout content containing the formats and/or formulas of the **Source** range to the range starting at the **Target** cell specified.

The extent of the duplication is determined by a combination of the **Source** range size and the **Method** specified in the **Setting**.

For example, suppose the **Source** range is three columns wide by six rows high and the **Method** is *Across* as follows:

When this connection is processed (usually after a data connection has placed content on the report), the **Source** range is determined by starting at *C3:E3* and expanded *Down* until *All cells are Empty*. The determined Source range is then copied to the *Target Cell* repeatedly *Across* the data until empty cells in three columns and six rows is reached i.e., the size of the **Source**.

Settings

Method

The **Method** specifies the direction used to determine the **Target** starting at the **Target Cell**.

Operation

The **Operation** indicates the elements of the **Source** range to duplicate to the **Target**.

- **Formats**

  Duplicate the cell formatting from the **Source** including (but not limited to) Number Formats, Font settings, Borders, Conditional Formatting and Data Validation.

- **Formulas**

  Duplicate any formulas from the **Source** to the **Target** using the same relative cell location.

Example

A template is configured for a user to select up to twelve tags from a historian to create a daily report. For each tag, the hourly minimum and maximum values are shown and on the report with the difference (delta). The template would look something like the following.

In the above, the E column contains a formula for the difference between the maximum and minimum. A history data group is used for values, connected **Direct**ly to cell *$B$4*.

The **Column** setting of the history group is:

Note the empty row prevents the difference formula from getting overwritten.

The template is set up with formatting in the range *C4:E29* and a **Duplicate Range** function is used to duplicate the formatting and formulas in this range across for the first tag to all the other selected tags.
Settings

Results

The completed report would look something like the following:

Daily Range Report

Date	MIXER_ZONE1_TEMP			MIXER_ZONE2_TEMP			MIXER_SPEED			MIXER_RAMPRESSURE		
	minimum	maximum	range	minimum	maximum	range	minimum	maximum	range	minimum	maximum	range
10/1/22 0:00	16.00	78.94	62.94	74.62	93.64	19.02	29.21	54.55	25.34	69.43	78.72	9.29
10/1/2022 1:00	16.00	80.33	64.33	78.13	91.06	12.93	29.61	48.64	19.04	61.93	69.28	7.35
10/1/2022 2:00	16.00	80.85	64.85	74.64	87.80	13.16	33.37	51.70	18.33	59.00	61.84	2.84
10/1/2022 3:00	77.84	79.68	1.84	78.35	90.88	12.54	33.26	50.20	16.94	59.00	61.66	2.66
10/1/2022 4:00	16.00	80.04	64.04	86.75	91.13	4.38	31.81	50.06	18.25	61.75	68.98	7.23
10/1/2022 5:00	16.00	80.62	64.62	78.91	93.06	14.16	34.93	52.05	17.11	69.12	78.40	9.27
10/1/2022 6:00	76.74	77.92	1.18	80.65	84.73	4.08	29.81	49.11	19.30	78.55	86.63	8.08
10/1/2022 7:00	16.00	79.22	63.22	74.11	86.06	11.95	29.90	38.45	8.55	86.74	90.80	4.06
10/1/2022 8:00	75.38	80.03	4.65	78.71	82.37	3.66	34.40	39.58	5.17	89.45	91.00	1.55
10/1/2022 9:00	16.00	80.98	64.98	81.46	85.16	3.70	37.72	47.44	9.72	83.06	89.39	6.33
10/1/2022 10:00	77.31	79.50	2.19	79.11	86.94	7.83	44.18	55.81	11.63	73.84	82.92	9.07
10/1/2022 11:00	16.00	80.04	64.04	79.56	81.48	1.92	48.35	55.41	7.07	65.03	73.68	8.65
10/1/2022 12:00	16.00	80.84	64.84	80.25	89.21	8.95	51.88	60.20	8.33	59.71	64.91	5.20
10/1/2022 13:00	52.00	78.22	26.22	87.57	89.50	1.94	56.06	66.66	10.60	59.00	59.72	0.72
10/1/2022 14:00	77.26	79.22	1.96	87.09	90.79	3.70	60.44	67.50	7.06	59.77	65.07	5.30
10/1/2022 15:00	16.00	80.97	64.97	89.29	92.13	2.84	58.68	67.60	8.91	65.20	73.89	8.69
10/1/2022 16:00	16.00	80.89	64.89	82.63	89.40	6.78	52.46	62.47	10.01	74.05	83.10	9.05
10/1/2022 17:00	40.00	77.56	37.56	82.21	87.13	4.92	52.62	61.34	8.71	83.24	89.48	6.24
10/1/2022 18:00	76.71	79.19	2.48	82.95	84.55	1.60	53.41	62.52	9.11	89.54	91.00	1.46
10/1/2022 19:00	16.00	80.57	64.57	83.05	88.10	5.05	42.14	53.46	11.32	86.60	90.77	4.17
10/1/2022 20:00	58.00	77.78	19.78	86.32	88.21	1.90	42.34	51.69	9.35	78.35	86.49	8.14
10/1/2022 21:00	77.03	79.16	2.14	77.03	89.13	12.10	44.01	51.77	7.76	68.93	78.19	9.26
10/1/2022 22:00	16.00	80.38	64.38	78.75	83.50	4.74	49.23	59.78	10.55	61.63	68.78	7.15
10/1/2022 23:00	16.00	80.24	64.24	84.84	91.59	6.75	52.04	58.86	6.82	59.00	61.54	2.54

Fill Range

The **Fill Range** function fills cells across rows or down columns as defined by the **Base** range with values as defined in the **Formulas** setting.

This is the equivalent of using the fill option (or fill tool) in the worksheet to drag formulas or values down or across cells.

Settings

Formulas

The range of cells containing the formulas (and/or values) to fill. If the **Formulas** contain absolute cell references, such as *$B$4*, they remain fixed during the fill operation otherwise they are adjusted as the cells are filled.

Place Formula

If set to *No* after the cells are filled the formulas are removed from the cells so only the values remain. Otherwise, formulas are left in the cells.

Apply Formatting

- **None**

  No formatting is applied to the filled range.

- **All**

  All the formatting from the **Formulas** range is applied to the filled range.

- **All Except Borders**

  All the formatting except the borders from the **Formulas** range is applied to the filled range.

Fill

This setting defines whether only cells containing *Formulas* are filled or if *All* cells are filled regardless of content. This can be really helpful if you have formulas interspersed with your data and want to use a single **Fill Range** to fill the formulas down but ignore the values themselves.

Placement

This setting determines the placement of the formulas when they are filed.

Direct means that the formulas are directly written to the cells beneath or to the right (depending on **Direction**) from the original **Formulas**. If there is any content in these cells, it is overwritten.

Insert At End means that before the formulas are written to the cells, the range is inserted, and cells are shifted either down or across (depending on **Direction**) then the formulas are filled. This means that any other formulas or charts that depend on the values from these formulas are automatically resized for the number of rows or columns inserted.

Example

The formula at cell E2 is =SUM(A2:C2)*$A$1 (note that $A$1 will not change during the fill).

	A	B	C	D	E
1	0.75				
2	116	72	11	16	149.25
3	117	73	12	17	
4	118	74	13	18	
5	119	75	14	19	
6	120	76	15	20	
7	121	77	16	21	
8					

To fill the formula to row 7, use the settings:

Base   *$A$2:$D$2, Down, All cells are empty*
Setting

Formulas	*$E$2*
Place Formula	*No*
Apply Formatting	*All*
Fill	*All*
Placement	*Direct*

Filter Range

The **Filter Range** function applies filtering to the **Apply To** range removing any row or column of data (based on **Direction**) that does not satisfy the **Condition** defined.

Settings
Filter

This defines how to filter **Condition** is applied to the range.

- *Value*
  The **Condition** is applied to the values in every row or column (depending on **Direction**) in the range.

- *Difference*
  The filter is applied to the difference in value between the row and row below or column and column across (depending on **Direction**) in the range.

Condition

This defines the condition of the filter. Only values in rows or columns (depending on **Direction**) that satisfy this condition remain, all other rows or columns are removed.

The condition is defined in the **Filter Browser** (see details below).

Type

This setting is only applicable when **Filter** is set to *Difference*.

- *Raw*
  Each consecutive row (or column) of values is evaluated for the **Condition**.

- *Deadband*
  As rows (or columns) are evaluated, once a consecutive set of values does not satisfy the **Condition**, rows beneath (or columns to the right) are calculated against the first row (or column) that did not satisfy the **Condition**.

Consider the following range of values:

	A
1	1
2	2
3	5
4	6
5	7
6	3
7	4

If the **Condition** is *$A = 1* and the **Type** is *Raw* rows 2, 3, 5 and 6 would not meet the criteria and be filtered out.

However, if **Type** is *Deadband*, rows 2, 3, 4 and 5 would not meet the criteria and be filtered out.

Display

This setting is only applicable when **Filter** is set to *Difference*.

- *All*
  If the **Condition** is not satisfied, both the leading and trailing rows (or columns) are removed from the range.
- *Leading*
  If the **Condition** is not satisfied, the leading rows (or columns) are removed from the range.
- *Trailing*
  If the **Condition** is not satisfied, the trailing rows (or columns) are removed from the range.

Consider the following range of values:

	A
1	1
2	2
3	5
4	6
5	7
6	3
7	4

If the **Condition** is *$A = 1* and the **Type** is *Raw* the results are:

	A
1	1
2	6
3	4

All

	A
1	1
2	5
3	6
4	3
5	4

Leading

	A
1	1
2	2
3	6
4	7
5	4

Trailing

If the **Type** is *Deadband*, the results are:

	A
1	1
2	3
3	4

All

	A
1	1
2	5
3	6
4	7
5	3
6	4

Leading

	A
1	1
2	2
3	3
4	4

Trailing

Case Sensitive

If the **Condition** is textual, this defines if case should be considered when evaluating the filter.

Delete Records

If set to *Yes,* then every record (row or column) that does not meet the **Condition** is deleted shifting every row beneath it up or every column to the right upwards or to the left (depending on **Direction**). This means that any additional data beneath or to the right of the filtered range is shifted as well. When set to *No,* any addition data beneath or to the right of the filtered range is left in place.

Example

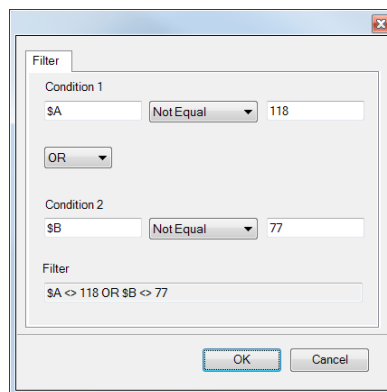Filter the filter A<>118 or B<>77 starting on row 2.

	A	B	C	D		A	B	C	D
1					1				
2	116	72	11	16	2	116	72	11	16
3	117	73	12	17	3	117	73	12	17
4	118	74	13	18	4	119	75	14	19
5	119	75	14	19	5	120	76	15	20
6	120	76	15	20	6				
7	121	77	16	21	7				
8					8				

Use the settings:

Apply To   *$A$2:$D$2*, *Down*, *All cells are empty*

Setting

Filter	*Value*
Condition	*$A<>118 OR $B<>77*
Type	*Raw*
Case Sensitive	*No*
Delete Records	*No*

Filter Browser

The Filter Browser is used to construct filter conditions. The values can be hard coded number, text string, cell references or **XLReporter** variables. When filtering text values using LIKE or NOT LIKE operators, the wild card (%) can be used. For example, *%ABC%* filters any text containing *ABC*, whereas *%ABC* filters any text ending with *ABC*.

Format Range

The **Format Range** function applies formatting to the **Apply To** range. This includes any conditional formatting configured.

Settings

Based on

This determines range within the **Apply To** range to get the formatting from. This can either be the *Topmost Row* or *Leftmost Column* of the range.

Adjust Column Widths

When set to *Yes*, the column widths of the **Apply To** range is resized based on its content. This is only applicable when **Direction** is set to *Across*.

Stripe Color

If set, the background color added to the range at the **Stripe Interval** specified. This can either be a specific color listed or a numeric color in the *R,G,B* format. For example, a gray stripe could be specified as *128,128,128*.

Stripe Interval

If a **Stripe Color** is specified this defines the interval at which to apply the striping. If the **Direction** is *Down* this interval represents rows. If the **Direction** is *Across* this interval represents columns.

Border Range

If set to *Yes*, an outside border is added to the range. The border is thin, continuous and uses the Automatic color setting. If something more specific is required, set this to *No* and configure a **Border Range** function.

Example

A batch report template is created to retrieve 1-minute samples over the duration of the batch from historical data. Every fourth row should be colored in a light blue and a border should be drawn around the data for completeness. Since batches run at different durations, the striping and border cannot be drawn on the template. The Format Range function is used to stripe and draw this border after the data is retrieved. Data starts on *$B$8:$H$8*. The settings for the function are:

Apply To   *$B$8:$H$8, Down, All cells are empty*

Setting

Based on	*Topmost Row*
Adjust Column Widths	*No*
Stripe Color	*Sky Blue*
Stripe Interval	*4*
Border Range	*No*

Formula Range

The **Formula Range** function adjusts formulas determined by the **Base** settings. When the formulas are added to the worksheet, they only need to reference the topmost or leftmost cells of the **Base** since this function will adjust the formula. Only relative cell references (e.g., with no $ like *A1* rather than *$A$1*) are adjusted within the formula.

Settings

Formulas

The range of cells containing the formulas to adjust.

Place Formula

If set to *No* the formulas are removed, leaving behind the values only.

Absolute Reference

This setting determines how the format of the cell references after they are adjusted. If set to *No* cell references are left relative (e.g., A1). If set to *Yes*, cell references are written back as absolute references (e.g., $A$1).

This setting only has an effect if **Place Formula** is set to *Yes*.

When choosing the value for this setting consider what happens to the range of formulas after the function is complete. For example, if after this function a **Fill Range** function is used to fill the formulas down or across, this setting should be *No* so the formulas adjust according to the row or column they are filled to.

Example

A1 contains the formula =SUM(A2)+$D$1 and B2 contains the formula =SUM(B2)+$D$1.

To apply the formula to rows 2 to 7, use the settings:

Base Setting	$A$2:$B$2, Down, All cells are empty
Formulas	$A$1:$B$1
Place Formula	No
Absolute Reference	No

Group Range

The Group Range function applies grouping to rows of data in the **Apply To** range when values in the **Group** column match based on the **Group Criteria** specified.

Grouping adds controls to the left of the row headers that allows you to expand or collapse one or more rows of data.

When applied, the initial row of data is not included in the group but any subsequent rows that match the criteria are added to the group. This makes the first row visible when the grouping is collapsed.

Settings

Group

The column on which the **Group Method** is applied. This should be a cell reference to the top row of the **Apply To** range.

Group Method

The method by which to group the data in the **Group** column. The **Group** column can contain text, numbers, or timestamps. Text can be grouped with or without case.

For numbers, grouping can be done on the **Cell Value** or the **Cell Text**. The **Cell Value** grouping means that values are grouped based is the underlying value in the cell with however many decimal points it has. The **Cell Text** grouping means the values are grouped by the value as formatted to display in the cell. For example, if the **Group** column has the values *2.11* and *2.12* and is formatted for 1 decimal place, the **Cell Value** grouping would treat these as different whereas the **Cell Text** grouping would condense these together as both are displayed as *2.1*.

For timestamps, the **Group Method** can be *Second*, *Minute*, *Hour*, *Day*, *Month* or *Year* to group based on an element of time.

Initial State

This defines whether the groups are initially *Collapsed* or *Expanded* after the function is executed.

Example

A daily report is generated. At a glance, hourly samples need to be displayed. However, if any of those values appear "out of spec", 1-minute samples around that hour should be accessible to analyze what is going on.

To accomplish this, the group configured for the report template is set up to retrieve 1-minute samples over the day. Then, the Group Range management function is configured to group the data based on the hour of the day and to be initially collapsed. The net result is a daily report that displays hourly samples where each hour can be expanded to show the 1-minute samples for that hour.

If the data starts in cells *$B$8:$H$8*, the Group Range settings are:

Apply To	*$B$8:$H$8*, *Down*, *All cells are empty*
Setting	
Group	*$B$8*
Group Method	*Hour*
Initial State	*Collapsed*

Hyperlink Range

The **Hyperlink Range** function takes any cells in the **Apply To** range that contain the HYPERLINK formula and converts them into an embedded hyperlink within the cell, removing the formula.

The HYPERLINK formula is very useful in building a dynamic hyperlink based on values in other cells on the worksheet which may be dynamically populated. However, when a workbook is published as a web page or PDF file, the hyperlink functionality from these formulas is removed. That is where this management function comes in because it converts the formulas to embedded hyperlinks which translate to the web and PDF formats.

Example

A process is set up that whenever a widget is rejected a picture is taken. In the PLC, the name of that picture is stored, and a bit is set high to indicate an issue. The customer would like a report containing the timestamp and a link to view the picture taken so their operators can see what is going on. The report should be a web page they can access from their browser.

To accomplish this, a report template is configured with a real time group to bring in the timestamp and the picture file name. Additionally, a HYPERLINK formula is configured on the sheet to link to the image file brought in. To convert that HYPERLINK formula to a hyperlink that works from a web page, a Hyperlink Range function is configured with the **Apply To** set to the cell with the HYPERLINK formula.

Lookup Range

The **Lookup Range** function converts values based on a lookup table. Standard **Table**s such as *On/Off* are provided for converting 0/1 values. The lookup table consists of an X and Y column(s) where the X column is used to for the lookup and the Y column(s) are used for conversion.

The **Placement** setting determines where the looked-up value is placed in the worksheet. If this parameter is set the same as the **Apply To Cell,** then the looked-up values overwrite the original values.

Settings

    Table

    The type of lookup table to use, either a standard table like *Yes/No*, *True/False* or *On/Off* or a *Custom* table as defined within a worksheet in the workbook.

    Table Range

    This is only applicable when **Table** is set to *Custom*.

    If the range is a single cell or column, that cell/column is treated as the X value of the lookup table and the column immediately to the right is treated as the Y value.

    If the range is a single row with multiple columns, the leftmost column of the range is treated as the X value of the lookup table and every other column is treated as a Y value. As a simple example, consider the following lookup table:

	G	H	I	J	K	L
1						
2						
3						
4		a	1	2	3	
5		b	2	3	4	
6		c	3	4	5	
7		d	4	5	6	
8		e	5	6	7	
9		f	6	7	8	
10		g	7	8	9	
11						

    If the **Table Range** is set to *$H$4* or *$H$4:$I$4*, and is set up so that the Y value appears to the right of the value in the report the results are:

	A	B	C	D	E	F
1						
2						
3						
4	a		1			
5	c		3			
6	e		5			
7	f		6			
8						

    However, if the **Table Range** is set to *$H$4:$K$4*, the results are:

	A	B	C	D	E	F
1						
2						
3						
4	a		1	2	3	
5	c		3	4	5	
6	e		5	6	7	
7	f		6	7	8	
8						

    The number of rows in the table is determined by finding the first empty row in the leftmost (X) column.

Please note that if the X column is numeric than it must be listed in order either ascending or descending otherwise the results of the function may not be accurate.

Lookup Mode

- *Exact*

  Only values that match exactly to values in the lookup table are written, anything else is skipped.

- *Smaller*

  This only applies to ranges where the X value is numeric.
  If the values to look up do not match values in the lookup table, the smallest value closest to the lookup value is considered a match and the Y value is applied.

- *Larger*

  This only applies to ranges where the X value is numeric.
  If the values to look up do not match values in the lookup table, the largest value closest to the lookup value is considered a match and the Y value is applied.

- *Closest*

  This only applies to ranges where the X value is numeric.
  If the values to look up do not match values in the lookup table, the closest to the lookup value is considered a match and the Y value is applied. If there are 2 values in the table equally distant from the looked-up value, the smaller of the 2 values is considered the match.

- *Interpolated*

  This only applies to ranges where the X value is numeric.
  If the values to look up do not match values in the lookup table, the Y value is interpolated based on the position in the table.

Paste

This is only applicable when **Table** is set to *Custom*.

This determines what is pasted from the Y value(s) of the lookup table when a match is found. *Value* pastes just the value from the lookup table, *Format* just copies the formatting from the lookup table (no value) and *All* copies both the formatting and value from the lookup table.

Clear Table

This setting only applies when the **Table** is set to *Custom*.

If set to *Yes*, the lookup table is cleared from the worksheet after the function is complete.

Example

Convert speed values so that values less than 10 show "SLOW" and values greater than 50 show "FAST".

