Petro Class

FlowTest

Advanced Well Testing Tools

About PetroClass FlowTest

FlowTest is a Production Testing software tool for testing oil and gas wells in Alberta Canada. FlowTest implements the Alberta Energy and Utilities Board (EUB) Pressure ASCII Standard (PAS PRD) version 4.00.

FlowTest generates and reads PAS PRD V4 files and the accompanying PDF image files. FlowTest implements all meter types and standards defined by the ERCB PAS PRD V4 Pressure ASCII Standard.

In Addition to standard production tests, FlowTest provides the ability to perform completion tests including perforating and fracturing, with commingled flow and load fluid recovery reporting.

If you have any questions or comments about PetroClass FlowTest, please feel free to contact us at flowtest@petroclass.com or visit us at www.petroclass.com

Mission Critical Disclaimer

THIS SOFTWARE AND SUPPORTING MODULES (INCLUDING REAL-TIME DATA COMPONENTS) ARE NOT SUITABLE FOR USE AS PART OF A MISSION CRITICAL OPERATION OR SAFETY MONITORING SYSTEM.

At Petro Class safety is a top priority and we recognize the importance of properly designed, redundant safety systems. Petro Class software products DO NOT meet the stringent requirements of such systems.

In general, ANY software running on a commercial operating system, using (off the shelf) hardware is NOT SUITABLE for monitoring critical systems! Be cautious of those who make claims to the contrary.

Version History

A document containing the FlowTest version history can be found in the FlowTest install directory called FlowTest Version History.pdf. To view the version history, from the main menu: select Help->Release Notes…

FAQ

1. **In a PAS file, why are the gas rates reported in the Data summary section different than the gas rates reported at the meter level.**

   All flow rates reported at the data summary level are average rates and have been normalized to properly represent material balance for all summarized fluids. The Meter Flow rates may differ (from the normalized data summary rates) if the meters integration method type is set to a trapezoidal mode. See 'Advanced Meter Properties' and 'Data Summary' sections of this document for more information.

   Also see: http://www.petroclass.com/flowtest/doc/ProdTestPitfalls1.pdf

2. **When I start FlowTest I get a message about a spell check module being available.**

   There is a spell checker add-on module that is installed separately from FlowTest. The install is available on the installation CD or download page.

3. **The 'Print' menu option is disabled (grayed out) how do I print?**

   FlowTest does not print directly to a printer; rather it generates PDF documents (which in turn can be printed). To print a table or plot, go to the 'Reporting' view, select the items for the report, and press the 'Generate' button. Once the report has been generated, you can use the print menu command (no longer grayed out) to print the PDF document.

4. **Sometimes when I enter a time in the data table the date will increment on its own.**

   If you enter a time less than the previous time, FlowTest assumes it is the next day and automatically increments the date. This behavior can be turned on or off in the 'User Preferences' table section.

5. **How do I change the title printed on the report for the tables and plots, they seem to default to "Grid" and "Plot"?**

   Either:
   a. When in the report generator the Report menu contains a "Report Titles…" option.
   b. Under the Plot or Table menu there is an item called "Report Title…" allowing you to change the report title?

   Can I create multiple plots and tables?

Yes, any number of plots and tables can be created for a given test. See the section titled "PRD User Interface Design Mode" for instructions on customizing FlowTest to add additional plots and tables.

6. **The PDF report has missing columns (but they are visible in the data table)**

   Table columns can be excluded (filtered) when generating the report. On the Reporting Tab, under Contents, expand the table missing the columns. Then select Filter, Columns and check the missing columns.

7. **How do I make the data table fit on a single page in the report?**

   On the Report navigation bar under "contents" expand the Table node and check the "Fit to page" option. Re-generate the report.

8. **How can I make the table font size in the report bigger?**

   By default the report table has the "Fit to page" option selected; this will automatically scale down the table font size such that all table columns will fit on a single page. In the case where you have several columns (30+) it may be better to allow the columns to span multiple pages. You can do this by clearing the "fit to page" option for the table and manually entering a scale to achieve the desired text size. Other options that affect auto scaling (when "Fit to page" is on) include:
   - The number of columns; you can remove (via the report filter) data columns that are not essential for the report.
   - The overall width of the columns ultimately determines the report scale so if you can decrease the width of the columns in the data table then the report auto scaling will be larger.