	A	B	C	D	E	F	G	H
1								
2		Time	Temp	Flow	Speed		X	Y
3		1:00	110	1.1	0		10	SLOW
4		1:15	115	2.4	8		25	
5		1:30	150	1.8	45		50	
6		1:45	165	3.7	46		75	FAST
7		2:00	172	1.4	48			
8		2:15	175	1.6	52			
9		2:30	177	2.3	47			
10		2:45	174	1.5	21			
11		3:00	180	2.1	9			
12								

	A	B	C	D	E
1					
2		Time	Temp	Flow	Speed
3		1:00	110	1.1	SLOW
4		1:15	115	2.4	SLOW
5		1:30	150	1.8	
6		1:45	165	3.7	
7		2:00	172	1.4	
8		2:15	175	1.6	FAST
9		2:30	177	2.3	
10		2:45	174	1.5	
11		3:00	180	2.1	SLOW
12					

| Category | Worksheet |
| Type | Lookup Range |

Apply To

Cell	$E$3
Direction	Down
End	All cells are empty

Placement

| Cell | $E$3 |
| Type | Direct |

Setting	Value
Table	Custom
Table Range	$G$3
Lookup Mo...	Larger
Paste	All
Clear Table	No

Replace Range

The **Replace Range** function replaces all occurrences of **Find What** in the **Apply To** range with the **Replace With** value.

Settings

Find What

The value in the range to be replaced. This can either be a hard coded value (numeric or text), an **XLReporter** Name Type or Variable or a combination of both.

To replace any blank cell with a value, leave this setting empty.

Replace With

The value in the range to replace the **Find What** value with. This can either be a hard coded value (numeric or text), an **XLReporter** Name Type or Variable or a combination of both.

To replace a value with a blank, leave this setting empty.

Match Entire Cell

If set to *Yes*, a value will only be replaced if the entire cell matches the **Find What** value. If set to *No*, the value will be replaced if it is found within a cell.

As a simple example, consider a configuration where **Find What** is *a* and **Replace With** is *x*. If the range contains 3 cells with the following values:

a
ab
abc

If **Match Entire Cell** is set to *Yes*, the results would be:

x
ab
abc

If *No*, the results would be:

x
xb
xbc

Match Case

If set to *Yes*, when **Find What** is set to a textual value, case is considered when determining a match, otherwise it is not.

Example

With **Find What** set to *10* and **Replace With** set to *2* and **Match Entire Cell Contents** set to *No*, a cell containing "101" is changed to "21".

Replace all the cells containing ??? with a blank.

	A	B	C	D	E
1					
2		Time	Temp	Flow	Speed
3		1:00	110	1.1	0
4		1:15	115	2.4	8
5		1:30	150	1.8	45
6		1:45	165	3.7	46
7		2:00	???	???	???
8		2:15	175	1.6	52
9		2:30	177	2.3	47
10		2:45	174	1.5	21
11		3:00	180	2.1	9

	A	B	C	D	E
1					
2		Time	Temp	Flow	Speed
3		1:00	110	1.1	0
4		1:15	115	2.4	8
5		1:30	150	1.8	45
6		1:45	165	3.7	46
7		2:00			
8		2:15	175	1.6	52
9		2:30	177	2.3	47
10		2:45	174	1.5	21
11		3:00	180	2.1	9

Apply To   *$B$3:$E$3, Down, All cells are empty*

Setting

Find What	*???*
Replace With	
Match Entire Cell	*No*
Match Case	*No*

Square Range

The **Square Range** function inserts additional rows of data into tabular data in order hold the value of the tag until the next sample.

For example:

	A	B	C
1			
2			
3		Time	Status
4		1:30	1
5		6.45	0
6		8:15	1
7		12:25	0
8		13:05	1
9		16:45	0
10			

	A	B	C
1			
2			
3		Time	Status
4		1:30	1
5		6.45	1
6		6.45	0
7		8:15	0
8		8:15	1
9		12:25	1
10		12:25	0
11		13:05	0
12		13:05	1
13		16:45	1
14		16:45	0
15			

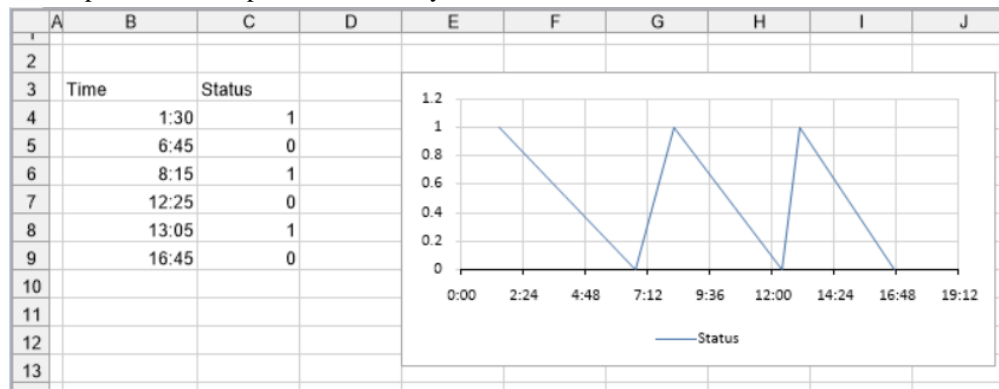   Before   After

Note that the value at 1:30 is added to the table with the timestamp 6:45 (next sample). This continues with all the samples in the table.
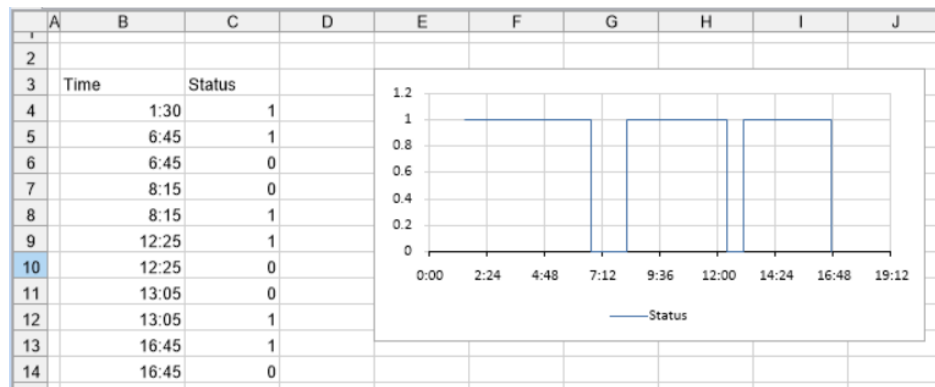
When the **Square Range** management function is applied to charts, it will smooth out the peaks and valleys which would be shown if the data had not used this function. The most effective chart type to use for this management function is an XY scatter chart plotting time on the X axis.

Example

As an example, here is a report with the daily run status of a machine and a chart.

	A	B	C	D	E	F	G	H	I	J
2										
3		Time	Status							
4		1:30	1							
5		6:45	0							
6		8:15	1							
7		12:25	0							
8		13:05	1							
9		16:45	0							
10										
11										
12										
13										

It is hard to determine from the chart the time period when the machine was running and when it was not. Now, with the **Square Range** management applied to the data (*$B$4:$C$4*), the chart is transformed.

	A	B	C	D	E	F	G	H	I	J
2										
3		Time	Status							
4		1:30	1							
5		6:45	1							
6		6:45	0							
7		8:15	0							
8		8:15	1							
9		12:25	1							
10		12:25	0							
11		13:05	0							
12		13:05	1							
13		16:45	1							
14		16:45	0							

Settings

The **Apply To** range is the only setting required for this function. This determines the range over which the function is applied. The timestamp (or whatever is used for the x-axis) is assumed to be the leftmost column of the range and every other column to the right is assumed to be a data series in the chart.

Sort Range

The **Sort Range** function sorts the **Apply To** range based on sorting conditions.
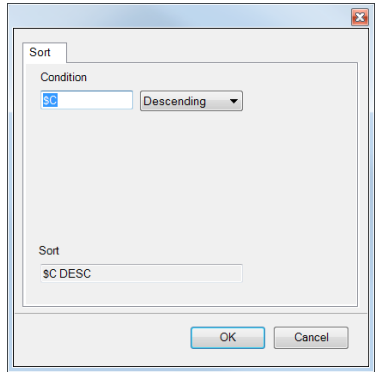
Settings

Sort By, Then By (2)

The sort conditions to apply to the range. These are defined in the Sort Browser (see below).

Case Sensitive

When set to *Yes*, if the column/row to sort contains text, the case is considered when sorting, otherwise case is not considered.

Sort Browser

This browser is used to construct sort conditions. The condition can be entered by selecting it and then clicking a column/row heading in the worksheet.

Example

Sort the values starting at *$B$3:$E$3* by the Temperature in *$C$3*.

Use the settings:

Apply To *$B$3:E$3*, *Down*, *All cells are empty*
Setting

Sort By	*$C DESC*
Then By	
Then By	
Case Sensitive	*No*

Text Range to Column

The **Text Range to Column** function splits up the values (numbers or text) in the **Apply To** range based on the **Delimiter**.

The **Apply To Range** only operates on a single column of data. The **Placement** defines where the first split value is placed when the function is executed. Subsequent split values will appear in columns adjacent to the **Placement**.

Settings

Delimiter

The text by which to split each cell in the **Apply To** range. A list of common delimiters is provided. If the **Delimiter** required is not listed, it can be manually entered in for the setting.

Example

Break the text in the *B* column based on the backslash (\) delimiter.

	A	B	C	D	E	F	G
1							
2							
3		X1245G\R32_Black\Mixer 3\Inlet Temperature		X1245G	R32_Black	Mixer 3	Inlet Temperature
4		X1245G\R32_Black\Mixer 3\Outlet Temperature		X1245G	R32_Black	Mixer 3	Outlet Temperature
5		X1245G\R32_Black\Mixer 5\Inlet Temperature		X1245G	R32_Black	Mixer 5	Inlet Temperature
6		X1245G\R32_Black\Mixer 5\Outlet Temperature		X1245G	R32_Black	Mixer 5	Outlet Temperature
7		X1245G\R32_Black\Mixer 7\Inlet Temperature		X1245G	R32_Black	Mixer 7	Inlet Temperature
8		X1245G\R32_Black\Mixer 7\Outlet Temperature		X1245G	R32_Black	Mixer 7	Outlet Temperature

Apply To   *$B$3, Down, All cells are empty*
Placement   *$D$3, Direct*
Setting
   Delimiter   \

Trim Range

The **Trim Range** function trims the top and/or bottom (or left and/or right depending on **Direction**) of the **Apply To** range until the **Condition** is satisfied.

Settings
   Start

   This setting indicates if records are removed from the *Top*, *Bottom* or both the *Top and Bottom*.

   Condition

   The **Condition** by which once the values in the range satisfy no other records are removed. This is specified by using the **Filter Browser** (see **Filter Range).**

   Case Sensitive

   If set to *Yes* and the **Condition** is textual, case is considered, otherwise it is not.

   Delete Records

   If this is set to *Yes*, the top and/or bottom (depending on Start) removed ranges are physically deleted from the worksheet causing cells below or to the right of the **Apply To** range to be shifted either upwards or leftwards depending on **Direction**.

Example

Remove the rows above and below the range until the speed is greater than 10.

	A	B	C	D	E
1					
2		Time	Temp	Flow	Speed
3		1:00	110	1.1	0
4		1:15	115	2.4	8
5		1:30	150	1.8	45
6		1:45	165	3.7	46
7		2:00	218	1.1	32
8		2:15	175	1.6	52
9		2:30	177	2.3	47
10		2:45	174	1.5	21
11		3:00	180	2.1	9

	A	B	C	D	E
1					
2		Time	Temp	Flow	Speed
3		1:30	150	1.8	45
4		1:45	165	3.7	46
5		2:00	218	1.1	32
6		2:15	175	1.6	52
7		2:30	177	2.3	47
8		2:45	174	1.5	21
9					
10					
11					

Apply To   *$B$3:E$3, Down, All cells are empty*
Setting
   Start   *Top and Bottom*
   Condition   *$E > 10*
   Case Sensitive   *No*
   Delete Records   *No*

Presentation

This set of Data Management functions are used for presentation beyond those provided by the Design Studio. For example, adding a summary table and chart to report data each time a condition is satisfied, such as every 8 hours.

Chart Enhancement

The Chart Enhancement function operates on an existing chart to adjust some of its components like data labels and axes to make the chart more user-friendly. For example, an XY scatter chart configured over a day showing timestamps can leave a gap on the left and right. Using this function, the X-axis can be adjusted to span only the day with nothing extra.

If the data series of the chart need to be adjusted for the amount of data to show, use the **Chart Range** function under the **Worksheet** category.

Settings

Chart Name

The name of the chart to apply the function to. The browse button (…) opens a list of every configured chart within the workbook to select from. The list is in the format:

Chart Name – Sheet!Range of the chart

If a chart is selected in the list, the worksheet for the chart is activated and the range of the chart is selected to highlight the chart itself.

The chart name is not visible and is typically not set by the user. When a chart is inserted into a worksheet it is given a default name (*Chart X* where *X* is a number that starts at 1). However, if the worksheet is copied to another sheet, if the default name is left it can be changed on the new worksheet. To combat this, charts in the template are renamed to a fixed name (*xlrX* where *X* is a number that starts at 1) so that chart names are consistent between worksheets.

Note that only charts configured to worksheets are listed. Charts configured on a Chart Sheet cannot be used with this function.

Adjust Labels

For each series of the chart, data labels may be turned on, so the value of each point is labeled. However, if the values are textual, the labels show as 0. If you wish to show the textual values for each point, set this to either *In-line* or *Alternate*.

In Line

In-line data labeling displays the label of each point in the same position, e.g., if the data label of the first point is set above the point, the label for each subsequent point of the series appears above the point.

Alternate

Alternate data labeling alternates the position of the data label for each point. For example, if the data label for the first point is above the point, the next is below the point, then above again and so on. This can be useful if the text of the data labels overlaps with each other.

Anchor Plot Area

If rows or columns are inserted into the report worksheet that causes the chart to expand, it can leave whitespace at the top or left of the chart because the plot area is moved down or to the right. This setting can correct this and anchor the plot area to the *Left*, to the *Top* or *Both*. This eliminates that useless whitespace from the chart.

Adjust X-Axis

This setting determines if the X-axis of the chart should be adjusted by updating the minimum and maximum values of the axis. Note that is only valid on charts like XY Scatter where the X-axis is defined with minimum and maximum values.

First Series means that the minimum and maximum values are derived from the values in the first series of the chart. If the values are numeric, the minimum is reduced by 1% and the maximum is increased by 1% before they are applied to the chart.

Custom means that the minimum and maximum values are derived as the minimum and maximum values from the cell range specified in the **Custom Scaling** setting.

Custom Scaling

If **Adjust X-Axis** is set to *Custom*, this defines the range of cells where the minimum and maximum values are derived for the X-axis.

Axis Ticks

This setting can be used to fix a number of tick marks for the X and or Y axis. The format of the setting is *X,Y* e.g., *5,7* for 5 X axis tick marks and 7 Y axis tick marks. If either is set to 0, the tick marks for the axis remain unchanged.

Adjust Y-Axis

This setting determines if the Y-axis of the chart should be adjusted by updating the minimum and maximum values of the axis.

First Series means that the minimum and maximum values are derived from the values in the first series of the chart. If the values are numeric, the minimum is reduced by 1% and the maximum is increased by 1% before they are applied to the chart.

Custom means that the minimum and maximum values are derived as the minimum and maximum values from the cell range specified in the **Custom Scaling** setting.

Custom Scaling

If **Adjust Y-Axis** is set to *Custom*, this defines the range of cells where the minimum and maximum values are derived for the Y-axis.

Note that the range specified here do not need to be the same ones used in the data series of the chart.

Example

A daily report template is configured containing an XY scatter chart to graphically display the daily data. The X axis is configured for the timestamps returned from the group. By default, there is a gap on the left and right of the chart because the X-axis is more than 1 day.

The Chart Enhancement function can correct this. Assuming the chart is named *xlr1*, the settings are:

Setting

Chart Name	*xlr1*
Adjust Labels	*No*
Anchor Plot Area	*None*
Adjust X-Axis	*First Series*
Custom Scaling	
Axis Ticks	*0,0*
Adjust Y-Axis	*No*
Custom Scaling	

Cross Tab on State Change

The **Cross Tab on State Change** function is used to analyze rows of data and cross tabulate (combine) multiple rows into a single row based on a change in **State** in a designated column. Consider the following data:

Date/Time	State
1/1/2020 00:00	ON
1/1/2020 01:00	OFF
1/1/2020 02:00	ON
1/1/2020 03:00	OFF
1/1/2020 04:00	ON
1/1/2020 05:00	OFF

Using this function, the following can be generated:

Start Date/Time	End Date/Time
1/1/2020 00:00	1/1/2020 01:00
1/1/2020 02:00	1/1/2020 03:00
1/1/2020 04:00	1/1/2020 05:00

The data may also have values from multiple sources which must also be considered. This is referred to as the **Key** column. Consider the following data:

Date/Time	Pump	State
1/1/2020 00:00	P1	ON
1/1/2020 00:30	P2	ON
1/1/2020 01:00	P1	OFF
1/1/2020 01:30	P2	OFF
1/1/2020 02:00	P1	ON
1/1/2020 02:30	P2	ON
1/1/2020 03:00	P1	OFF
1/1/2020 03:30	P2	OFF
1/1/2020 04:00	P1	ON
1/1/2020 04:30	P2	ON
1/1/2020 05:00	P1	OFF
1/1/2020 05:30	P2	OFF

If the **Key** column is set to *Pump*, the following can be generated:

Start Date/Time	Pump	End Date/Time
1/1/2020 00:00	P1	1/1/2020 01:00
1/1/2020 00:30	P2	1/1/2020 01:30
1/1/2020 02:00	P1	1/1/2020 03:00
1/1/2020 02:30	P2	1/1/2020 03:30
1/1/2020 04:00	P1	1/1/2020 05:00
1/1/2020 04:30	P2	1/1/2020 05:30

Settings

Key

This setting defines the column within the range that helps identify what should be considered a state change. In the example above, the *Pump* column is used as the **Key** column so that every state change of every unique pump is considered separately.

Note that the **Key** column is not a required setting. It is not needed if all the **State** values pertain to the same key.

If the **Key** is not needed the value of this setting should be left blank. If it is needed it should be set to the cell in the top row for the appropriate column within the **Apply To** range.

State

This setting defines the column within the range with the unique state values. This should be set to the cell in the top row for the appropriate column within the **Apply To** range.

State Change

This defines how changes in state are detected.

- *Any*
  Any row where the value in the **State** column equals **Value 1** or **Value 2**, a state change has occurred.

  If **Value 1** and **Value 2** are left empty state changes are determined by the first and last rows where the **State** value and **Key** value (if specified) match.

- *Distinct*
  Only the first match of the **State** column with **Value 1** or **Value2** is considered a state change. This means if **Value 1** is *0* and there are 5 consecutive rows of *0*, only the first is considered a state change.

- *Any Value Change*
  Any change in value in the **State** column or **Key** column (if specified) is considered as two state changes: the end of the previous state and the beginning of a new one. When **State Change** is set to this type, **Value 1** and **Value 2** are ignored.

Value 1

The value that defines when a new state has been detected. This can be a fixed value or a cell reference.

Value 2

The value that defines when the exit state has been detected. This can be a fixed value or a cell reference.

Range 1

This defines the range of cells to copy when a new state has been detected. This should be defined as a range of cells in the top row of the **Apply To** range.

This range is pasted to the worksheet based on the **Placement** cell defined.

Range 2

This defines the range of cells to copy when the exit state has been detected. This should be defined as a range of cells in the top row of the **Apply To** range.

Range 2 Placement

This setting determines how **Range 2** is written to the worksheet.

- *At End*
  Range 2 is placed directly to the <u>right</u> of **Range 1**.

- *Append*
  Range 2 is appended to the first empty cell at or to the <u>right</u> of the **Placement** column.

- *Insert At Start*
  Range 2 is inserted at the **Placement** column pushing the **Range 1** data to the <u>right</u>.

- *Insert At End*
  Range 2 is inserted immediately to the right of the end of the **Range 1** data pushing anything to the right outwards.

Mechanics

State Change is Any or Distinct

When the **State Change** is *Any* or *Distinct*, if the **State** value equals **Value 1**, the range specified in **Range 1** is copied to the **Placement** cell and the **Key** value (if specified) is retained. If the **State** value equals **Value 2**, the range specified in **Range 2** is copied to the **Placement** area. If the **Key** column is specified, **Range 2** is pasted to the row corresponding to the **Key**, otherwise it is pasted to the row of the last **Value 1** state change.

If **State Change** is *Any* and **Value 1** and **Value 2** are left blank, each unique set of **State** and **Key** (if specified) values are determined. **Range 1** is copied from the first row containing the set and **Range 2** is copied from the last row containing the set.

State Change is Any Value Change

When the **State Change** is *Any Value Change* when any state change is detected, the range specified in **Range 2** is copied and pasted to the row of the previous state change. Then the range specified in **Range 1** is copied and pasted to the new row in the **Placement** area.

When data is copied to the **Placement** area, if the **Placement Cell** has no formatting applied to it, the format in the **Apply To** range is copied along with the values, otherwise only the values are pasted.

Example

Calculate runtimes from an event log of machine starts/stops.

	A	B	C	D	E	F
1						
2		Time			Machine	State
3		1:00			Mixer	On
4		1:15			Extruder	On
5		1:30			Mixer	Off
6		1:45			Grinder	On
7		2:00			Mixer	On
8		2:15			Extruder	Off

	A	B	C	D	E
1					
2		On	Off	Duration	Machine
3		1:00	1:30	0:30	Mixer
4		1:15	2:15	1:00	Extruder
5		1:45			Grinder
6		2:00			Mixer
7					
8					

Use the settings (the duration is a formula):

Apply To	$B$3:F$3, *Down*, *All cells are empty*
Setting	
Key	*$E$3*
State	*$F$3*
State Change	*Any*
Value 1	*On*
Value 2	*Off*
Range 1	*B3:E3*
Range 2	*B3*
Range 2 Placement	*Append*

Insert Into Range

The **Insert Into Range** function takes a **Collection** (a range of cells containing items such as formulas and charts) and inserts them above, below and/or within the **Apply To** range. The function can be used to insert subtotals and charts into a range of data.

Settings

Top Collection

This setting is a range of cells containing all the labels, formatting, formulas, and charts to insert at the top of each determined range (as defined by **Insert Mode**). This range must be on the same worksheet as the **Apply To** range.

Any charts or formulas within the collection that refer to data in the **Apply To** range should only reference the top row within the range. When the **Collection** is inserted, all of these cell references are automatically adjusted to the amount of data in the range.

Bottom Collection

This setting is a range of cells containing all the labels, formatting, formulas, and charts to insert at the bottom of each determined range (as defined by **Insert Mode**). This range must be on the same worksheet as the **Apply To** range.

Any charts or formulas within the collection that refer to data in the **Apply To** range should only reference the top row within the range. When the **Collection** is inserted, all of these cell references are automatically adjusted to the amount of data in the range.

Paste

This defines what is pasted from the **Collection(s)** to the range. This can be set to just copy the *Values*, just the *Fomulas* or *All* to copy everything in the **Collection(s)** including all formatting configured.

Insert Mode

This defines how the **Collection(s)** are inserted into the range.

All means that the **Top Collection** (if defined) is inserted at the very top of the **Apply To** range and the **Bottom Collection** (if defined) is inserted at the very bottom of the **Apply To** range.

Column Change means that at every change in value of a specified **Column** (see below) the **Collection(s)** are inserted into the range.

Column

If **Insert Mode** is set to *Column Change*, this setting defines the column in the range to monitor for a change in value. The setting must be set to a column reference, e.g., *$B* for the B column.

Add Grouping

When set to *Yes*, every **Collection** inserted into the range will have an outline defined for it within the worksheet. The outline appears to the left of the row labels and can be used to show or hide the rows within it.

Initial State

If **Add Grouping** set to *Yes,* this setting defines the initial state of the group outline, either *Expanded* or *Collapsed*.

Clear Collection

If set to *Yes*, after the function is complete the **Collection** range(s) are cleared from the worksheet.

Example

Add a subtotal showing the average temperature of each tank.

	A	B	C	D	E	F	G	H
1								
2		Tank	Level	Temp		Collection		
3		Tank 1	1002	92.0		Average Temp		92.0
4		Tank 1	994	98.0				
5		Tank 1	800	91.0				
6		Tank 1	732	93.0				
7		Tank 2	2723	120.0				
8		Tank 2	2600	131.0				
9		Tank 3	1276	89.0				
10		Tank 3	1288	76.0				
11		Tank 3	1365	85.0				
12								
13								
14								
15								

	A	B	C	D
1				
2		Tank	Level	Temp
3		Tank 1	1002	92.0
4		Tank 1	994	98.0
5		Tank 1	800	91.0
6		Tank 1	732	93.0
7		**Average Temp**		**93.5**
8		Tank 2	2723	120.0
9		Tank 2	2600	131.0
10		**Average Temp**		**125.5**
11		Tank 3	1276	89.0
12		Tank 3	1288	76.0
13		Tank 3	1365	85.0
14		**Average Temp**		**83.3**
15				

The collection contains an average in H3 = AVERAGE(D3)

Apply To $B$3:D$3, *Down*, *All cells are empty*
Setting

Top Collection	
Bottom Collection	*$F$3:$H$3*
Paste	*All*
Insert Mode	*Column Change*
Column	*$B*
Add Grouping	*No*
Initial State	*Expanded*
Clear Collection	*No*

List from Bitmask

PLC integers used as bitmasks are useful for holding information by assigning each bit to a specific requirement. For example, a 16-bit integer could represent 16 different states of the process.

This function expands an integer into a list where each row represents a bit of the integer that is "set". The expansion can also include other values.

Example

Suppose that at the end of a machine cycle, the date/time, operator, and an integer bitmask is saved to the report (the bitmask here could represent certain actions that the operator performed during the cycle.

Result

	A	B	C	D	E	F	G	H
1								
2								
3		Time	Operator	Actions		Expanded list		
4		1:30	Janet	5		1:30	Janet	1
5		1:49	Fred	14		1:30	Janet	4
6		4:20	Charlie	3	→	1:49	Fred	2
7		5:07	Fred	11		1:49	Fred	4
8						1:49	Fred	8
9						4:20	Charlie	1
10						4:20	Charlie	2
11						5:07	Fred	1
12						5:07	Fred	2
13						5:07	Fred	8

Going a step further, if a **Lookup Range** function is applied, the numeric in the list can be converted to a readable text string.

Setting

Category	Presentation
Type	List from Bitmask

Apply To

Cell	$B$4:$D$4
Direction	Down
End	All cells are empty

Placement

Cell	$F$4
Type	Direct

Setting	Value
Bitmask	$D$4
Paste	All

Outline Range

The **Outline Range** function removes repeating values in rows or columns (depending on **Direction**) in the **Apply To** range. The function removes repeats on the first column. It then removes repeats on the next column only if there was a repeat on the previous column. This continues until the range is completed.

Settings

Match Case

If set to *Yes*, when comparing textual values for repeats, the case is considered, otherwise it is not.

Delete Empty

If set to *Yes*, if the empty rows or columns are left in the Apply To range, the rows or columns are deleted from the range. Otherwise, empty rows or columns will remain in the range.

Example

Remove repeating values starting on row 3.

	A	B	C	D	E
1					
2		Hour	Speed	Temp	Flow
3		1:00	0.1	110	0.1
4		1:00	0.1	115	0.3
5		1:00	0.5	150	0.2
6		1:00	0.5	165	0.2
7		2:00	34.7	165	5.0
8		2:00	38.2	175	16.0
9		2:00	42.5	177	30.0
10		2:00	42.5	177	30.0
11		3:00	12.4	175	58.0
12		3:00	9.7	177	76.0
13					

	A	B	C	D	E
1					
2		Hour	Speed	Temp	Flow
3		1:00	0.1	110	0.1
4				115	0.3
5			0.5	150	0.2
6				165	0.2
7		2:00	34.7	165	5.0
8			38.2	175	16.0
9			42.5	177	30.0
10					
11		3:00	12.4	175	58.0
12			9.7	177	76.0
13					

Apply To   *$B$3:E$3, Down, All cells are empty*
Setting

Match Case	*No*
Delete Empty	*No*

Propagate Range

The **Propagate Range** function propagates the value and format of non-empty cells down (or across) into empty cells within the **Apply To** range. This function can be used to handle sparse data or to produce a contiguous row or column of data for a chart.

Settings
Mode

The mode in which the data is propagated to empty cells. The *Staircase* mode copies the value from the last non-empty cell to the empty cells.

Example
Fill empty cells starting on row 3.

	A	B	C	D	E
1					
2		Hour	Speed	Temp	Flow
3		1:00	0.1	110	0.1
4				115	0.3
5			0.5	150	0.2
6				165	0.2
7		2:00	34.7	165	5.0
8			38.2	175	16.0
9			42.5	177	30.0
10					16.0
11		3:00	12.4	175	58.0
12			9.7	177	76.0
13					

	A	B	C	D	E
1					
2		Hour	Speed	Temp	Flow
3		1:00	0.1	110	0.1
4		1:00	0.1	115	0.3
5		1:00	0.5	150	0.2
6		1:00	0.5	165	0.2
7		2:00	34.7	165	5.0
8		2:00	38.2	175	16.0
9		2:00	42.5	177	30.0
10		2:00	42.5	177	16.0
11		3:00	12.4	175	58.0
12		3:00	9.7	177	76.0
13					

Apply To   *$B$3:E$3, Down, All cells are empty*
Setting

Mode	*Staircase*

Stack Range

The **Stack Range** function stacks groups of columns in the **Apply To** range by placing the leftmost column of the group in the **Placement** and leaving the remaining columns in place. This function can be used to combine data logged at different intervals into a single table with sparse data.

This can be very useful if the report has multiple data sources, and you want to combine that data together into a single table to see what happened at what time. It is also useful if multiple data groups must be used to retrieve all the data required for the report.

Note that the **Apply To** range does not need to include the first group since that is already correctly positioned.

Settings

Rows In Header

The number of rows above the **Apply To** range to consider as headers. When the leftmost column of the group is stacked, the headers row(s) for that column are removed.

Column Group Count

The number of columns for a group.

Sort

This indicates whether or not to sort the resultant range based on the values in the column of the **Placement**. *None* indicates no sorting will be done, while *Ascending* and *Descending* apply a sort to the range.

If the results are sorted, duplicate values in the **Placement** are combined together to form a single row.

Example

Combine raw data for Speed, Temperature and Flow into a table with a common timestamp.

	A	B	C	D	E	F	G
1							
2		Time	Speed	Time	Temp	Time	Flow
3		1:10	0.1	1:15	110	1:05	5.0
4		1:20	0.5	1:45	115	1:30	16.0
5				2:10	150	2:20	30.0
6						2:45	16.0
7							
8							
9							
10							
11							

	A	B	C	D	E
1					
2		Time	Speed	Temp	Flow
3		1:05			5.0
4		1:10	0.1		
5		1:15		110	
6		1:20	0.5		
7		1:30			16.0
8		1:45		115	
9		2:10		110	
10		2:20			30.0
11		2:45			16.0

Apply To *$D$3:G$3*, *Down*, *All cells are empty*
Placement *$B$3*
Settings

Rows In Header	*1*
Column Group Count	*2*
Sort	*Ascending*

Transform Range

The **Transform Range** function takes a range consisting of two rows of headings and one row of data and transforms this to a summary table.

For example, suppose the values in the report are displayed as follows (typical format from a history group):

Flow	Flow	Flow	Speed	Speed	Speed	Temp	Temp	Temp	Pressure	Pressure	Pressure
Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
23.52	38.15	30.84	149.34	176.81	163.08	39.12	45.62	42.37	8.35	8.89	8.62

Using this function, this data can be shown as a summary table in either of the two styles:

	Flow	Speed	Temp	Pressure
Min	23.52	149.34	39.12	8.35
Max	38.15	176.81	45.62	8.89
Avg	30.84	163.08	42.37	8.62

or

	Min	Max	Avg
Flow	23.52	38.15	30.84
Speed	149.34	176.81	163.08
Temp	39.12	45.62	42.37
Pressure	8.35	8.89	8.62

The transformation takes the top two rows and treats them as either the column or row captions. The third row is used as the data for the summary table.

If the Source does not contain 3 rows then this function does nothing, more than 3 rows then the first 3 rows are considered. If there are empty cells within the headings of the **Source** range, it assumes the text of the cell to the left. For example, if the **Source** range is:

	A	B	C	D	E	F	G	H	I	J	K	L	M
1													
2													
3		Flow			Speed			Temp			Pressure		
4		Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
5		23.52	38.15	30.84	149.34	176.81	163.08	39.12	45.62	42.37	8.35	8.89	8.62

The headings in *$C$3* and *$D$3* are treated as *Flow*, *$F$3* and *$G$3* are *Speed* and so on.

The **Placement** can be set to a cell within the **Source** range.

Settings

Orientation
This setting determines the orientation of the summary table.

- **Column, Row**
  The first row of the **Source** becomes the \ column headings, and the second row becomes the row headings of the summary table.

- **Row, Column**
  The first row of the Source becomes the row headings, and the second row becomes the column headings of the summary table.

Paste
The elements from the **Source** (e.g., formats) that are applied to the summary table. This applies both to the row and column headers as well as the data.

Clear Source
If set to **Yes**, the **Source** range is cleared, otherwise it is left in the sheet.

Example
A user can select up to ten tags from their historian to get the minimum, maximum and average over a specified time period. The report is to show each selected tag as a row with the minimum, maximum and average shown as three columns.

The history data group provides the data which has the **Columns** and **Time Period** tabs configured as follows:

This group is connected to cell *$B$4* in the template. The **Transform Range** management function is set up as:

Note that the **Source** starts on column C since the timestamp is in column B. It also acounts for the user selecting a variable number of tags.

The summary table produced for the report will look like:

Date			
10/1/2022			
	minimum	maximum	average
MIXER_ZONE1_TEMP	16.00	80.98	70.69
MIXER_ZONE2_TEMP	74.11	93.64	84.12
MIXER_SPEED	29.21	67.60	51.63
MIXER_RAMPRESSURE	59.00	91.00	73.89
EXTR_ZONE1_TEMP	35.00	60.92	55.62
EXTR_ZONE2_TEMP	11.00	94.58	83.26
EXTR_SPEED	12.00	87.81	76.63
EXTR_PELLETSPEED	13.00	89.00	75.93

2D Transformation

The **2D Transformation** function works on a table of three columns where one column is the X coordinate, one column is the Y coordinate, and the last column is the value to create a new table of values based on the coordinates.

Settings

Row Offset

The cell that contains the X coordinate for transformation. This cell should be in the same row as the top row in the **Base** range and the column should be contained within the **Base** range.

Row Origin

The origin point for the **Row Offset** values. Typically, this is set to *0* but in cases where the offsets are non-zero this can compensate. For example, if the **Row Offset** values are the days of the month (1-31) this can be set to *1*.

Column Offset

The cell that contains the Y coordinate for transformation. This cell should be in the same row as the top row in the **Base** range and the column should be contained within the **Base** range.

Column Origin

The origin point for the **Column Offset** values. Typically, this is set to *0* but in cases where the offsets are non-zero this can compensate. For example, if the **Column Offset** values are the days of the month (1-31) this can be set to *1*.

Data Range

This setting defines the range of data copied from the **Base** range. This should be one or more columns from the top row of the **Base** range.

Paste

This setting defines what is pasted from the **Data Range** to the **Placement** for every row.

Clear Data

If set to *Yes* or *Yes (Extended)*, all the data from **Base** range is cleared. *Yes (Extended)* also clears any headers above the **Base** range.

Example

Display temperature 2 in in a minute/hour display.

	A	B	C	D	E	F	G
1							
2		Time	Temp 1	Temp 2	Temp 3	hour	minute
3		1:00	110	175	110	1	0
4		1:15	115	177	115	1	1
5		1:30	150	174	150	1	2
6		1:45	165	150	110	1	3
7		2:00	218	165	115	2	0
8		2:15	175	110	150	2	1
9		2:30	177	115	165	2	2
10		2:45	174	150	218	2	3
11		3:00	180	168	175	3	0

	A	B	C	D	E	F	G
17							
18							
19							
20					minute		
21				0	15	30	45
22			0				
23		hour	1	175	177	174	150
24			2	165	110	115	150
25			3	168			
26							
27							

Note the two additional columns hour and minute using functions which are used to detemine the placement of the temperature value (in practice these would be hidden).

Base	*$C$3:E$3, Down, All cells are empty*
Placement	*$D$22*

Settings

Row Offset	*$F$3*
Row Origin	*0*
Column Offset	*$G$3*
Column Origin	0

Data Range	*$D$3*
Paste	*All*
Clear Data	*No*

Value Limit Range

The **Value Limit Range** function filters or color codes the **Apply To** range based on the **Low Limit** and/or **High Limit** specified.

Settings

Low Limit

The value by which if any value in any cell within the **Apply To** range is less than or equal to, that value is considered outside the limits.

This can be specified as a fixed number or a cell reference.

High Limit

The value by which if any value in any cell within the **Apply To** range is greater than or equal to, that value is considered outside the limits.

This can be specified as a fixed number or a cell reference.

Show Values

This setting defines what to show after the function has executed.

- **All**

  All values in the **Apply To** range are displayed with values outside the limits formatted as defined below.

- **Between Limits**

  Only values between the **Low Limit** and **High Limit** defined are shown in the **Apply To** range. Values outside the limits are cleared.

- **Outside Limits**

  Only values outside the **Low Limit** and **High Limit** defined are shown in the **Apply To** range. Values within the limits are cleared.

Low Format

The background color for any value less than or equal to the **Low Limit**. This can either be a specific color listed or a numeric color in the *R,G,B* format. For example, a gray background could be specified as *128,128,128*.

Between Format

The background color for any value between the **Low Limit** and **High Limit**. This can either be a specific color listed or a numeric color in the *R,G,B* format. For example, a gray background could be specified as *128,128,128*.

High Format

The background color for any value greater than or equal to the **High Limit**. This can either be a specific color listed or a numeric color in the *R,G,B* format. For example, a gray background could be specified as *128,128,128*.

Delete Empty Rows

This setting only applies if **Show Values** is set to *Between Limits* or *Outside Limits*.

If set to *Yes*, if the function results in completely empty rows within the **Apply To** range, the row is deleted from the range. Otherwise, empty rows will remain in the **Apply To** range.

Extend Columns

If **Delete Empty Rows** is set to *Yes*, this is the number of columns to extend to the left and right to include when deleting the rows. For example, the extend the range by *1* column to the left and *2* to the right, set this to *1,2*.

Example

Color code temperatures below 140 and greater than 200.

	A	B	C	D	E
1					
2		Time	Temp 1	Temp 1	Temp 1
3			1:00	110	175	110
4			1:15	115	177	115
5			1:30	150	174	150
6			1:45	165	150	110
7			2:00	218	165	115
8			2:15	175	110	150
9			2:30	177	115	165
10			2:45	174	150	218
11			3:00	180	168	175
12					

	A	B	C	D	E
1					
2		Time	Temp 1	Temp 1	Temp 1
3			1:00	110	175	110
4			1:15	115	177	115
5			1:30	150	174	150
6			1:45	165	150	110
7			2:00	218	165	115
8			2:15	175	110	150
9			2:30	177	115	165
10			2:45	174	150	218
11			3:00	180	168	175
12					

Settings

Apply To   *$C$3:E$3, Down, All cells are empty*

Setting

Low Limit	*140*
High Limit	*200*
Show Values	*All*
Low Format	*Sky Blue*
Between Format	*None*
High Format	*Light Red*
Delete Empty Rows	*No*
Extend Columns	*0,0*

Weave Into Range

The **Weave Into Range** function weaves a **Collection** range into the **Apply To** range, preserving the formatting of each if requested.

The function compares each value in leftmost column of the **Collection** range to the leftmost column of the **Apply To** range. When a match is found, the row in the **Collection** range is placed into the **Apply To** range based on the **Weave Mode** setting. If a match is not found, then the location of the closest match is determined. Note that the values of the leftmost column of the **Apply To** range must be ordered.

Settings

Weave Mode

This setting determines how the values from the **Collection** range are written to the **Apply To** range.

- *Column Insert*
  For every row in the **Collection** range, a row is inserted into the **Apply To** range regardless as to whether the values in the leftmost column of both ranges match.

  The value of the leftmost cell of the **Collection** range is copied to the leftmost cell of the inserted row in the **Apply To** range. The remaining values in the **Collection** range are copied to the right edge of the **Apply To** range.

- *Row Append*
  For every row in the **Collection** range, if the value in the leftmost column matches the value in the leftmost column of the **Apply To** range, the values from the second column outward in the **Collection** range are copied and pasted to the right edge of the **Apply To** range.

  If no match is found a row is inserted into the **Apply To** range, the value from the leftmost column in the **Collection** range is copied and pasted to the leftmost column of the **Apply To** range. The remaining columns in the **Collection** range are copied and pasted to the right edge of the **Apply To** range.

- *Replace Blanks and Errors*
  The values in the **Collection** range are only copied over blanks and errors in the **Apply To** range.

  This is most useful when a data connector does not provide a **Secondary Server** and there are redundant data servers available to retrieve data from and the report should use data from the secondary server if data from the primary is not available.