     When auto scaling "fit to page" the report table the scale is determined by the overall width of the table columns. Basically fewer and narrower columns will increase the text font size of the final output.

     See the previous 2 FAQ questions and the "Reporting section" for additional information.

9. **If I change the %CO2 or N2 load gas in the data table the total rate changes, why?**

   When the load gas recovery option is added to a gas meter the load gas inputs (CO_2, N_2 or C3) become part of the volumetric rate calculation. FlowTest continually adjusts the gas properties to account for the added load gas in the output stream.

   In a typical case (for a constant static, diff and temp) as you add load gas (which is typically more dense than the methane reservoir gas) the volumetric flow rate decreases as the gas gravity increases.

10. **Some numbers show up as #### in the data table, what does this mean?**

When numbers in the data table are displayed as ##### this means that the column width is too narrow to display the entire number. Increasing the column width will display the number.

11. Report headers are not updating to what was entered in the test information.

The likely cause of this is that a previous user has entered test information (from a previous job) into the report preferences template. Go to 'User Preferences', 'Report' section, 'Page Header Items' and clear out the hard coded information.
Test specific information should not be entered into the User preferences report header items. For more information see: Reporting, Report Options, Page Header Items.

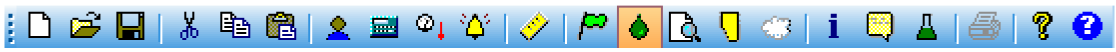
12. How can I zero meters during the test?

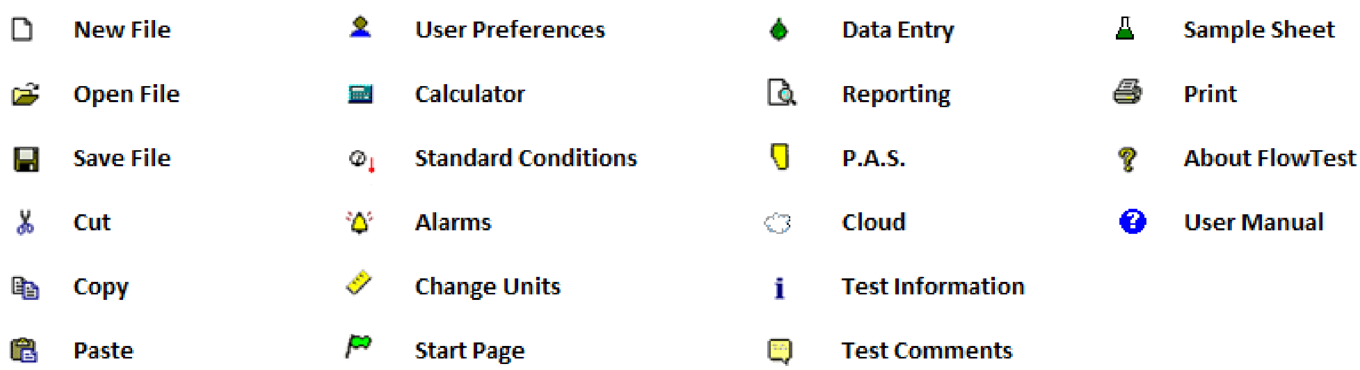
Meter and Data Summary totals can effectively be zeroed by using a 'Net Cum' series. Net Cum series allow you to net-out (or zero) any cum during the test.
For additional information see: Net Cumulative Series.

13. How do I get "Daily hours flowed" as a summary smart-tag?

To report any flow times such as hours flowed or hours flowed to pipeline you must first create a flow-time series on the appropriate cumulative series. Then you can reference the flow-time series in the smart-tag using the "GAIN" notation.
<SERIES[TAGNAME] GAIN 24> (this reports the 24 hour gain of the series).
For additional information see: the Flow-Time generic series and Smart-tag reference.