  In this scenario, two data connections are added into a template. These connections are identical except one is connected to the primary server and the other connected to the secondary. The **Apply To** range of the Weave Into Range is configured for the range where the primary server data connection is configured and the **Collection** range for the secondary server. If any values are missing from the primary server connection or return an error symbol (*???, ###, @@@* or *!!!),* the values from the **Collection** range are woven into the **Apply To** range.

Use Collection Format

If set to *Yes* when values are copied from the **Collection** to the **Apply To** range, the format from the **Collection** is pasted with it. Otherwise, the formatting of the **Apply To** range is used.

Add Grouping

Grouping allows rows or columns to be shown and hidden in a worksheet. When grouping is set on a number or rows or columns a button is added to the left or top that allows you to expand or contract the rows or columns on the sheet. This can be added automatically to the rows or columns of data woven in from the **Collection** range so that data can be easily shown or hidden within the **Apply To** data by setting **Add Grouping** to *Yes*.

Initial State

If **Add Grouping** is set to *Yes*, this setting determines if the **Collection** data is *Expanded* or *Collapsed* when the report is initially generated.

Clear Collection

This setting determines if the **Collection** range is cleared after the function is complete.
- *None*
  The **Collection** range is not cleared.
- *All*
  The **Collection** range is cleared including any applied formatting.
- *All (extended)*
  The **Collection** range is first extended upwards to detect any headings, then the range is cleared including any applied formatting.
- *Contents*
  The contents of the **Collection** range are cleared. Any formatting applied will remain.
- *Contents (preserve leftmost column)*
  The contents of the **Collection** range with the exception of the leftmost column are cleared. Any formatting applied will remain.

Example

Combine alarm data into process data.

Settings

Apply To	*$B$3:E$3, Down, All cells are empty*
Collection	*$G$3:H$3*
Settings	

Weave Mode	*Column Insert*
Use Collection Format	*Yes*
Add Grouping	*Yes*
Initial State	*Expanded*
Clear Collection	*All*

Analysis

This set of Data Management functions are used for statistical analysis.

Conditional Summary

The **Conditional Summary** function generates summary values from the **Base** range using the **Calculation**(s) specified and places the results as a table at the **Placement**.

Settings

    Condition

    The **Condition** to apply to every column (or row depending on **Direction**) to derive the **Calculation(s)** specified).

    This is specified by using the **Filter Browser** (see **Filter Range).**

    Calculation (up to 5)

    The **Calculation** to apply to every column (or row depending on direction) in the **Base** range.

    If the **Direction** is *Down* or *None*, each **Calculation** appears as a row in the **Placement** whereas if **Direction** is *Across* each **Calculation** appears as a column in the **Placement**.

    Add Labels

    If set to *Yes* and the **Direction** is *Down* or *None*, labels for each **Calculation** appear to the left of the data. If the **Direction** is *Across*, labels appear above the data.

    Case Sensitive

    If the **Condition** is textual and case is important, set **Case Sensitive** to *Yes.*

Example

Calculate the average, maximum and minimum.

	A	B	C	D	E	
1						
2		Time	Temp 1	Temp 2	Temp 3	
3		1:00	110	175	110	
4		1:15	0	177	115	
5		1:30	150	174	150	
6		1:45	165	150	110	
7		2:00	218	165	115	
8		2:15	175	110	150	
9		2:30	177	115	165	
10		2:45	174	150	218	
11		3:00	180	168	175	
12						
13						
14						
15						
16						

	A	B	C	D	E	
1						
2		Time	Temp 1	Temp 2	Temp 3	
3		1:00	110	175	110	
4		1:15	0	177	115	
5		1:30	150	174	150	
6		1:45	165	150	110	
7		2:00	218	165	115	
8		2:15	175	110	150	
9		2:30	177	115	165	
10		2:45	174	150	218	
11		3:00	180	168	175	
12						
13		Average	168.6	150.9	149.1	
14		Maximum	218.0	175.0	218.0	
15		Minimum	110.0	110.0	110.0	
16						

Use the settings:

Base	$C$3:E$3, *Down*, *All cells are empty*	
Placement	$C$13	
Setting		
	Condition	$C > 0
	Calculation	*Average*
	Calculation	*Maximum*
	Calculation	*Minimum*
	Calculation	*None*
	Calculation	*None*
	Add Labels	*Yes*
	Case Sensitive	*No*

Correlation

The **Correlation** function examines the measurements in the **Base** range and places their correlation in a table at the **Placement**. The table displays each combination of column pairs.

Correlation determines whether the two measurements tend to move together i.e., large values of one tend to be associated with large values of the other (positive correlation), small values of one tend to be associated with large values of the other (negative correlation) or the value are unrelated (correlation near 0). Correlation coefficient is scaled to lie between -1 and +1 inclusive.

The equation for the correlation coefficient is:

$$Correl(X,Y) = \frac{\sum (x-\bar{x})(y-\bar{y})}{\sqrt{\sum (x-\bar{x})^2 \sum (y-\bar{y})^2}}$$

Settings

Place Formula

If set to *Yes*, the **Correlation** formulas are left in the **Placement**. If set to *No,* only the values appear in the **Placement**.

Example

Determine the correlation coefficients of temperature data.

	A	B	C	D	E
2		Time	Temp 1	Temp 2	Temp 3
3		1:00	110	175	110
4		1:15	115	177	115
5		1:30	150	174	150
6		1:45	165	150	110
7		2:00	218	165	115
8		2:15	175	110	150
9		2:30	177	115	165
10		2:45	174	150	218
11		3:00	180	168	175

	A	B	C	D	E
13					
14					
15			Temp 1	Temp 2	Temp 3
16		Temp 1	1.00		
17		Temp 2	-0.40	1.00	
18		Temp 3	0.32	-0.32	1.00
19					
20					
21					
22					

Temp 1 and Temp 3 are in positive correlation

Base	$C$3:E$3, *Down*, *All cells are empty*	
Placement	$C$16	
Setting		
	Place Formulas	*No*

Covariance

The **Covariance** function examines the measurements in the **Base** range and places their covariance in a table at the **Placement**. The table displays each combination of column pairs.

Covariance determines whether the two measurements tend to move together i.e., large values of one tend to be associated with large values of the other (positive covariance), small values of one tend to be associated with large values of the other (negative covariance) or the value are unrelated (covariance near 0). Covariance is not scaled.

The equation for the covariance coefficient is:

$$Cov(X,Y) = \frac{\sum (x - \bar{x})(y - \bar{y})}{n}$$

Settings

Place Formula

If set to *Yes*, the **Covariance** formulas are left in the **Placement**. If set to *No,* only the values appear in the **Placement**.

Example

Determine the covariance of temperature data.

	A	B	C	D	E
1					
2		Time	Temp 1	Temp 2	Temp 3
3		1:00	110	175	110
4		1:15	115	177	115
5		1:30	150	174	150
6		1:45	165	150	110
7		2:00	218	165	115
8		2:15	175	110	150
9		2:30	177	115	165
10		2:45	174	150	218
11		3:00	180	168	175

	A	B	C	D	E
12					
13					
14					
15			Temp 1	Temp 2	Temp 3
16		Temp 1	1006.67		
17		Temp 2	-306.74	575.06	
18		Temp 3	351.56	-265.15	1214.22
19					
20					
21					
22					

Base   *$C$3:E$3, Down, All cells are empty*

Placement *$C$16*

Setting

Place Formulas   *No*

Descriptive Formulas

The **Descriptive Formulas** function generates values from the **Base** range using the **Formula**(s) specified and places the results as a table at the **Placement**.

Settings

Formula (up to 6)

The formula to apply to every column (or row depending on **Direction**) in the **Base** range. This can be any formula supported by Excel with # used in place of the cell reference for the column (or row).

For example, to count all the values in each column that are greater than *0*, set **Formula** to *=COUNTIF(#,">0")*

Add Labels

If set to *Yes* and the **Direction** is *Down* or *None*, labels appear to the left of the data. If the **Direction** is *Across*, labels appear above the data. Labels are derived from the formula name.

Place Formula

If set to *Yes*, the formulas are left in the **Placement**. If set to *No,* only the values appear in the **Placement**.

Example

Calculate the average of the absolute deviations of temperature.

	A	B	C	D	E
1					
2		Time	Temp 1	Temp 2	Temp 3
3		1:00	110	175	110
4		1:15	115	177	115
5		1:30	150	174	150
6		1:45	165	150	110
7		2:00	218	165	115
8		2:15	175	110	150
9		2:30	177	115	165
10		2:45	174	150	218
11		3:00	180	168	175
12					
13		AveDev			

	A	B	C	D	E
1					
2		Time	Temp 1	Temp 2	Temp 3
3		1:00	110	175	110
4		1:15	115	177	115
5		1:30	150	174	150
6		1:45	165	150	110
7		2:00	218	165	115
8		2:15	175	110	150
9		2:30	177	115	165
10		2:45	174	150	218
11		3:00	180	168	175
12					
13		AveDev	25.1	20.0	29.2
14					

Base   *$C$3:E$3, Down, All cells are empty*

Placement   *$C$13*

Setting

    Formula   *=AveDev(#)*

    Formula

    Formula

    Formula

    Formula

    Formula

    Add Labels   *No*

    Place Formula   *No*

Descriptive Statistics

The **Descriptive Statistics** function generates statistical values from the **Base** range using the **Statistic**(s) specified and places the results as a table at the **Placement**.

Settings

    Statistic (up to 6)

    The statistic to derive for each column (or row depending on the **Direction**). The following are available:

- *Average*
  The arithmetic mean.
- *Count*
  A count of non-empty cells
- *Kurtosis*
  Characterizes the relative peakness or flatness of a distribution compared with the normal distribution. Positive indicates a relatively peaked distribution while negative indicates a relatively flat distribution
- *Maximum*
  The largest value
- *Median*
  The middle value
- *Minimum*
  The smallest value
- *Mode*
  The most frequently occurring value
- *Range*
  The difference between the maximum and the minimum,
- *Sample Variance*
  The variance
- *Skewness*
  Characterizes the degree of asymmetry of a distribution around its mean. Positive skewness indicates a distribution with an asymmetric tail extending toward more positive

values. Negative skewness indicates a distribution with an asymmetric tail extending toward more negative values.

- *Standard Deviation*

  The standard deviation is a measure of how widely values are dispersed from the average value (the mean).

- *Standard Error*

  The Standard error of the mean.

- *Total*

  The total.

Add Labels

If set to *Yes* and the **Direction** is *Down* or *None*, labels appear to the left of the data.

Place Formula

If set to *Yes*, the formulas are left in the **Placement**. If set to *No,* only the values appear in the **Placement**.

Example

Calculate the kurtosis and standard deviation of temperatures.

	A	B	C	D	E
1					
2		Time	Temp 1	Temp 2	Temp 3
3		1:00	110	175	110
4		1:15	115	177	115
5		1:30	150	174	150
6		1:45	165	150	110
7		2:00	218	165	115
8		2:15	175	110	150
9		2:30	177	115	165
10		2:45	174	150	218
11		3:00	180	168	175
12					
13		Kurtosis			
14		Deviation			

	A	B	C	D	E
1					
2		Time	Temp 1	Temp 2	Temp 3
3		1:00	110	175	110
4		1:15	115	177	115
5		1:30	150	174	150
6		1:45	165	150	110
7		2:00	218	165	115
8		2:15	175	110	150
9		2:30	177	115	165
10		2:45	174	150	218
11		3:00	180	168	175
12					
13		Kurtosis	0.1	-0.3	0.3
14		Deviation	33.7	25.4	37.0

Base *$C$3:E$3, Down, All cells are empty*

Placement *$C$13*

Setting

Statistic	*Kurtosis*
Statistic	*Standard Deviation*
Statistic	
Statistic	
Statistic	
Statistic	
Add Labels	*No*
Place Formula	*No*

Exponential Smoothing

The **Exponential Smoothing** function is used to smooth out irregularities (peaks and valleys) to easily recognize trends.

The function uses the smoothing constant (α) which is associated with the **Damping Factor** (1- α). The larger the damping factor, the more the peaks and valleys are smoothed out. The smaller the damping factor, the closer the smoothed values are to the actual data points.

Settings

Damping Factor

The smoothing constant to apply. This can be a fixed number or a cell reference which contains the **Damping Factor** to apply.

Standard Error

If set to *Yes*, a **Standard Error** column is added to the **Placement**.

Place Formula

If set to *Yes*, the formulas for the smoothing as well as the **Standard Error** (if included) remain in the **Placement**. If set to *No*, only values appear in the **Placement**.

Empty Cell Padding

If set to *Yes*, the values written to the **Placement Cell** start one row down or one column to the right (depending on **Direction**). Otherwise, values start at the **Placement** cell itself.

Example

Smooth the trend of a temperature

Time	Temp 1	DF=0.3
1:00	110	
1:15	115	110
1:30	150	114
1:45	165	139
2:00	218	157
2:15	175	200
2:30	177	182
2:45	174	179
3:00	180	175
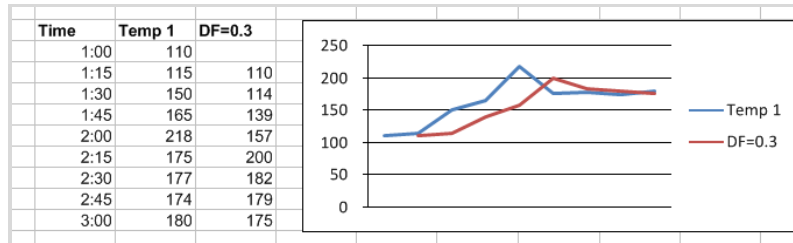
Base   *$C$3, Down, All cells are empty*
Placement   *$D$3*
Setting
    Damping Factor   *0.3*
    Standard Error   *No*
    Place Formula   *No*
    Empty Cell Padding   *Yes*

Histogram

The **Histogram** function calculates individual and cumulative frequencies for a cell range of data and data bins. It also generates data for the number of occurrences of a value in a data set.

Settings

Bin Range

The bins are defined by setting the **Bin Range**.

If the **Bin Range** is 0, every unique value in the **Base** range is a bin. This can be used to a get a frequency of every unique value in a range.

If the **Bin Range** is greater than zero, then the bins are equally spaced between the minimum and maximum values of the **Base**.

If the **Bin Range** is a cell range, the cell values in the range are used as bins. When specified as a cell range the range should only be 1 column wide.

Pareto

If set to *Yes*, the resultant table is shown in descending order of frequency.

If the **Bin Range** is a cell reference, is on the same worksheet and starts on the same row as the **Placement** cell, the resultant table is expanded to include the **Bin Range** as well as any other columns in between.

For example, if the **Bin Range** is *$B$4:$B$9* and the **Placement** is *$D$4*, if **Pareto** is set to *Yes*, the resultant table to sort in descending order is *$B$4:$D$9*.

Place Formula

If set to *Yes*, the formulas remain in the **Placement**. If set to *No*, only values appear in the **Placement**.

Calculation (up to 4)

In addition to frequency distribution, additional **Calculation**(s) can be selected which will appear as additional columns to the right of the **Placement**. The following are available:

- *Percentage*

  This calculates the percentage of frequency for each bin.

- *Cumulative Percentage*

  This calculates the cumulative percentage of frequency for each bin.

- *Rank*

  This calculates the rank of frequency for each bin.

- *Percentile*

  This calculates the percentage rank (percentile) of frequency for each bin.

Example

Show the frequency of process events in order of occurrence.

	A	B	C	D	E	F
1						
2		Time	Event		Event	Freq.
3		1:00	pressure hi			
4		1:11	valve shut			
5		1:45	gate flood			
6		1:55	pressure hi			
7		2:00	material jam			
8		2:34	open fail			
9		2:45	valve shut			
10		2:57	open fail			
11		3:01	pressure hi			
12		3:06	material jam			
13						

	B	C	D	E	F
1					
2	Time	Event		Event	Freq.
3	1:00	pressure hi		pressure hi	3
4	1:11	valve shut		valve shut	2
5	1:45	gate flood		material jam	2
6	1:55	pressure hi		open fail	2
7	2:00	material jam		gate flood	1
8	2:34	open fail			
9	2:45	valve shut			
10	2:57	open fail			
11	3:01	pressure hi			
12	3:06	material jam			
13					

Base   *$C$3, Down, All cells are empty*

Placement   *$E$3*

Setting

    Bin Range   *0*

    Pareto   *Yes*

    Place Formula   *No*

    Calculation

    Calculation

    Calculation

    Calculation

Moving Average

The **Moving Average** function projects values in the forecast period, based on the average value of the variable over a specific number of preceding periods. A moving average provides trend information that a simple average would mask. Use this to forecast sales, inventory, or other trends.

Settings

    Interval

The number of preceding values to consider for the **Moving Average**. This can be a fixed number or a cell reference.

    Standard Error

If set to *Yes*, a **Standard Error** column is added to the **Placement**.

Place Formula

If set to *Yes*, the formulas for the average as well as the **Standard Error** (if included) remain in the **Placement**. If set to *No*, only values appear in the **Placement**.

Empty Cell Padding

If set to *Yes*, the values written to the **Placement Cell** start at the end of the first interval down or to the right (depending on **Direction**). Otherwise, values start at the **Placement** cell itself.

Example

Show the moving average and standard error of a temperature.

	A	B	C	D	E
1					
2		Time	Temp 1	Mov. Avg.	St. Error
3		1:00	110		
4		1:15	115		
5		1:30	150		
6		1:45	165		
7		2:00	218		
8		2:15	175		
9		2:30	177		
10		2:45	174		
11		3:00	180		
12					

	A	B	C	D	E
1					
2		Time	Temp 1	Mov. Avg.	St. Error
3		1:00	110		
4		1:15	115		
5		1:30	150	125	
6		1:45	165	143	
7		2:00	218	178	30
8		2:15	175	186	27
9		2:30	177	190	25
10		2:45	174	175	10
11		3:00	180	177	8
12					

Base   *$C$3, Down, All cells are empty*

Placement   *$D$3*

Setting

Interval	*3*
Standard Error	*No*
Place Formula	*No*
Empty Cell Padding	*Yes*

Summarize Range

The **Summarize Range** management function is used to summarize a table of raw data based on an **Interval** specified. For example, if the worksheet contains 1-minute raw samples over day, this function can derive hourly calculations for those samples.

The **Formulas** for the first "set" of calculations are configured on the sheet and from there the subsequent formulas are derived and added to the report. If you do not require a summary formula like Average or Max, but rather, want to show the value every *X* number of seconds, this function can do that. For the "formula", enter the top cell you want to show surrounded by parenthesis, e.g., *(B3)*. This can also be used to show the timestamp at the beginning of each **Interval**.

Settings

Formulas

The range of cells containing the **Formulas** to use for the function.

Interval

The **Interval** to apply to the cell references in the **Formulas** to derive the summaries. This can be a hard coded value or a cell reference.

Place Formula

If set to *Yes,* the formulas remain in the worksheet, otherwise the formulas are removed so that only the values remain.

Apply Formatting

If set to *All*, the formatting applied to the **Formulas** range is applied to all other rows (or columns). Otherwise, no formatting is applied.

Example

Show the hourly average of 2 temperatures from 1-minute raw data.

Base	$B$3:$D$3, Down, All cells are empty	
Setting		
Formulas	$G$3:$H$3	
Interval	60	
Place Formula	Yes	
Apply Formatting	All	

Cell Action

This set of Data Management functions provide ways to trigger actions based on values in cells in the report. For example, only when the value of a cell is out of tolerance, a specific group of connections is updated in the report.

By Value

The **By Value** function evaluates the **Criteria** specified and if it is satisfied, triggers the **Action** specified.

Setting

Action

The **Action** to trigger if the **Criteria** is satisfied. This can be *UpdateBook*, *UpdateSheet*, *UpdateGroupBook* or *UpdateGroupSheet*.

Worksheet

If the **Action** is set to *UpdateSheet* or *UpdateGroupSheet*, the **Worksheet** must be set to the name of a worksheet in the template.

Group

If the **Action** is set to *UpdateGroupBook* or *UpdateGroupSheet*, one or more **Group** numbers must be specified. For multiple groups, separate each with a comma.

Criteria

The condition to check and trigger the **Action** if satisfied. Up to 2 conditions can be specified each of which can evaluate the value in a cell.

This is specified by using the **Filter Browser** (see **Filter Range).**

Case Sensitive

If the **Criteria** is text based, set this to *Yes* to consider case when evaluating.

Example

A daily report template is configured to retrieve the maximum temperature for a tank over the day. If that temperature is greater than 95, a second report must be generated to show all the alarms for that tank over the day otherwise only the daily tank worksheet is needed.