FlowTest Menu and Toolbar items





- New File - creates a blank FlowTest file from a template.
- Open File - opens an existing FlowTest file.
- Save File - saves the current FlowTest file.
- Cut - cut to the clipboard.
- Copy - copy to the clipboard.
- Paste - paste from the clipboard.
- User Preferences - display the User Preferences dialog.
- Calculator - display the calculator application.
- Standard Conditions - display the Standard Conditions dialog.
- Alarms - display the alarm monitor dialog.
- Change Units - toggles the unit mode between Metric and Imperial units.
- Start Page - displays the start-up view
- Data Entry - set the Navigation bar to the Data Entry view.
- Reporting - set the Navigation bar to the Report view.
- P.A.S. - set the Navigation bar to the PAS view.
- Cloud - set the Navigation bar to the Cloud view.
- Test Information - display the Test Information dialog.
- Test Comments - display the Test Comment dialog.
- Print - print the current report.
- Sample Sheet - display the sample sheet entry window
- About FlowTest - display current program information.
- User Manual - display the FlowTest user manual.

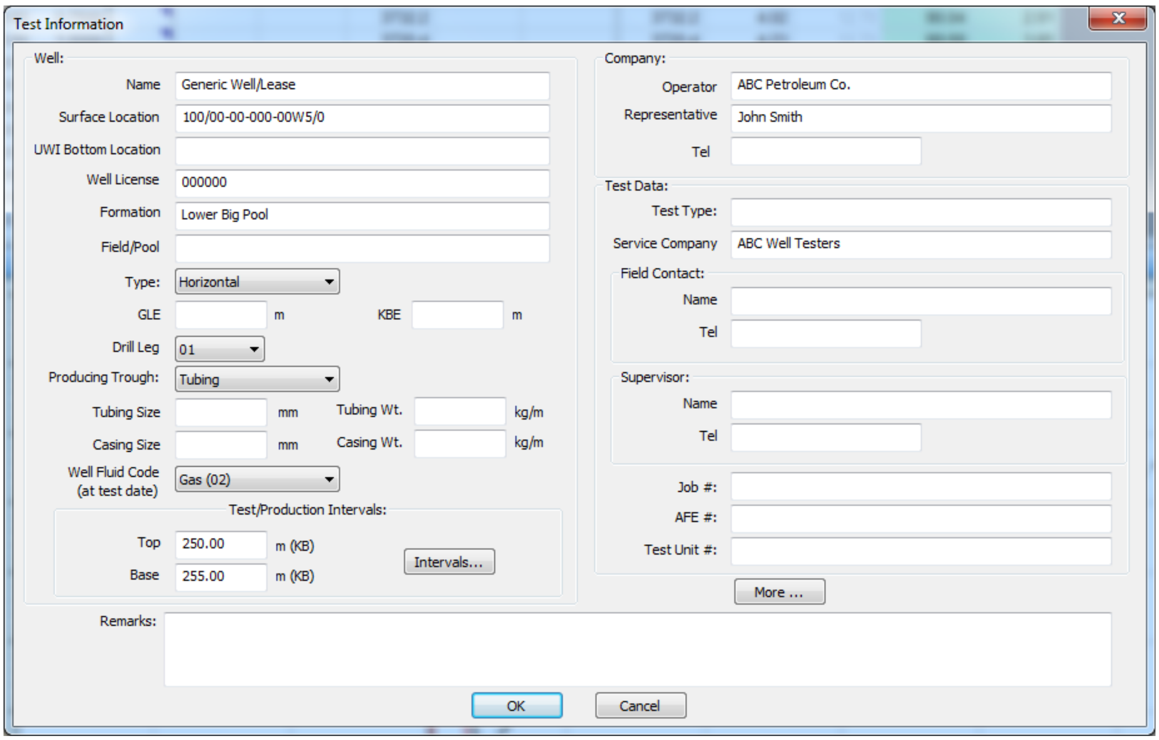
	**Spell Checker**
	**Highlight Smart Tags**
	**Restore View**
	**Maximize View**
	UI Designer

- Spell Checker - Spell checker (on/off).
- Highlight Smart Tags - Highlight table smart tags (on/off) .
- Restore View - Restore a maximized view.
- Maximize View - Maximize the active view.
- UI Designer - Enter/exit UI design mode.

Test Information

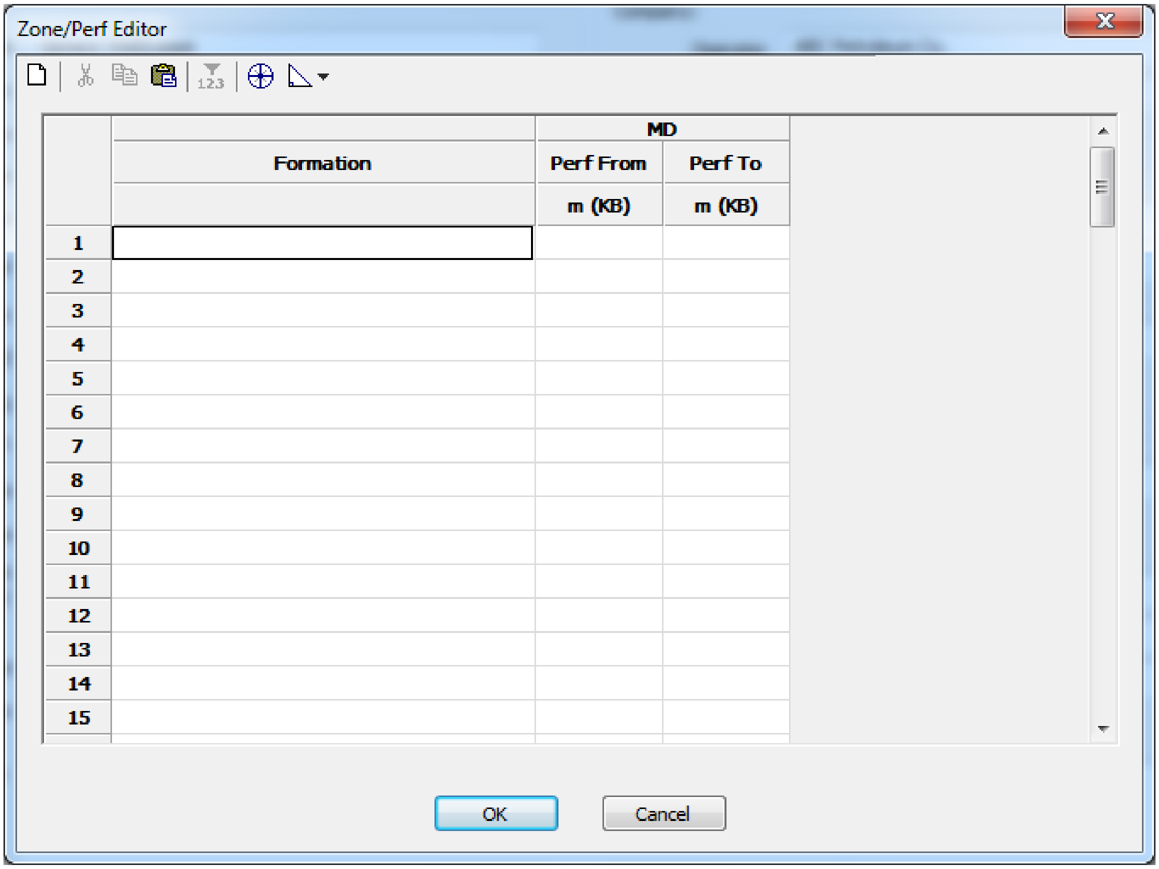
The Test Information dialog is where well and company information is entered. The data entered in this dialog is used in the PAS file generation as well as the PDF report (see PAS and Reports sections).

The Test Information dialog is accessed via the Test Information button on the main toolbar.



Production Intervals can be defined as a single range or (by pressing the “Intervals…” button) additional perforations and zones can be defined.

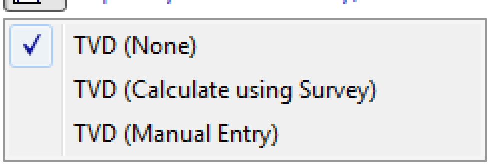
Production Intervals



Production intervals are specified by a formation name along with a ‘from/to’ measured depth, optionally, true vertical depths can be either entered or calculated (given a deviation survey) by specifying the appropriate settings via the toolbar.