To accomplish this, the template workbook contains two worksheets: one for the daily tank maximum (*Data*) and the other for the alarms (*Alarms*).
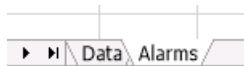
A history group is configured to retrieve the daily maximum of the tank with **Scope** set to the *Data* worksheet.

Another group is configured to retrieve the daily alarms for the tank with the **Scope** set to the *Alarms* worksheet.

For **the Data Management**, a **By Value** function is configured.

Active By is set to *Data* with the **Action** set to *UpdateSheet* and the **Worksheet** set to *Alarms*. The **Criteria** is set for the cell where the daily maximum is written so that the *Alarms* worksheet is only updated if that value is > *95*.

In order to only show the *Alarms* report if this criteria is reached, first the *Alarms* worksheet is hidden in the template workbook. Then, in **Report Names**:

Template	Folder	Report	Over
WORKBOOK			
Daily Tank Temp		Daily Tank Temp {YYYY}-{MM}-{DD}	No
WORKSHEET			
*			
Data			
Alarms		Alarm Data	No

The *Alarms* template worksheet has its **Report** configured as *Alarm Data*. This means that if the *Alarms* worksheet is updated, it creates the *Alarm Data* worksheet, makes it visible, and writes the data to it. Since the *Alarms* worksheet can only be updated if the criteria is met, this report worksheet is only generated if the value is > 95.

To generate this report the following action is scheduled:

Notice that only the *Data* worksheet is scheduled to update.

By Value in Range

The **By Value in Range** function evaluates the **Criteria** specified for every value in the **Apply To** range and if it is satisfied, triggers the **Action** specified.

Settings

Action

The **Action** to trigger if the **Criteria** is satisfied. This can be *UpdateBook*, *UpdateSheet*, *UpdateGroupBook* or *UpdateGroupSheet*.

Worksheet

If the **Action** is set to *UpdateSheet* or *UpdateGroupSheet*, the **Worksheet** must be set to the name of a worksheet in the template.

Group

If the **Action** is set to *UpdateGroupBook* or *UpdateGroupSheet*, one or more **Group** numbers must be specified. For multiple groups, separate each with a comma.

Criteria

The condition to check and trigger the **Action** if satisfied. Up to 2 conditions can be specified each of which can evaluate the value in every cell of the **Apply To** range.

This is specified by using the Filter Browser (see **Filter Range).**

Case Sensitive

If the **Criteria** is text based, set this to *Yes* to consider case when evaluating.

Example

A daily report template is configured to show hourly averages calculated over the day from a historian. However, sometimes during the day, the primary historian may go offline and thus the data returned for that time may be bad (???). However, the system has a secondary historian which does have the data that is missing. The secondary historian should only be queried if the primary has gone offline during the day.

To accomplish this, first in the project, two connectors must be configured: one to the primary historian and one to the secondary historian.

In the report template a **Data Connection** is configured to retrieve the daily data from the primary historian.

Scope	Any Sheet	Group	1

Source

Connector	XLR_History
Name	Daily Averages

Placement

Cell	$B$4
Type	Direct

That connection is configured with the **Group** set to *1*.

A second **Data Connection** is configured to retrieve the daily data from the secondary historian.

Scope	Any Sheet	Group	2

Source

Connector	XLR_History_Secondary
Name	Daily Averages_Secondary

Placement

Cell	$B$4
Type	Direct

That connection is configured with the **Group** set to *2* with the exact same **Placement** as the first connection.

Finally, a **Data Management By Value Range** function is configured.

Active By	Any Sheet	Group	1

Category	Cell Action
Type	By Value In Range

Apply To

Cell	$B$4:$F$27
Direction	None
End	All cells are empty

Placement

Cell	
Type	

Setting	Value
Action	UpdateGroupSheet
Worksheet	Template
Group	2
Criteria	range = ???
Case Sensit...	No

Notice that this connection is configured for **Group** *1*.

The **Criteria** is set so if any cell in the range *($B$4:$F$27)* is "???", an *UpdateGroupSheet* of **Group** *2* is triggered which retrieves the data from the secondary historian.

To generate this report the following action is scheduled:

Notice that only **Group** *1* is updated from the Scheduler.

By Row Iteration

The **By Row Iteration** function goes over each row of the **Range** specified, setting the cell values in each row to variables and triggering the **Action** specified.

The top row of the **Range** contains the names of the variables to set for each row.

When iterating, if any column in the row contains a formula error, that row is skipped entirely.

Settings

Action

This setting can either be a specific action (selectable from the drop-down list) or a range of cells each of which contain a fully qualified action to trigger for each row of the **Range**. For example:

UpdateSheet 'MyTemplate.xlsx.Template'
PrintSheet 'MyTemplate.xlsx.Template' 'default'

Worksheet

If the **Action** is set to *UpdateSheet* or *UpdateGroupSheet*, the **Worksheet** field must be set to the name of a worksheet in the template.

Group

If the **Action** is set to *UpdateGroupBook* or *UpdateGroupSheet*, one or more **Group** numbers must be specified. For multiple groups, separate each with a comma.

Example

Consider a report requirement where every day a variable number of batches is produced in a plant and at the end of the day, a report is required for each batch produced. A table in a database contains a record for each batch as well as the time it started and ended.

Batch	StartDateTime	EndDateTime
1200362	10/1/2020 7:08:15 AM	10/1/2020 1:01:21 PM
1200363	10/1/2020 4:07:45 PM	10/1/2020 9:15:32 PM
1200404	10/1/2020 1:32:00 AM	10/1/2020 4:07:00 AM
1210043	10/1/2020 10:01:32 PM	10/1/2020 11:56:11 PM

In the template, on the *Batch List* worksheet the labels are set up for the **Batch**, **StartDateTime**, and **EndDateTime**.

The database group that returns the batch information over the day is connected to **$B$4** in the *Batch List* worksheet.

The *Template* worksheet is set up for the batch report.

A history data group is configured for this worksheet to retrieve the data. The **Time Period** for the group is set up to use the *StartDateTime* and *EndDateTime* returned from the database.

This group is connected to **$B$15** on the *Template* worksheet.

To ensure a workbook is created for every day and contains a report (worksheet) for every batch produced that day, the **Report Names** are set as:

Template	Folder	Report	Over
WORKBOOK			
Batch Daily Report		Batch Daily Report-{YYYY}-{MM}-{DD}	No
WORKSHEET			
*			
Batch List			
Template		{Batch}	No

For the *Template* worksheet, the **Report** is set to use the *Batch* name returned from the database.

Select **Options** in the upper right corner and check the box for *Hide Template Sheet(s) on report update*.

To trigger a batch report for every record, the **By Row Iteration** function is configured as:

Notice that **Active By** is set to *Batch List,* meaning that this function executes when the *Batch List* worksheet is updated.

Also notice that the **Range** starts at *$B$3:$D$3*. This is the row containing the headers which are used as the variables in the template.

Finally, notice that the **Action** is *UpdateSheet* to the *Template* worksheet which means that the *Template* worksheet is updated for every row of data returned on the *Batch List* worksheet starting at row 4.

To generate the report(s) every day, the following Schedule action should be configured:

Note that only the *Batch List* worksheet is updated from the Scheduler. This in turn will trigger an update of the *Template* worksheet for every batch returned from the database.

The net result is a report like this:

| | Options « | Save 🔙 Print ▾ ≡ Email | 🖫 Freeze Panes 🎴 Zoom In 🎴 Zoom Out | 🎹 Keypad |

Options tree:
- Aerospace Thermal Uniform
  - 2020
    - September
- Alarm Sources - Oil and Ga
  - 2020
- **Batch Daily Report**
- Building Energy
  - 2020
- CIP - Food and Beverage
  - V12-34 Fermenter

🔄 Refresh ⬜ Store

Name
Batch Daily Report-2020-10-01

Local

Batch Data

			Start :	10/1/20 22:01	
Batch : 1210043			End :	10/1/20 23:56	
			Duration :	1:54:39	(h:mm:ss)

		MIXER				EXTRUDER					REAC
	Zone 1	Zone 2	Speed	Pressure	Zone 1	Zone 2	Speed	Pressure	Body	Pressure
	degF	degF	RPM	PSI	degF	degF	RPM	PSI	degF	PSI
Average	71.8	88.5	35.4	85.2	56.7	85.9	79.1	75.9	54.3	100.5
Maximum	79.5	92.0	39.2	90.4	59.4	95.3	82.9	87.0	60.6	113.4
Minimum	28.0	83.6	30.7	78.0	55.3	35.0	74.4	21.0	25.0	82.5
Date										
10/1/20 22:01	77.2	88.2	34.1	78.0	55.3	91.5	77.7	45.0	57.5	82.5
10/1/20 22:06	77.5	89.0	35.6	78.8	56.1	92.3	79.2	85.0	58.3	84.5
10/1/20 22:11	77.6	89.2	37.3	79.6	56.2	92.5	80.9	86.7	58.4	86.4
10/1/20 22:16	76.7	89.3	39.2	80.3	56.3	92.6	82.9	29.0	58.5	88.3
10/1/20 22:21	77.8	89.0	38.0	81.1	55.9	92.3	81.6	69.0	58.2	90.2
10/1/20 22:26	76.9	89.4	36.7	81.8	56.3	92.8	80.3	85.3	58.6	92.0
10/1/20 22:31	78.1	89.6	38.1	82.5	56.4	92.9	81.7	86.7	58.6	93.8
10/1/20 22:36	78.2	89.5	38.4	83.2	56.3	92.8	82.0	87.0	58.5	95.6
10/1/20 22:41	78.0	89.1	38.1	83.9	55.8	92.4	81.8	21.0	58.1	97.2
10/1/20 22:46	78.4	89.3	36.1	84.6	56.0	92.7	79.8	61.0	58.3	98.0

Batch List / 1200404 / 1200362 / 1200363 \ 1210043 /

Notice that the workbook is named after the day and there is a worksheet for each batch.

Data Export

This set of Data Management functions export worksheet data to relational databases (like Microsoft SQL Server or Access), process tags, **XLReporter** Functions, or file formats such as CSV and XML.

To Database

The **To Database** function exports the contents of a cell range to a relational database. The function is flexible enough to handle the export of either single or multiple rows/columns of data on the worksheet to single/multiple records in the database.

When data is exported, the values are formatted as they appear in the cells on the worksheet. This means that the cell(s) should be formatted to adhere to the format required for the column in the database table being exported to. For example, if a metric requires specific significant figures, the cells being exported from should be formatted to reflect this.

Settings

Configuration

This is set to the name of a database export file. A browse button is provided to create and configure these files.

Continue on Fail

Set to *Yes* to indicate that an export of multiple rows/columns, the export should continue despite any errors that may occur.

Database Export Builder

The Database Export Builder is used to configure the rules for the export. The settings are stored in a file with extension **asql**.
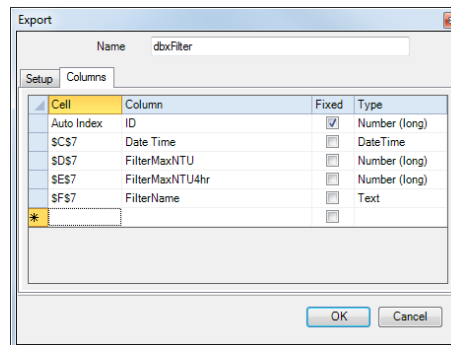
The display contains a **Setup** tab and either a **Columns** tab or the **Commands** tab depending on the choice made on the **Setup** tab.

Popup Menus

Popup menus appear when right-clicking rows in the **Columns Grid**. The following options are available:

Auto Index

When selected, this indicates that the data exported to the column is determined by the Auto Index. See the **Auto Index** section below for more information.

Insert

This inserts a new row in the **Columns Grid**. A new row can also be inserted by pressing the **Insert** button on the keyboard.

Delete

This deletes the row from the **Columns Grid**. The row can also be deleted by pressing the **Delete** button on the keyboard.

Content

Name

This is the name of the configuration.

Tabs

Setup

Connector

A dropdown list of available connectors which define a connection to a database.

Table

This field indicates the table to use for the export. The dropdown displays a list of all available tables in the selected **Connector**. Note that data cannot be exported to a View. If it is necessary to export to multiple tables, multiple exports must be configured.

Method

Columns

The **Columns** method is used to link columns from the selected table to cells on the worksheet. No knowledge of SQL syntax is needed.

Commands

The **Commands** method is used to execute specific SQL commands on the database defined in the connector. The SQL syntax must be specified exactly how it is required by the database.

Bulk Copy

The **Bulk Copy** method is only available for **Connectors** to a Microsoft SQL Server database.

This method exports the entire range of data as defined in the **Range** settings of the function to the **Table** selected, where each column in the range is written to the corresponding column in the **Table**.

Columns are exported in the order that the columns are configured in the **Table**. For example, if the **Table** contains the columns: *Value1*, *Value2*, *Value3* and *Value4* and the **Range** is *$B$4:$E$28*, each row of data starting on row 4 are written with values in *B* column written to *Value1*, the *C* column to *Value2* and so on.

If there are less columns in the **Range** than columns in the **Table**, the columns that are not in the **Range** are set to NULL. If there are more columns in **Range** than columns in the **Table,** the **Range** is truncated to match the number of columns in the **Table**.

Columns

Columns Grid

Cell

This field indicates the cell containing the data to export to the configured column.

Column

This field indicates which column in the database the data will be exported to.

Fixed

This indicates that the cell reference will remain fixed in place even if the management connection has been configured to export a dynamic range.

For example, a database table has 5 columns including a Timestamp column and 4 data columns, and a daily report has a timestamp in cell $A$1 and 4 columns containing the day's data within the cell range of $B$4:$E$27. We can configure our data export to use the timestamp in $A$1 for each record in the cell range by assigning the cell to the Timestamp column and checking *Fixed*.

Type

This field displays the data type of the selected column in the database. See the **Database Management** section of this document for more information on data types.

Note that when the data type of a column is modified in the database, the export group needs to be re-configured. From the **Setup** tab, change the **Export Table** section and then re-select the **Table**.

Commands

In the grid, specify SQL commands (some level of SQL is required). A command can contain a cell reference enclosed in curly brackets e.g., {$A$1}. When a cell reference uses the $ symbol, it remains fixed while the range is exported. If the $ is not used, the value changes for every row/column in the **Source** range.

Auto Index

When exporting to more than one table, an **Auto Index** can be used to maintain a relationship between the tables. The **Auto Index** is a number that is incremented after the completion of an *UpdateSheet* or *UpdateBook* action so while the action is in progress, each export will use the same index value.

For example, suppose a database contains two tables. One table contains the columns Batch ID, BatchStartTime and BatchEndTime, and the other table contains the process data for each batch. If an Auto Index is used a unique relationship can be made between the tables during the export operation.

Creating the Auto Index Table

The Auto Index table can be created using the **Database Manager** application. Connect to the database where the data will be exported.

Select **Add** to create a new table. Set **Name** to *AutoIndex*. Under **Columns** in the first row, set **Name** to *ID* and **Type** to *Number (long)*. Click **OK** to create the table.

Usage

To use the Auto Index feature, each database table that will be used must contain a column for the Index, and the data type must be *Number (Long)*. When configuring the **Cell** for the **Column**, right click and select *Auto Index*. Note that when exporting to tables in two separate databases, the AutoIndex is determined by the table in the first export.

Example

A daily report is required showing hourly maximums over the day for tanks and extruders. In addition, the daily maximum for each tank and extruder is displayed using MAX functions within the worksheet. A second, monthly report is required to display the daily maximums for the month.

While it is possible to get the daily maximums for the month from the historian, this requires a lot of number crunching on the historian. Since the daily report already has these values, it would be less taxing to log the daily maximums to a database and then retrieve these values from the database for the monthly report.

The first thing to configure is a database table to hold the daily maximums. XLReporter provides the Database Manager application to perform this function.
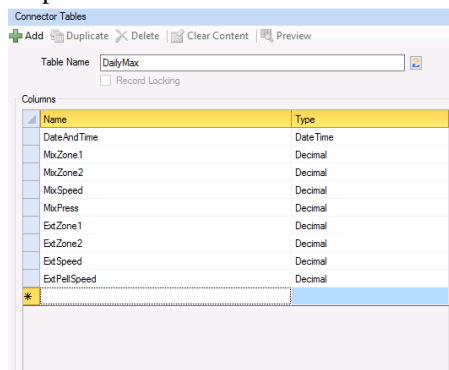
The daily report template is set up with the daily maximum calculations beneath where the hourly maximums for the day are placed.

To export the daily maximums to the database a **Data Export To Database** function is configured:

Notice the **Range** is set to *$B$31:$J$31* with **Direction** set to *None* so that only row 31 is exported.

In the **Configuration** itself:

Each **Column** is configured with the corresponding cell in row 31.

Now in the monthly report template a data group can be configured to retrieve the data from this database table.

To Variables

The **To Variables** function exports the contents of cells(s) to **XLReporter** variables. The variables can either be Function variables defined in the project (like a Register), Memory variables or Custom variables. Variables can be selected from the browser or manually entered at the top of the browser.

Settings

Input Cell (up to 4)

The cell containing the value to export to variable.

Variable (up to 4)

The variable to export the cell value to.

Example

A daily report is required to retrieve the maximum flow rate over the day and the time that it occurred. Then, a set of process values need to be retrieved at the time the maximum flow rate occurred for analysis purposes.

To accomplish this, first a **Data Connection** is configured to retrieve the daily maximum and the time that it occurred.

Notice this connection is configured for **Group** *1*.

A second data connection is configured to retrieve the sample values at the time that maximum occurred.

Notice this connection is configured for **Group** *2*.

Looking at the group itself, under the **Time Period** tab,

The **Type** is set to *Variable* with the **Start Date** set to *{Start Date}*. This variable needs to be set with the time of the maximum flow rate for the day.

To set this, a **Data Management To Variable** function is configured.

The *Start Date* **Variable** is set to **Cell** *$B$5* which contains the time the maximum flow rate occurred.

This connection is also set to Group 1 so that the variable is set before the process data is retrieved.

In the Scheduler there are 2 actions required to run: the update of group 1 and then the update of group 2. These can be scheduled to run at same time as long as the group 1 update is listed first.

To Variable List

The **To Variable List** function exports the contents of cells to **XLReporter Variables** based on a **Configuration** specified. This is an alternative to the **To Variables** function if more than 4 values need to be exported.

Settings

Configuration

The configuration that defines the variables and cells containing the data to export. The Variable Export Builder is used to perform this (see below).

Variable Export Builder

The Variable Export Builder builds the configuration file that is used to export data from cells to variables in the project. The settings are stored in a file with extension **avxp**.

Under the **Variable List** tab specify the **Cell** and **Variable** name for every variable that should be exported to. Note that Function, Memory and Custom variables are all supported. A browser is provided to select the variable, or it can be manually entered at the top.

Example

A factory generates a report on ten machines every time a machine cycle ends. The report for each machine is identical except for the source tags. Instead of setting up ten different report templates, a single template can use variables for the tag names.

A history group is used as the data source and would be configured with variables as follows:

A second template is configured to provide the values for the variables using a lookup table with a row for each of the ten machines and a column for the corresponding source tags for that machine as follows:

	B	C	D	E	F	G	H	I	J	K	L
10											
11	Machine	Tag 1	Tag 2	Tag 3	Tag 4	Tag 5	Tag 6	Tag 7	Tag 8	Tag 9	Tag 10
12	Extruder	Extr_Zone1_Temp	Extr_Zone2_Temp	Extr_Pellet_Speed	Extr_Pressure	Extr_Gear_Ratio					
13	Mixer	Mixer_Zone1_Temp	Mixer_Zone2_Temp	Mixer_Speed	MixerPressure	Mixer_Torque	Mixer_Weight_In	Mixer_Weight_Out			
14	Reactor	Reactor_Temp1	Reactor_Temp2	Reactor_Pressure1	Reactor_Pressure2	Reactor_Speed1	Reactor_Speed2	Reactor_Line_In	Reactor_Torque	Reactor_Accept	Reactor_Reject

The worksheet also contains VLOOKUP in row 3 which select the tags based on the *Machine* name is *B3*. For example, if *B3* is set to Reactor then the *C3:L3* will contain the reactor tag names.

fx C3 =VLOOKUP($B$3,$B$12:$L$14,2)

	B	C	D	E	F	G	H	I	J	K	L
1											
2	Machine	Tag 1	Tag 2	Tag 3	Tag 4	Tag 5	Tag 6	Tag 7	Tag 8	Tag 9	Tag 10
3		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

The tags in row 3 are passed to the variables used by the history group using a

To Variable List management function.

Cell	Variable
$C$3	Tag 1
$D$3	Tag 2
$E$3	Tag 3
$F$3	Tag 4
$G$3	Tag 5
$H$3	Tag 6
$I$3	Tag 7
$J$3	Tag 8
$K$3	Tag 9
$L$3	Tag 10

Name: Machine Source

Whenever a machine cycle ends, the variable for the machine name is set, this lookup template is updated to set the source tag variables and then the report template is updated to generate the report for the machine.

To Tag List

The **To Tag List** function exports the contents of many cells to (real time) process tags based on a **Configuration** specified.

Before exporting, the formatting of the cells that contain the source data is changed to the format of the named cell *Format_Normal*. If the named cell does not exist, the background color of the source data is cleared.

In the event that either the writing or reading (if **Readback** set to **Yes**) fails, the cell formatting is changed according to the following:

a) Write Fail: the cell formatting is modified to the format of the named cell *Format_WriteFail*. If the named cell does not exist, the background color of the source data is set yellow.

b)   Read Fail: the cell formatting is modified to the format of the named cell called *Format_ReadFail*. If the named cell does not exist, the background color of the source data is set red.

In the event that the writing and reading (if **Readback** set to *Yes*) is successful, the cell formatting is changed to the format of the named cell *Format_Success*. If the named cell does not exist, the background color is unchanged.

Note that the formatting of the named cell *Format_Success* will overwrite any existing formatting in the source data.

Settings

Configuration

The configuration that defines the process tags and cells containing the data to export. The Tag Export Builder is used to perform this (see below).

Readback

If set to *Yes*, after the cell values are written to the process tags a readback is performed to verify the values have been written correctly.

Wait Time

If **Readback** is set to *Yes*, the amount of time (in seconds) to wait between writing the values and performing the readback.

Readback Tolerance

If **Readback** is set to *Yes,* the tolerance where if the value read back compared to the value written is within the tolerance, the write is considered a success.

Fail Count

To display a count of how many tags failed to export or readback, set this to a cell reference, otherwise it can be left blank.

Tag Export Builder

The Tag Export Builder builds the configuration file that is used to export data from cells to tags in the real time server.   The settings are stored in a file with extension **atxp**.

Under the **Setup** tab specify the **Connector** to the real time database to export data to.

Under the **Tag List** tab specify the **Cell**, **Tag** and **Tag Type** for every tag data should be exported to.

If there is an array of tags to export data to, they can be specified as a single entity. The configuration is identical to that of a single tag connection and can contain
[start direction end] where,

start   start index

direction   the direction the values will be read from the worksheet

end   end index

For example, suppose $A$4 is assigned to Temperature[01-12]. The values from $A$4 to $L$4 will be exported to Temperature01 to Temperature12.

Suppose $A$4 is assigned to Temperature[01|12]. The values from $A$4 to $A$15 will be exported to Temperature01 to Temperature12.

Example

A report template is configured with a list of recipe IDs along with four set points for the recipe that must be downloaded to the PLC before the recipe can be produced. The recipe table in in cells $K$5:$O$12.

In the worksheet VLOOKUP functions are used to get the four set points based on the recipe ID specified.

The recipe is entered by setting a variable. The variable is set as a **Data Connection** in the template.

To download the set points to the PLC a **Data Export To Tag List** function is configured.

In the **Configuration** itself,

Each set point is set to the corresponding cell on the worksheet.

There are multiple ways that the variable for the Recipe ID can be set including from a value in the PLC or from a prompt in an On Demand report. The key is that when the report is updated, the Recipe is written in which causes the formulas to update with the set points which then get downloaded to the PLC.

Range to Text

The **Range to Text** function exports a range of cells to a text file in the file format specified.

Settings

Format

The file format for the text file can be *CSV* (*Comma Delimited*) or *Text (Tab Delimited)* format.

Directory

The directory where the text file is stored. If this is left blank, the text file is stored in the **Reports Directory** of the current project (as defined in the **Project Explorer**). If this is not a full path reference, the setting is used as subfolders of the **Reports Directory**. If any part of the directory does not exist, it is created.

This can be a fixed name or cell reference where the cell reference contains the directory. Fixed names can contain **XLReporter** Name Types like {YYYY}, {MMM}, etc. See the **Name Types** chapter for the full list of supported keywords. Note that some keywords, such as *{DATIM}* contain illegal directory characters when evaluated. These keywords cannot be used for the directory.

File

The name of the text file to export the range to with or without a file extension. If the file extension is not specified, it is derived from the **Format** setting (either CSV or TXT).

If this setting is left blank, the text file is named after the target workbook in the format *Workbookt.FileExtension* where *FileExtension* is either CSV or TXT depending on the **Format** setting. If this is run on demand the target workbook is the name of the template.

Keywords for the date and time can be entered for the file name e.g., entering *{MMM}_{DD}_{YYYY}.csv* will name a report generated on June 1st 2020 as *Jun_1_2020.csv*. Note that some keywords, such as *{DATIM}* contain illegal file name characters when evaluated. These keywords cannot be used for the file name.

This setting may also be specified as a cell reference.

Overwrite
If set to *Yes*, the text file is overwritten if it exists. If set to *No* and the file exists, nothing is done.

Example
A report template is designed to show 15-minute samples as well as daily summaries and a chart of the samples throughout the day. Those 15-minute samples need to be exported to a csv file so that can be imported into a data analysis system which keeps track of the entire facility.

To export the 15-minute samples a Range to Text function is used. If the data range starts at $B$8:$H$8, the settings are:

Range	*$B$8:$H$8, Down, All cells are empty*
Setting	
Format	*CSV (Comma Delimited)*
Directory	\\FileServer\Analysis
File	*{YYYY}-{MM}-{DD}.csv*
Overwrite	*No*

Where *FileServer* is the name or IP address of the target location.

Worksheet to Text

The Worksheet to Text function exports an entire worksheet in the workbook to a text file in the file format specified.
Setting
Format
The file format for the export file in either CSV or *Text* formats.

Directory
The directory where the text file is stored. If this is left blank, the text file is stored in the **Reports Directory** of the current project (as defined in the **Project Explorer**). If this is not a full path reference, the setting is used as subfolders of the **Reports** directory. If any part of the directory does not exist, it is created.

This can be a fixed name or cell reference where the cell reference contains the directory. Fixed names can contain **XLReporter** Name Types like {YYYY}, {MMM}, etc. See the **Name Types** chapter for the full list of supported keywords. Note that some keywords, such as *{DATIM}* contain illegal directory characters when evaluated. These keywords cannot be used for the directory.

File
The name of the text file with or without a file extension. If the file extension is not specified, then it is either *CSV* or *TXT* according to the **Format** setting.

If this setting is left blank, the text file is named after the target workbook and worksheet (as specified in the template) in the format *Workbook_Worksheet.FileExtension* where *FileExtension* is either CSV or TXT.

Note that keywords for the date and time can be entered for the file name e.g., entering *{MMM}_{DD}_{YYYY}.csv* will name a file generated on June 1st 2020 as *Jun_1_2020.csv*. Note that some keywords, such as *{DATIM}* contain illegal file name characters when evaluated. These keywords cannot be used for the file name.

This setting may also be specified as a cell reference.

Overwrite

If set to *Yes*, the text file is overwritten if it exists. If set to *No* and the file exists, nothing is done.

Example

An analysis application requires 15-minute samples on equipment over the day to monitor how efficiently the plant is operating. That application cannot directly interface with the process historian but can import CSV files.

In this case, XLReporter can act as middleware to get the data from the process historian and export the CSV file for the analysis application. To accomplish this, a history data group is configured to retrieve the 15-minute samples and a Worksheet to Text management function is configured to export the data to CSV. The settings are:

Setting	
Format	*CSV (Comma Delimited)*
Directory	\\FileServer\Analysis
File	*{YYYY}-{MM}-{DD}.csv*
Overwrite	*No*

Where *FileServer* is the name or IP address of the target location.

Range to XML (Schema)

The Range to XML (Schema) function saves an XML file based on the range specified by using an XML Schema defined by the user.

Before this function can be used, an XML Schema needs to be created. To create an XML Schema, copy the sample schema file below and paste it in Notepad. Save this file with the extension XSD.

An element name is needed for each column that is exported. The syntax for element name is <xsd:element name="Time" type="xsd:time"/>. The text "Time" is the column heading and the text "xsd:time" is referring to the data type. Add an element name sequence for each column that is exported and remove any extra element name sequences.

Sample Schema
```
<?xml version="1.0" encoding="UTF-8" standalone="no" ?>
<xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema">
 <xsd:element name="Schema">
  <xsd:complexType>
   <xsd:sequence>
    <xsd:element minOccurs="0" maxOccurs="unbounded" name="Data">
     <xsd:complexType>
      <xsd:sequence>
       <xsd:element name="Time" type="xsd:time"/>
       <xsd:element name="Operator" type="xsd:string"/>
       <xsd:element name="Flow" type="xsd:int" />
      </xsd:sequence>
     </xsd:complexType>
    </xsd:element>
```

```
    </xsd:sequence>
  </xsd:complexType>
 </xsd:element>
</xsd:schema>
```

Settings

Schema

The name of the XML Schema used to perform the export to the XML file. If this is entered without a fully qualified path e.g., *C:\XLRproject\Data\mySchema*, the schema file must be located in the *Data* folder of the project.

Directory

The directory where the XML file is stored. If this is left blank, the text file is stored in the **Reports Directory** of the current project (as defined in the **Project Explorer**). If this is not a full path reference, the setting is used as subfolders of the **Reports Directory**. If any part of the directory does not exist, it is created.

This can be a fixed name or cell reference where the cell reference contains the directory. Fixed names can contain **XLReporter** Name Types like {YYYY}, {MMM}, etc. See the **Name Types** chapter for the full list of supported keywords. Note that some keywords, such as *{DATIM}* contain illegal directory characters when evaluated. These keywords cannot be used for the directory.

File

The name of the XML file to save. If this is left blank, the file is named after the target workbook in the format *Workbook.xml*. If this is run on demand, the target workbook is the name of the template.

Note that keywords for the date and time can be entered for the file name e.g., entering *{MMM}_{DD}_{YYYY}* will name a file generated on June 1st 2020 as *Jun_1_2020.xml*. Note that some keywords, such as *{DATIM}* contain illegal file name characters when evaluated. These keywords cannot be used for the file name.

This setting may also be specified as a cell reference.

Table

The XML table in the schema file to use. If this field is left blank, the first table in the schema file will be used.

Mode

Overwrite

If the XML file exists it is overwritten with the latest data.

Append

The latest data is appended to the XML file once it exists.

Example

An analysis application requires 15-minute samples on equipment over the day to monitor how efficiently the plant is operating. That application cannot directly interface with the process historian but can import XML files and provides a schema for the XML structure.

In this case, XLReporter can act as middleware to get the data from the process historian and export the XML file for the analysis application. To accomplish this, a history data group is configured to retrieve the 15-minute samples and a Range to XML management function is configured to export the data to XML.

If the data starts in *$B$8:$H$8*, the settings are:

Range	*$B$8:$H$8, Down, All cells are empty*
Setting	
Schema	*C:\Analysis\schema.xsd*
Directory	*\\FileServer\Analysis*
File	*{YYYY}-{MM}-{DD}.xml*
Table	*Data*
Mode	*Append*

Where *FileServer* is the name or IP address of the target location.

Sheet to Workbook

The **Sheet to Workbook** function is used to export the current worksheet from the report to another Excel workbook.

Settings

   Directory

The directory where the Excel workbook to export the worksheet to exists. If this is left blank, the **Reports Directory** of the current project is used (as defined in the **Project Explorer**). If this is not a full path reference, the setting is used as subfolders of the **Reports Directory**.

This can be a fixed name or cell reference where the cell reference contains the directory. Fixed names can contain **XLReporter** Name Types like {YYYY}, {MMM}, etc. See the **Name Types** chapter for the full list of supported keywords. Note that some keywords, such as *{DATIM}* contain illegal directory characters when evaluated. These keywords cannot be used for the directory.

   Workbook Name

The name of the workbook to export the worksheet to.

This can be a fixed name or cell reference where the cell reference contains the directory. Fixed names can contain **XLReporter** Name Types like {YYYY}, {MMM}, etc.

If the **Workbook** does not exist, it will be created.

   Target Sheet

If this setting is specified, when the worksheet is copied to the workbook it is renamed to what is specified, otherwise the name of the worksheet in the report is used.

   Overwrite

If **Overwrite** is set to *Yes* and the **Target Worksheet** name exists in the **Target Workbook**, it is deleted and the new worksheet from the source is inserted as the last worksheet tab in the **Target Workbook**.

If **Overwrite** is set to *No* and the worksheet name already exists in the workbook being exported to, the following occurs:
- If the **Target Sheet** is specified, nothing is exported.
- If the **Target Sheet** is not specified, the sheet is renamed as *Target Book-Target Sheet* in the target workbook.

Example

A batch report template is created to show all the data collected over a specific batch. This template contains one worksheet, and each batch report is its own workbook. However, management would like to be able to compare all the batches run over the day by having a workbook for the day that has a worksheet for every batch run.

To accomplish this, a Sheet to Workbook management function is configured in the batch report template to copy the batch report worksheet to the daily report workbook for management. The settings are:

Setting

Directory	*Daily Batch*
Workbook Name	*Daily Batch {YYYY}-{MM}-{DD}*
Target Sheet	*{RG000}*
Overwrite	*No*

Note, *RG000* holds the name of the batch.

Range to Workbook

The **Range to Workbook** function is used to export a range of cells from the report to a worksheet in another Excel workbook.

Settings

Directory

The directory where the Excel workbook to export the range to exists. If this is left blank, the **Reports Directory** of the current project is used (as defined in the **Project Explorer**). If this is not a full path reference, the setting is used as subfolders of the **Reports Directory**.

This can be a fixed name or cell reference where the cell reference contains the directory. Fixed names can contain **XLReporter** Name Types like {YYYY}, {MMM}, etc. See the **Name Types** chapter for the full list of supported keywords. Note that some keywords, such as *{DATIM}* contain illegal directory characters when evaluated. These keywords cannot be used for the directory.

Workbook Name

The name of the workbook to export the range to. The workbook must exist, it will not be created.

This can be a fixed name or cell reference where the cell reference contains the directory. Fixed names can contain **XLReporter** Name Types like {YYYY}, {MMM}, etc.

If this setting contains a full path, that path is used as the **Directory**.

Target Sheet

The worksheet in the workbook to export the range to. The worksheet must exist, it will not be created.

Target Cell

The cell in the **Target Sheet** to paste the exported range to. This cell is the upper left-hand corner of where the data should be pasted.

Note, if merged cells are to be exported, the **Target Cell** should encompass the entire range of the merge. For example, if you are exporting cell $B$4 to cell $D$7 and $B$4 is merged from B4 to D4, then the **Target Cell** should be *$D$7:$F$7*.

Paste

This setting defines what to paste from the range to the **Target Cell**. If the range to export contains formulas to other worksheets it is recommended to use the *Values* or *Values and Formats* setting, otherwise the formulas may result in errors in the exported workbook.

Example

A daily report template is created to show all the data collected over the day as well as a summary of information collected. However, management has a workbook they manually create every month with sheets for every day which requires the daily summary data from these reports.

Rather than have them copy and paste manually from the daily reports, a Range to Workbook management function is configured in the daily report template to copy the summary information from the worksheet to the monthly workbook.

If the summary data is in cells *$B$4:$H$8*, the settings are:

Range   *$B$4:$H$8, None, All cells are empty*

Setting

Directory	*\\FileServer\Monthly Operations*
Workbook Name	*Monthly Operations {MMM}-{YYYY}*
Target Sheet	*{DD}*
Target Cell	*$B$4*
Paste	*Values*

Where *FileServer* is the name or IP address of the target location.

Range to JSON

The **Range to JSON** function is used to export a range of cells from the report to a file formatted as JSON.

The **Orientation** of the range determines how the JSON is outputted. For example, if the range is name value pair columns like this:

Date	7/26/2023 0:00
Plant	Bedrock 1
Line	Mixer
Operator	Fred Flintstone

The output of the JSON file is:

```
{
    "header": {
        "Date": "2023-07-26T00:00:00-04:00",
        "Plant": "Bedrock 1",
        "Line": "Mixer",
        "Operator": "Fred Flintstone"
    }
}
```

If the range is a data table like this:

Date	Zone 1 Temp	Zone 2 Temp	Speed	Pressure
7/26/2023 0:00	75.21	75.21	30.21	78.18
7/26/2023 1:00	76.32	77.84	35.22	86.48
7/26/2023 2:00	77.97	78.66	33.27	90.77
7/26/2023 3:00	78.32	90.98	37.55	89.55
7/26/2023 4:00	79.63	90.38	41.86	83.25
7/26/2023 5:00	75.84	76.35	56.05	74.06
7/26/2023 6:00	79.25	87.86	53.02	65.21
7/26/2023 7:00	76.06	89.68	49.10	59.77

The output of the JSON file is:

```
{
  "data": [
    {
      "Date": "2023-07-26T00:00:00-04:00",
      "Zone 1 Temp": 75.21,
      "Zone 2 Temp": 75.21,
      "Speed": 30.21,
      "Pressure": 78.18
    },
    {
      "Date": "2023-07-26T01:00:00-04:00",
      "Zone 1 Temp": 76.32,
      "Zone 2 Temp": 77.84,
      "Speed": 35.22,
      "Pressure": 86.48
    },
    {
      "Date": "2023-07-26T02:00:00-04:00",
      "Zone 1 Temp": 77.97,
      "Zone 2 Temp": 78.66,
      "Speed": 33.27,
      "Pressure": 90.77
    },
    {
      "Date": "2023-07-26T03:00:00-04:00",
      "Zone 1 Temp": 78.32,
      "Zone 2 Temp": 90.98,
      "Speed": 37.55,
      "Pressure": 89.55
    },
```

If the range is name value pair rows like this:

	Zone 1 Temp	Zone 2 Temp	Speed	Pressure
Average	72.34	84.49	47.22	76.31

The output of the JSON file is:

```
{
  "average": {
    "Zone 1 Temp": 72.34,
    "Zone 2 Temp": 84.49,
    "Speed": 47.22,
    "Pressure": 76.31
  }
}
```

If the JSON file exists it can either be overwritten or can be appended to with the new JSON object.

For the data itself, numbers and text are exported as formatted in the cell. For example, if the cell is a number formatted to 2 decimal places, even if the underlying value is more than 2 decimal places it is exported as it is displayed in the cell.

Date values are exported in the standard format *yyyy-MM-ddTHH:mm:ss-xxx* where xxx is the offset from UTC.

Settings

Directory

The directory where the JSON file is saved. If this is left blank, the **Reports Directory** of the current project is used (as defined in the **Project Explorer**). If this is not a full path reference, the setting is used as subfolders of the **Reports Directory**. If any part of the directory does not exist, it is created.

This can be a fixed name or cell reference where the cell reference contains the directory. Fixed names can contain **XLReporter** Name Types like {YYYY}, {MMM}, etc. See the **Name Types** chapter for the full list of supported keywords. Note that some keywords, such as *{DATIM}*

contain illegal directory characters when evaluated. These keywords cannot be used for the directory.

File

The name of the JSON file to export the range to. If no file extension is specified, *.json* is used.

If this setting is left blank, the text file is named after the target workbook in the format *Workbook.json*. If this is run on demand the target workbook is the name of the template.

Note that keywords for the date and time can be entered for the file name e.g., entering *{MMM}_{DD}_{YYYY}* will name a report generated on June 1st 2020 as *Jun_1_2020.json*. Note that some keywords, such as *{DATIM}*, contain illegal file name characters when evaluated. These keywords cannot be used for the file name.

This setting may also be specified as a cell reference.

Mode

This defines how the JSON file is treated if it exists.

Overwrite means the JSON file is overwritten with the JSON object produced.

Append means the new JSON object is appended to the existing file content and saved out. This allows 1 file to contain multiple JSON objects.

Orientation

The Orientation of the range of data to export to JSON (as depicted above). The following are available:

Data Table

The range to export is a table where the top row are headers and there is at least 1 row of data to export. This produces a JSON array object for each row where each column is a value, and the field name is the header in the top row.

Date	Zone 1 Temp	Zone 2 Temp	Speed	Pressure
7/26/2023 0:00	75.21	75.21	30.21	78.18
7/26/2023 1:00	76.32	77.84	35.22	86.48
7/26/2023 2:00	77.97	78.66	33.27	90.77
7/26/2023 3:00	78.32	90.98	37.55	89.55
7/26/2023 4:00	79.63	90.38	41.86	83.25
7/26/2023 5:00	75.84	76.35	56.05	74.06
7/26/2023 6:00	79.25	87.86	53.02	65.21
7/26/2023 7:00	76.06	89.68	49.10	59.77

In the range above, the field names are *Date*, *Zone 1 Temp*, *Zone 2 Temp*, *Speed* and *Pressure* and each row (starting at Date *7/26/2023 0:00*) is a row in the array.

This produces the following:

```json
{
  "data": [
    {
      "Date": "2023-07-26T00:00:00-04:00",
      "Zone 1 Temp": 75.21,
      "Zone 2 Temp": 75.21,
      "Speed": 30.21,
      "Pressure": 78.18
    },
    {
      "Date": "2023-07-26T01:00:00-04:00",
      "Zone 1 Temp": 76.32,
      "Zone 2 Temp": 77.84,
      "Speed": 35.22,
      "Pressure": 86.48
    },
    {
      "Date": "2023-07-26T02:00:00-04:00",
      "Zone 1 Temp": 77.97,
      "Zone 2 Temp": 78.66,
      "Speed": 33.27,
      "Pressure": 90.77
    },
    {
      "Date": "2023-07-26T03:00:00-04:00",
      "Zone 1 Temp": 78.32,
      "Zone 2 Temp": 90.98,
      "Speed": 37.55,
      "Pressure": 89.55
    },
```

Name-Value Column

The range to export consists of 2 columns where the left column is the field name, and the right column is the value. For example, the range:

Date	7/26/2023 0:00
Plant	Bedrock 1
Line	Mixer
Operator	Fred Flintstone

This results in the following JSON:

```json
{
  "header": {
    "Date": "2023-07-26T00:00:00-04:00",
    "Plant": "Bedrock 1",
    "Line": "Mixer",
    "Operator": "Fred Flintstone"
  }
}
```

Note that the range must consist of 2 columns. If more than 2 columns are specified, only the 2 leftmost columns are considered, all other columns are disregarded.

Name-Value Row

The range to export consists of 2 rows where the top row is the field name, and the bottom row is the value. For example, the range (disregarding the label in the leftmost column):

	Zone 1 Temp	Zone 2 Temp	Speed	Pressure
Average	72.34	84.49	47.22	76.31

This results in the following JSON:

```
{
  "average": {
    "Zone 1 Temp": 72.34,
    "Zone 2 Temp": 84.49,
    "Speed": 47.22,
    "Pressure": 76.31
  }
}
```

Note that the range must consist of 2 rows. If more than 2 rows are specified, only the top 2 rows are considered, all other rows are disregarded.

Object Name

The name of the JSON object exported. By default, this is set to *data*.

This can be a fixed name or cell reference and can contain **XLReporter** Name Types like {YYYY}, {MMM}, etc.

If this is not specified, it defaults to the worksheet name.

Format

The format applied to the JSON in the file when exported.

None means that no formatting is applied at all.

Indent means that the JSON object(s) is indented, making it easier to read if the file is to be viewed.

When indented, any invalid JSON is cleaned up. If set to *None*, none of the exported data is analyzed and is used as is, which may result in incorrect syntax.

Example

Taking the example explained above, if all 3 ranges were to be saved to a single JSON file, this would be done in 3 **Data Export Range to JSON** connections.

The first exports the header information:

Date	7/26/2023 0:00
Plant	Bedrock 1
Line	Mixer
Operator	Fred Flintstone

If this data is in the range *$B$4:$C$7*, and the JSON file is named after the **Target Report** and saved in the **Reports** folder of the project, the following settings are used:

Range	*$B$4:$C$7, None, All cells are empty*
Setting	
Directory	
File	
Mode	*Overwrite*
Orientation	*Name-Value Column*
Object Name	*header*
Format	*Indented*

The next connection exports the hourly data table:

Date	Zone 1 Temp	Zone 2 Temp	Speed	Pressure
7/26/2023 0:00	75.21	75.21	30.21	78.18
7/26/2023 1:00	76.32	77.84	35.22	86.48
7/26/2023 2:00	77.97	78.66	33.27	90.77
7/26/2023 3:00	78.32	90.98	37.55	89.55
7/26/2023 4:00	79.63	90.38	41.86	83.25
7/26/2023 5:00	75.84	76.35	56.05	74.06
7/26/2023 6:00	79.25	87.86	53.02	65.21
7/26/2023 7:00	76.06	89.68	49.10	59.77

If the headings for this data are *$B$10:$F$10*, the following settings are used:

Range   *$B$10:$F$10, Down, All cells are empty*

Setting

    Directory

    File

    Mode   *Append*

    Orientation   *Data Table*

    Object Name   *data*

    Format   *Indented*

Finally, the last connection exports daily average values:

	Zone 1 Temp	Zone 2 Temp	Speed	Pressure
Average	72.34	84.49	47.22	76.31

Note that these values are calculated by using the *AVERAGE* formula on the hourly values in the data table shown above.

If this range is *$C$37:$F$38*, the following settings are used:

Range   *$C$37:$F$38, None, All cells are empty*

Setting

    Directory

    File

    Mode   *Append*

    Orientation   *Name-Value Row*

    Object Name   *$B$38*

    Format   *Indented*

Range to Bitmap

The **Range to Bitmap** function is used to export a range of cells to a bitmap image file (.bmp). The range can contain text, values, formatting, formulas, charts, and any other object that can be put into a worksheet. This can be used to take information from the report worksheet and make it available to other applications that can display bitmap images.

This function can be used to generate snippets that can be delivered using the **TemplateSnippet** method in the **XLReporter REST API**. The snippet can also be displayed in the dashboards of WIN-911's Control Center.

Settings

    Directory

    The directory where the bitmap is saved. If this is left blank, the **Reports Directory** of the current project is used (as defined in the **Project Explorer**). If this is not a full path reference, the setting is used as subfolders of the **Reports Directory**. If any part of the directory does not exist, it is created.

This can be a fixed name or cell reference where the cell reference contains the directory. Fixed names can contain **XLReporter** Name Types like {YYYY}, {MMM}, etc. See the **Name Types** chapter for the full list of supported keywords. Note that some keywords, such as *{DATIM}* contain illegal directory characters when evaluated. These keywords cannot be used for the directory.

If the bitmap is to be used as a snippet, the **Directory** must either be empty or a fixed name. If the snippet is generated from a report template and instance, the variable *{Instance}* can be used for **Directory** in order to create a set of snippets for each instance of the template configured.

File

The name of the bitmap file to export the range to. If no file extension is specified, *.bmp* is used.

If this setting is left blank, the bitmap file is named after the target workbook in the format *Workbook.bmp*. If this is run on demand the target workbook is the name of the template.

Note that keywords for the date and time can be entered for the file name e.g., entering *{MMM}_{DD}_{YYYY}* will name a report generated on June 1st 2020 as *Jun_1_2020.bmp*. Note that some keywords, such as *{DATIM}*, contain illegal file name characters when evaluated. These keywords cannot be used for the file name.

This setting may also be specified as a cell reference.

If the bitmap is to be used as a snippet, the **File** must either be empty or a fixed name. If the snippet is generated from a report template and instance, the variable *{Instance}* can be used for **File** in order to create a set of snippets for each instance of the template configured.

Pixel Format

This defines the pixel format of the rendered bitmap. For details on the available formats and what they mean, see the Microsoft documentation for the *System.Drawing.Imaging.PixelFormat* enumeration.

Example

A daily report is generated to report on OEE for different pieces of equipment across the plant as well as an overall OEE score for the entire plant for the day. The overall OEE is shown as a value as well as a "meter" indicating how good or bad it was. This information is found within the range $I$2:$L$7. To render this as a bitmap image that can then be displayed on a dashboard, the following would be configured:

Range   *$I$2:$L$7, None, All cells are empty*
Setting
    Directory
    File
    Pixel Format   *No Format*

Chart to Bitmap

The **Chart to Bitmap** function is used to export a chart in the report workbook to a bitmap image file (.bmp). This can be used to take a chart from the report worksheet and make it available to other applications that can display bitmap images.

This function can be used to generate snippets that can be delivered using the **TemplateSnippet** method in the **XLReporter REST API**. The snippet can also be displayed in the dashboards of WIN-911's Control Center.

Settings
    Chart Name

The name of the chart to export the chart to. The browse button (…) opens a list of every configured chart within the workbook to select from. The list is in the format:

Chart Name – Sheet!Range of the chart

If a chart is selected in the list, the worksheet for the chart is activated and the range of the chart is selected to highlight the chart itself.

The chart name is not visible and is typically not set by the user. When a chart is inserted into a worksheet it is given a default name (*Chart X* where *X* is a number that starts at 1). However, if the worksheet is copied to another sheet, if the default name is left it can be changed on the new worksheet. To combat this, charts in the template are renamed to a fixed name (*xlrX* where *X* is a number that starts at 1) so that chart names are consistent between worksheets.

Note that only charts configured to worksheets are listed. Charts configured on a Chart Sheet cannot be used with this function.

Directory

The directory where the bitmap is saved. If this is left blank, the **Reports Directory** of the current project is used (as defined in the **Project Explorer**). If this is not a full path reference, the setting is used as subfolders of the **Reports Directory**. If any part of the directory does not exist, it is created.

This can be a fixed name or cell reference where the cell reference contains the directory. Fixed names can contain **XLReporter** Name Types like {YYYY}, {MMM}, etc. See the **Name Types** chapter for the full list of supported keywords. Note that some keywords, such as *{DATIM}* contain illegal directory characters when evaluated. These keywords cannot be used for the directory.

If the bitmap is to be used as a snippet, the **Directory** must either be empty or a fixed name. If the snippet is generated from a report template and instance, the variable *{Instance}* can be used for **Directory** in order to create a set of snippets for each instance of the template configured.

File

The name of the bitmap file to export the chart to. If no file extension is specified, *.bmp* is used.

If this setting is left blank, the bitmap file is named after the target workbook in the format *Workbook.bmp*. If this is run on demand the target workbook is the name of the template.

Note that keywords for the date and time can be entered for the file name e.g., entering *{MMM}_{DD}_{YYYY}* will name a report generated on June 1st 2020 as *Jun_1_2020.bmp*. Note that some keywords, such as *{DATIM}*, contain illegal file name characters when evaluated. These keywords cannot be used for the file name.

This setting may also be specified as a cell reference.

If the bitmap is to be used as a snippet, the **File** must either be empty or a fixed name. If the snippet is generated from a report template and instance, the variable *{Instance}* can be used for **File** in order to create a set of snippets for each instance of the template configured.

Pixel Format

This defines the pixel format of the rendered bitmap. For details on the available formats and what they mean, see the Microsoft documentation for the *System.Drawing.Imaging.PixelFormat* enumeration.

Example

A daily report is generated to report on plant downtime and includes a pie chart showing the distribution of downtime reasons for the day (chart is named *xlr1*). To render the chart as a bitmap image that can then be displayed on a dashboard, the following would be configured:

Setting

Chart Name	*xlr1*
Directory	
File	
Pixel Format	*No Format*

Data Import

This set of **Data Management** functions import data from workbooks, worksheets, text files, xml files, and Excel Add-ins.

Range From Workbook

The **Range From Workbook** function is used to import data from an outside workbook to a **Placement Cell** location in the current workbook.

Settings

Directory

The directory where the Excel workbook to import the range from exists. If this is left blank, the **Reports Directory** of the current project is used (as defined in the **Project Explorer**). If this is not a full path reference, the setting is used as subfolders of the **Reports Directory**.

This can be a fixed name or cell reference where the cell reference contains the directory. Fixed names can contain **XLReporter** Name Types like {YYYY}, {MMM}, etc. See the **Name Types** chapter for the full list of supported keywords

Workbook Name

The name of the workbook to import the range from.

This can be a fixed name or cell reference where the cell reference contains the directory. Fixed names can contain **XLReporter** Name Types like {YYYY}, {MMM}, etc.

If this setting contains a full path, that path is used as the **Directory**.

In addition, the **Workbook Name** can be specified with a wildcard. This changes the setting from a specific file name to a filter that is used to get the most recent file in the **Directory** specified. For example, a **Workbook Name** of *Flow*.xlsx* would import data from the most recent file in the **Directory** that starts with *Flow* and ends with *.xlsx*.

Start

If **Start** is intended to be a reference to a range found on the worksheet, it must be set as a single cell and the value in the cell must be a cell range containing "$", e.g., "$B$30:$D$30". Otherwise, this can be set to the entire range to import.

Direction

This setting defines the **Direction** in which to expand the **Start** by in order to determine the entire range of data to import.

Until

This setting defines how to terminate the detection of the range to import.

Paste

This setting defines what to paste from the range to the **Placement**. If the range to import contains formulas to other worksheets it is recommended to use the *Values* or *Values and Formats* setting, otherwise the formulas may result in errors in the report workbook.

Example

To extract summary data existing in a *June* monthly worksheet in a workbook called *MyReport2020*.xlsx the following settings would be used:

Placement

Cell	*$B$4*
Type	*Offset*
Direction	*Down*
Offset	*dM*

Setting

Directory	*C:\Reports*
Workbook Name	*MyReport{YYYY}*
Worksheet	*{MMMM}*
Start	*$B$30:$D$30*
Direction	*None*
Until	*All cells are empty*
Paste	*All*

Range From Workbook List

The **Range From Workbook List** function has the same functionality as the **Range From Workbook** function but operates on a list of parameters specified as a table in a worksheet in the template. This allows multiple ranges from multiple worksheets to be imported using a single action.

Sheet From Workbook

The **Sheet From Workbook** function is used to import an entire **Source Sheet** to a **Target Sheet**.

Settings

Directory

The directory where the Excel workbook to import the worksheet from exists. If this is left blank, the **Reports Directory** of the current project is used (as defined in the **Project Explorer**). If this is not a full path reference, the setting is used as subfolders of the **Reports Directory**.

This can be a fixed name or cell reference where the cell reference contains the directory. Fixed names can contain **XLReporter** Name Types like {YYYY}, {MMM}, etc. See the **Name Types** chapter for the full list of supported keywords.

Workbook Name

The name of the workbook to import the worksheet from.

This can be a fixed name or cell reference where the cell reference contains the directory. Fixed names can contain **XLReporter** Name Types like {YYYY}, {MMM}, etc.

If this setting contains a full path, that path is used as the **Directory**.

In addition, the **Workbook Name** can be specified with a wildcard. This changes the setting from a specific file name to a filter that is used to get the most recent file in the **Directory** specified. For example, a **Workbook Name** of *Flow*.xlsx* would import data from the most recent file in the **Directory** that starts with *Flow* and ends with *.xlsx*.

Source Sheet

The name of the worksheet to import.

Target Sheet

If specified, when the worksheet is imported into the report workbook this name is applied. Otherwise, the worksheet name is not changed.

If the target sheet name already exists in the report workbook, the name is rebuilt **as Workbook Name-Target Sheet** (truncated to 31 characters). If that sheet exists, a default name (e.g., **Target Sheet (2)**) is used.

Hyperlink Cell

A hyperlink can be added to the sheet(s) imported to navigate back to the **Active By** worksheet which may contain summary information about the worksheet(s) imported. **Hyperlink Cell** determines which cell the hyperlink will appear in on the imported sheet(s).

Hyperlink Text

This is the text that will appear in the cell for users to click on. If the cell is specified and the text is not, the **Active By** sheet name will appear as the text.

Overwrite

If **Overwrite** is set to *Yes* and the **Target Worksheet** name exists in the workbook, it is deleted, and the new worksheet is inserted as the last worksheet tab in the **Target Workbook**.

If **Overwrite** is set to *No* and the worksheet name already exists in the workbook the name is reconfigured as *Workbook Name-Target Sheet*. If a sheet with that name exists, the worksheet is named *Target Sheet (x)* where *x* is a number starting at 2.

Example

To move an entire monthly *June* worksheet from workbook named *Station_1_2020* and rename the *June* worksheet to *ST_1* in a summary workbook the following settings would be used:

Setting

Directory	*C:\Reports*
Workbook Name	*Station_1_{YYYY}*
Source Sheet	*{MMMM}*
Target Sheet	*ST_1*
Hyperlink Cell	
Hyperlink Text	
Overwrite	No

Sheet From Workbook List

The **Sheet From Workbook List** function has the same functionality as the **Sheet From Workbook** function but operates on a list of parameters specified as a table in a worksheet in the template. This allows multiple ranges from multiple worksheets to be imported using a single action.

From Text File

The **From Text File** function imports the content of a text file into a worksheet.

Settings

Directory

The directory where the text file to import exists. If this is left blank, the **Reports Directory** of the current project is used (as defined in the **Project Explorer**). If this is not a full path reference, the setting is used as subfolders of the **Reports Directory**.

This can be a fixed name or cell reference where the cell reference contains the directory. Fixed names can contain **XLReporter** Name Types like {YYYY}, {MMM}, etc. See the **Name Types** chapter for the full list of supported keywords.

Text File

The name of the text file to import.

This can be a fixed name or cell reference where the cell reference contains the directory. Fixed names can contain **XLReporter** Name Types like {YYYY}, {MMM}, etc.

If this setting contains a full path, that path is used as the **Directory**.

In addition, the **Text File** can be specified with a wildcard. This changes the setting from a specific file name to a filter that is used to get the most recent file in the **Directory** specified. For example, a **Text File** of *Flow*.csv* would import data from the most recent file in the **Directory** that starts with *Flow* and ends with *.csv*.

Delimiter

This setting defines how the values are separated in the file. A drop-down list of common separators is provided to select from, or a custom delimiter can be manually entered.

Rows in Header

This setting defines how many rows in the text files should be considered header rows. If the **Placement Type** is set to any of the *Insert* options, when the text file data is written, the header rows will appear at the top/left base on the **Placement Cell** and **Direction** without any inserting, and then the data itself is inserted. For any other **Placement Type** this setting is ignored.

Example

To extract the content of an hourly CSV file directly into an Excel workbook the following settings would be used:

Placement

Cell	*$B$4*
Type	*Offset*
Direction	*Down*
Offset	*hD*

Setting

Directory	*C:\MyCSVFiles*
Text File	*{YY}{MM}{DD}_{hh}_Station 1.CSV*
Delimiter	*Comma*
Rows In Header	*0*

From XML File

The From XML File function is used to import data from a specific **Table** in an XML file.

Settings

Directory

The directory where the XML file to import from exists. If this is left blank, the **Reports Directory** of the current project is used (as defined in the **Project Explorer**). If this is not a full path reference, the setting is used as subfolders of the **Reports Directory**.

This can be a fixed name or cell reference where the cell reference contains the directory. Fixed names can contain **XLReporter** Name Types like {YYYY}, {MMM}, etc. See the **Name Types** chapter for the full list of supported keywords.

XML File

The name of the XML file to import.

This can be a fixed name or cell reference where the cell reference contains the directory. Fixed names can contain **XLReporter** Name Types like {YYYY}, {MMM}, etc.

If this setting contains a full path, that path is used as the **Directory**.

In addition, the **XML File** can be specified with a wildcard. This changes the setting from a specific file name to a filter that is used to get the most recent file in the **Directory** specified. For example, an **XML File** of *Flow*.xml* would import data from the most recent file in the **Directory** that starts with *Flow* and ends with *.xml*.

Table

This setting is the name of the table in the XML file to import data from. If there are multiple tables in the file to import data from, each must be specified in their own Management connection.

Headings

This setting determines how the column headings in the **Table** are handled.

- *None*
  This indicates that only data is imported into the report from the file. Every column is imported in the order it is shown in the file.

- *From File*
  This indicates that the column headings of the table in the file are shown as the top row with the data in subsequent rows beneath. Every column is imported in the order it is shown in the file.

- *From Sheet*
  This indicates that the headings are from the worksheet, one row above the **Placement Cell** specified. The headings from the sheet determine which headings are imported from the table in the file as well as the order in which they are displayed in the report. With the setting, the headings from the sheet must match exactly with the column names in the table in the file.

  For example, if the table in the file consists of the columns *Flow*, *Speed*, *Pressure*, *Temp* and *Timestamp* but you only want to show *Timestamp* and *Speed* data starting in *$B$4*, in *$B$3* enter *Timestamp* and in *$C$3* enter *Speed*.

Example

A third-party software vendor produces an XML file every day containing data that needs to be brought into a daily report alongside process data that XLReporter can access directly.

To bring in the data from the XML file a From XML File function is configured. The settings are:

Placement
Cell	*$B$4*	
Type	*Direct*	

Setting
Directory	*C:\MyXMLFiles*	
XML File	*{YY}{MM}{DD}.xml*	
Table	*Data*	
Headings	*None*	

From Add-in Formulas

The **From Add-in Formulas** function is used to import data from formulas provided by 3rd party add-ins in Excel. This allows reports to be more "portable" as now the data from these add-in formulas can be viewed by anyone as there is no more add-in dependency.

Settings

Add-in

If the **Add-in** providing the formulas is an xla or xlam file, specify the name of it for this setting (including the file extension).

Remove Formulas

Typically, the add-in formulas should be removed in the final report. To do so, set this to either *All* or *Range*. *All* removes every formula on the report worksheet while *Range* removes the formulas specifically from the **Range** specified.

Range

If **Remove Formulas** is set to *Range*, the cell reference specified for this setting will have all formulas removed so that just the values remain.

Alternatively, this can be set to the start of an array formula reference anywhere in the workbook. When set to this, any range of cells containing this formula reference is removed leaving only the values behind. Additionally, if the **Add-in** specified is for the PI DataLink from OSIsoft (Pidldialogs), any range of array formulas is triggered to resize before the formulas are removed.

In order for this to work the **PIdldialogs** add-in must installed in Excel. To install, in Excel select **File, Options**. In **Excel Options** select **Add-ins** on the left.

On the right, click the **Go** button for **Manage**. If **PidlDialogs** is listed, make sure it is checked. If it is not listed, click the **Browse** button to add it.

If the PI server has been installed by a third-party like Rockwell Software or Emerson Automation Solutions browse to the installation folder for the historian of that software and then to *PIPC\Excel* and select *pidldialogs.xla*.

If the PI server has been installed directly from OSIsoft, locate the folder where PI DataLink is installed, browse to the *Excel* folder beneath it and select *pidialogs.xla*.

Make sure **PIdldialogs** is checked and click **OK** to install.

Note, in order for this function to work, a licensed copy of Microsoft Excel must be installed on the system.

Example

A report template is configured with multiple sets of formulas from the PI DataLink add-in across multiple worksheets. All the formulas use timestamps written to cells $A$1 and $A$2 which are configured as Variable connections in the template. The time duration varies, and the formulas must be removed so that the report can be viewed on systems where the PI DataLink add-in is not installed.

To accomplish this, a From Add-in Formulas function is configured. The settings are:

Setting

Add-in	*pidldialogs.xla*
Remove Formulas	*Range*
Range	*=PI*

With these settings, every range containing an array formula starting with *=PI* is refreshed and then the formulas removed leaving just the values behind.

From Image File

The **From Image File** function imports an image file like a bitmap, jpeg, gif, or other format into a report worksheet. This can be used in conjunction with the **Data Export Range to Bitmap** and **Chart to Bitmap** functions to build reports like executive summaries which show charts and summary data from other more detailed reports.

Settings

Directory

The directory where the image file to import exists. If this is left blank, the **Reports Directory** of the current project is used (as defined in the **Project Explorer**). If this is not a full path reference, the setting is used as subfolders of the **Reports Directory**.

This can be a fixed name or cell reference where the cell reference contains the directory. Fixed names can contain **XLReporter** Name Types like {YYYY}, {MMM}, etc. See the **Name Types** chapter for the full list of supported keywords.

Image File
The name of the image file to import.

This can be a fixed name or cell reference where the cell reference contains the directory. Fixed names can contain **XLReporter** Name Types like {YYYY}, {MMM}, etc.

If this setting contains a full path, that path is used as the **Directory**.

Example
To import the daily OOE summary that was exported from the Daily OEE report, the following is used:
Placement
    Cell   *$B$4*
    Type   *Direct*
Setting
    Directory
    Image File   *{YY}{MM}{DD}_OEE.bmp*

Function

The following management functions simplify some of the functionality that could be done by using workbook functions and formulas.

Delete Worksheet

The **Delete Worksheet** function deletes the specified worksheet from the report. This is useful if the worksheet is being used for "temporary" calculations for the final report workbook. Before applying this function, make sure that that there are no links referencing it from other sheets.

Settings

Worksheet

The name of the worksheet to delete. This can be a fixed name or a cell reference where the cell contains the name of the worksheet to delete.

Active Worksheet

The name of the worksheet to activate after the **Worksheet** specified is deleted. This can be blank, a fixed name or a cell reference where the cell contains the name of the worksheet to activate.

If left blank and the worksheet to delete is the active worksheet, the next worksheet to the right becomes active. If the worksheet is the rightmost worksheet, then the worksheet immediately to the left becomes active.

Range

The range to select on the **Active Worksheet** if it is specified. This can be left blank if it is not needed.

Example

An On Demand batch report is used to compare multiple batches. This report is constructed by configuring a separate worksheet containing a sub-report representing a single batch. For each batch specified for the report, the sub report is populated and copied to the report. On completion, the worksheet representing the sub report is no longer required and can be deleted.

Settings

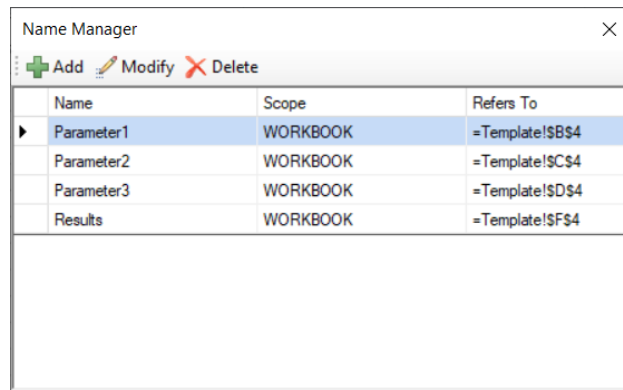|	
Worksheet	*SubReport*
Active Worksheet	*Report*
Range	

Result from Template

Data management combined with the hundreds of formulas/functions can produce very complex information for reports. However, sometimes it takes multiple, intermediate steps to get these results which can make the report itself appear way more complicated that it needs to be.

For these situations, the **Result from Template** function can be used to copy parameters from the report to another template, trigger all the formulas and data management set on that template and then return the results to the report is a specific location to provide a simple, clean report.

Please note that if no data management is required but rather only workbook formulas/functions, consider using the **Result from Workbook** function described below.

In the template where the work is done, named ranges are used to identify where up to 6 parameters are copied from the report as well as where the results are located that are copied back to the report. Parameters are designated with the names **Parameter1** to **Parameter6,** and the results are designated with the name *Results*.

Note that each parameter as well as *Results* should refer to a single cell or a range and that the **Scope** of each name must be set to *WORKBOOK*.

For more information on named ranges and cells see the **Named Cells/Ranges** section of the **Template Studio** document under the **DESIGN** category in the **Document Library**.

Note that *Results* can be a single cell, a single row, a single column, or a complete range.

If *Results* is a single cell, the width is determined by finding the first empty row to the right of the *Results* cell. Then, the height is determined by finding the first row where all columns are empty.

If *Results* is a single row spanning multiple columns, the height of the range is determined by finding the first row where all cells are empty.

If *Results* is a single column spanning multiple rows, the width of the range is determined by finding the first column where all cells are empty.

If *Results* is a range with multiple rows and columns, no further expansion on the width or height is done. The range is used as is.

In the template where the work is done, any data management function (with the exception of **Result from Template**) can be configured as a connection. Every management connection configured must have **Active By** set to a specific worksheet (do not use *Any Sheet*). Once all the management connections are configured, click **Export** to export these to the *Data Management* worksheet within the template. This sheet must be saved in the template as the **Result from Template** function executes the management functions on this sheet. If, at a later date, management connections are added, removed, or modified, click **Export** again to rebuild the worksheet.

Example

As a simple example, use a template to produce the total, average, minimum and maximum from a range of data copied from a report and returning those summary calculation results.

	A	B	C	D	E	F	G	H	I	J
fx	G4			=SUM(B4:E4)						
2										
3				Data				Results		
4							0	#DIV/0!	0	0
5										
6										
7										
8										
9										
10										

In the template *SummaryCalc*, cell *B4* is named *Parameter1* and cells *G4:J4* are named *Results*. To expand the formulas in *G4:J4*, a **Formula Range** management function is configured as a connection.

Active By	Template		Group	0
Category	Worksheet			
Type	Formula Range			

Base
Cell	$B$4:$E$4	
Direction	Down	
End	All cells are empty	

Placement
Cell		
Type	Direct	

Setting	Value
Formulas	$G$4:$J$4
Place Formula	No
Absolute Reference	No

Once added and saved, the management connection is exported to the *Data Management* worksheet and the *SummaryCalc* template is complete.

In the report template, a data connection is configured to retrieve the raw data from the historian and an area has been dedicated to the results from the *SummaryCalc* template.

	A	B	C	D	E	F	G	H	I	J	K
2											
3		Date/Time		Machine 1	Machine 2	Machine 3	Machine 4		Total	Average	Minimum	Maximum
4											
5											
6											
7											
8											
9											
10											
11											

To get the summary data, the **Result from Template** management function is configured.

Note that **Parameter 1** is set to *$C$4:$F$4*. When run, this range is expanded downwards until all the cells between *C* and *F* are empty.

Settings

Template

The name of the template which contains the rules that determine the *Results*. This can be fixed text or a cell reference.

If the file extension of the template is not specified, it is assumed to be the default set in the project.

Parameter 1 – Parameter 6

Up to 6 parameters can be passed to the template. The values in these parameters are written into the named cells *Parameter1 – Parameter6* in the workbook specified.

These can be hard coded or cell references. If set to a cell reference, the cell reference is expanded based on the data in the report.

If the parameter is a single cell the width is determined by finding the first empty row to the right of the cell. Then, the height is determined by finding the first row where all columns are empty.

If the parameter is a single row spanning multiple columns, the height of the range is determined by finding the first row where all cells are empty.

If the parameter is a single column spanning multiple rows, the width of the range is determined by finding the first column where all cells are empty.

If the parameter is a range with multiple rows and columns, no further expansion on the width or height is done. The range is used as is.
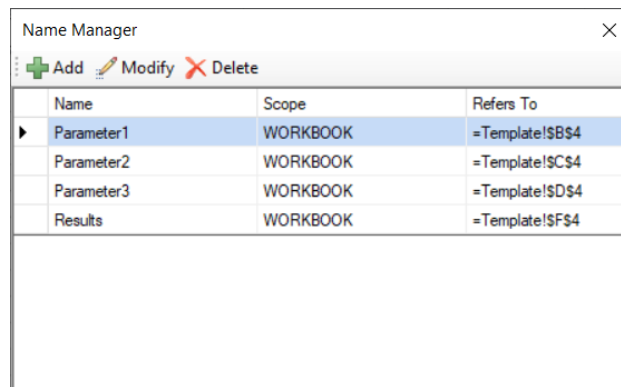
Paste

This setting determines what from the *Results* is copied back to the report. To use the formatting from the template, select *Values and Formats*, otherwise select *Values* to use the formatting set in the report template.

Result from Workbook

A powerful feature of workbooks is that they provide hundreds of formula/functions.

With complex formula rules, it may be preferable to express them in a workbook separate from the report so that they can be used in every report without replication. The **Result from Workbook** function is provided to copy parameters from the report to a separate workbook where complex formulas operate on the data and return those results to the report.

In the separate workbook, named ranges are used to identify where up to 6 parameters are copied from the report as well as where the results are located that are copied back to the report. Parameters are designated with the names **Parameter1** to **Parameter6,** and the results are designated with the name *Results*.

Note that each parameter as well as *Results* can refer to either a single cell or a range and that the **Scope** of each name must be set to *WORKBOOK*.

For more information on named ranges and cells see the **Named Cells/Ranges** section of the **Template Studio** document under the **DESIGN** category in the **Document Library**.

For example, in water treatment, a lookup table is used to calculate giardia levels from chlorine, temperature and pH. These tables are readily available from the EPA web site.

Look-up Table for Required CT for 1 log Reduction in Giard

Temp Degrees	Chlorine Conc	Lookup Row	pH	Output															
	Input																		
4.5	2.5	4525	6.1	48															
C	(mg/l)	x	6.0	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.9	7.0	7.1	7.2	7.3	7.
0.0	0.0	0	46	48	49	51	52	54	56	58	61	63	65	68	71	73	7
0.5	0.0	500	46	48	49	51	52	54	56	58	61	63	65	68	71	73	7
0.5	0.2	502	46	48	49	51	52	54	56	58	61	63	65	68	71	73	7
0.5	0.4	504	46	48	49	51	52	54	56	58	61	63	65	68	71	73	7
0.5	0.6	506	47	49	51	52	54	56	58	60	63	65	67	70	72	75	7
0.5	0.8	508	48	50	52	53	55	57	59	61	64	66	68	71	74	76	7
0.5	1.0	510	49	51	53	55	57	59	61	63	66	68	70	73	76	78	8
0.5	1.2	512	51	53	55	56	58	60	62	65	67	70	72	75	78	80	8
0.5	1.4	514	52	54	56	57	59	61	64	66	69	71	74	77	80	83	8

To make this suitable as a lookup to a report, each of the inputs and the output need to be identified. The inputs (yellow) are given the names *Parameter1, Parameter2* and *Parameter3*. The output cell is given the name *Results*.

The formula for the output is similar to the following which uses the temperature, chlorine, and pH to determine the result from the EPA lookup table:

=VLOOKUP(C6, C8:AH425, MATCH(D6, C8:AH8,1))

Note that this workbook is provided in the *XLReporter_library_Import* directory as *giardia-lookup.xlsx*

Example

As a simple example, use an external workbook to sum Parameter1 and Parameter2.

	A	B	C	D	E	F
2		Sum #	Parameter1	Parameter2		Results from Workbook
3		1	10	5		15
4		2	20	1		21
5		3	30	30		60

This configuration uses a *Calculators* workbook that has a *Results*, *Parameter1*, and *Parameter2* **Named Cells** with the following declarations:
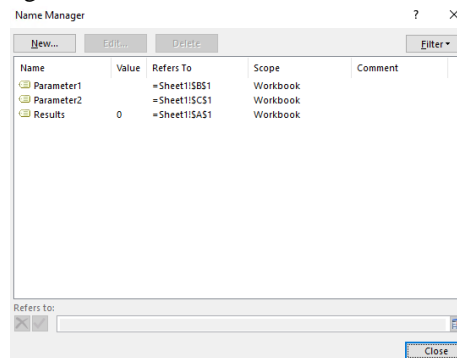
The *Results* cell contains a *=Parameter1+Parameter2* formula.

Setting	Value
Workbook ...	Calculator
Parameter 1	$C$3
Parameter 2	$D$3
Parameter 3	
Parameter 4	
Parameter 5	
Parameter 6	
Paste	Values

Use the settings:

Apply To   *$B$3:$D$3, Down, All cells are empty*
Placement   *$F$3, Insert At End, Down*
Setting
    Workbook Name   *Calculator*
    Parameter 1   *$C$3*
    Parameter 2   *$D$3*
    Parameter 3
    Parameter 4
    Parameter 5
    Parameter 6
    Paste   *Values*

Settings

Workbook Name

The name of the workbook which contains the rules that determine the *Results*. This can be fixed text or a cell reference.

If the full path of the workbook is not specified, it is assumed that the workbook is in the **Input** folder of the project. If the file extension of the workbook is not specified, it is assumed to be the default set in the project.

Parameter 1 – Parameter 6

Up to 6 parameters can be passed to the workbook. The values in these parameters are written into the named cells *Parameter1 – Parameter6* in the workbook specified.

These can be hard coded or cell references. If set to a cell reference and the **Apply To** range spans multiple rows, the row for the cell reference is adjusted as each row in the **Apply To** range is processed.

Paste

This setting determines what from the *Results* is copied back to the report. To use the formatting from the workbook, select *Values and Formats*, otherwise select *Values* to use the formatting set in the template.

Number to Bits

Registers read from a PLC that represent a bitmask need to be expanded to their individual bits so as to give meaning to the register value e.g., an alarm register representing which alarms are active.

Setting	Value
Count	8

The **Apply To** is the top row of the column containing the numbers to expand. The bit setting is written to the **Placement**. The **Count** is the count of how many bits in the number will be used, e.g., a value of *62* with a **Count** of *5* produces *11110*.

Settings

   Count

   A count of how many bits in the number will be used. This value cannot exceed 63 so if the value specified is greater than 63 it will be truncated.

Example

A motor has 8 possible alarms which are represented in the PLC as the bits of an integer register. A change in the integer value causes the timestamp and value to be written in a new row starting in cells *$B$4* and *$C$4*.

The alarm bits can be expanded in rows starting in cell *$E$4* with the following configured:

Placement

Apply To	*$C$4, Down, All Cells Empty*
Placement	*$E$4, Direct*

Setting

Count	*8*

Select Worksheet

The **Select Worksheet** function selects a worksheet in the report making it the visible worksheet when the workbook is opened.

Settings

   Worksheet

   The name of the worksheet to select. This can be a fixed name or a cell reference where the cell contains the name of the worksheet to select.

   Range

   The range to select on the **Worksheet** specified. This can be left blank if it is not needed.

Example

A monthly report workbook contains report worksheets for every day of the month as well as a **Summary** worksheet containing daily summaries. The daily report worksheets are updated every day. When a user views the monthly report workbook, the **Summary** worksheet should be selected.

Data Management

In practice, the last updated sheet will be the one visible to the user when the workbook is opened which is not what is required. Use this function with:

Settings
    Worksheet   *Summary*

Timestamp Convert

Timestamps from a data source sometimes needs to be converted to the requirement of the report. For example, it is common to find timestamps in Coordinated Universal Time (UTC), which is the primary time standard by which the world regulates clocks, needing to be converted into a local time.

This function converts cell values in the **Apply To** range based on the **Format** specified. The converted timestamps are written based on the **Placement** settings. To overwrite the timestamps with the converted, set the **Placement** cell to the top left corner of the **Apply To** range.

Settings
    Format
    The format to convert the timestamp to. The following are available:

        Locale Time
        Use this **Format** if the timestamps to convert are in UTC time and need to be converted to a time in a specific **Locale**.

        UTC Time
        Use this **Format** if the timestamps to convert are in a time in a specific **Locale** and need to be converted to UTC time.

        Custom
        Use this format to add or subtract from the timestamps. The **Value** and **Unit** settings are used for this setting.

    Locale
    The time zone to convert the timestamp to (if **Format** is *Locale Time*) or to convert the timestamp from (if **Format** is *UTC Time*).

    If left blank this is assumed to be the time zone of the Windows OS.

    A list of all supported Locale setting can be found in the text file *timezones.txt*. This is located in the installation directory of the product (*C:\XLReporter* by default).

    This setting can be a fixed time zone name or a cell reference. When set as a cell reference the cell specified is the top row of a list of time zones that correspond to every row of data in the **Apply To** range.

    Value, Unit
        The value to adjust the timestamp (positive or negative) in the unit specified.

Example
A report contains totals of the previous day, but the timestamps are from the current day. If the timestamp is written to cell *$B$4*, it can be converted to the previous day as follows:

Placement
    Apply To   *$B$4, None, All Cells Empty*
    Placement   *$B$4, Direct*
Setting
    Format   *Custom*
    Locale
    Value   *1*
    Unit   *Day*

Trim Text

Some data sources can return textual data in a format that is not conducive to a report. For example, text strings may be returned with a fixed length or padded with spaces, which in the report will not display correctly.

This function trims the text from every cell in the **Apply To** range, writing the trimmed text to the corresponding cell based on the **Placement**. To overwrite the original text with the trimmed text, set the **Placement** cell to the top left corner of the **Apply To** range.

Settings

Text to Trim

Set to the text string to trim. A dropdown list provides some common characters to trim. The text string to trim can also be entered directly in this setting.

Trim From

This determines from where the text is trimmed: from the *Left*, from the *Right*, or *Both* from the left and right.

Example

A database table contains a column that is fixed to 32 characters which means that if any text is less than 32 characters it has empty spaces to fill the remaining characters. This column of data starts in cell *$C$4*. To trim the trailing spaces from these values:

Apply To	*$C$4, Down, All Cells Empty*
Placement	*$C$4, Direct*
Setting	
Text to Trim	*Space*
Trim From	*Right*

Zero Pad

When displaying information like numeric product codes or batch IDs, it may be required to zero pad these values so that each is a consistent length. If the values are delivered as numbers, this function can zero pad them to a consistent length.

This function zero pads the value from every cell in the **Apply To** range, writing the zero-padded value to the corresponding cell based on the **Placement**. To overwrite the original value with the zero-padded value, set the **Placement** cell to the top left corner of the **Apply To** range.

Settings

Padding

This determines the maximum number of characters each value in the **Apply To** range is padded.

Example

The part number fabricated by a machine must always be *12* characters in length with 0's padding any part number less than 12 characters to be consistent. The report shows all the part numbers generated over the day with the part number itself starting in cell *$C$4*. To zero pad these values in place:

Apply To	*$C$4, Down, All Cells Empty*
Placement	*$C$4, Direct*
Setting	
Padding	*12*

Custom Category

Overview

XLReporter provides an interface for users to provide their own business logic in .NET classes.

A management function in a custom category behaves similar to other management functions except that the input cell range together with the user specified parameters are passed to a .NET class for processing. The result from the .NET class is positioned on the configured output cell.

This is an advanced feature and is described in more detail in the **Generate Reports Programmatically** document found in the **Document Library** under the **REPORT** section.

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