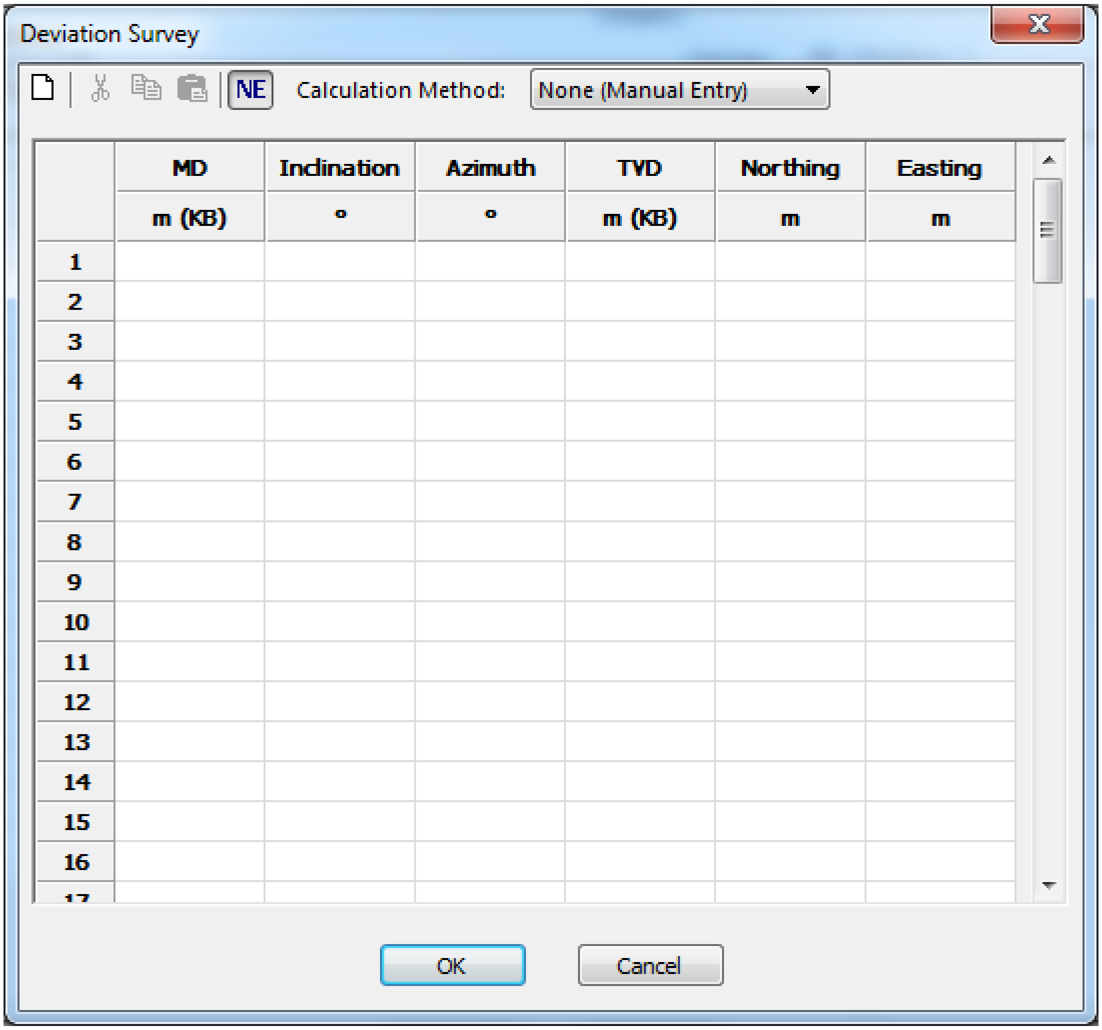
 Add/edit a deviation survey

 Specify the TVD entry/calculation mode



Deviation Survey

A deviation survey can be specified to calculate true vertical depths from measured depths for each perforation interval.



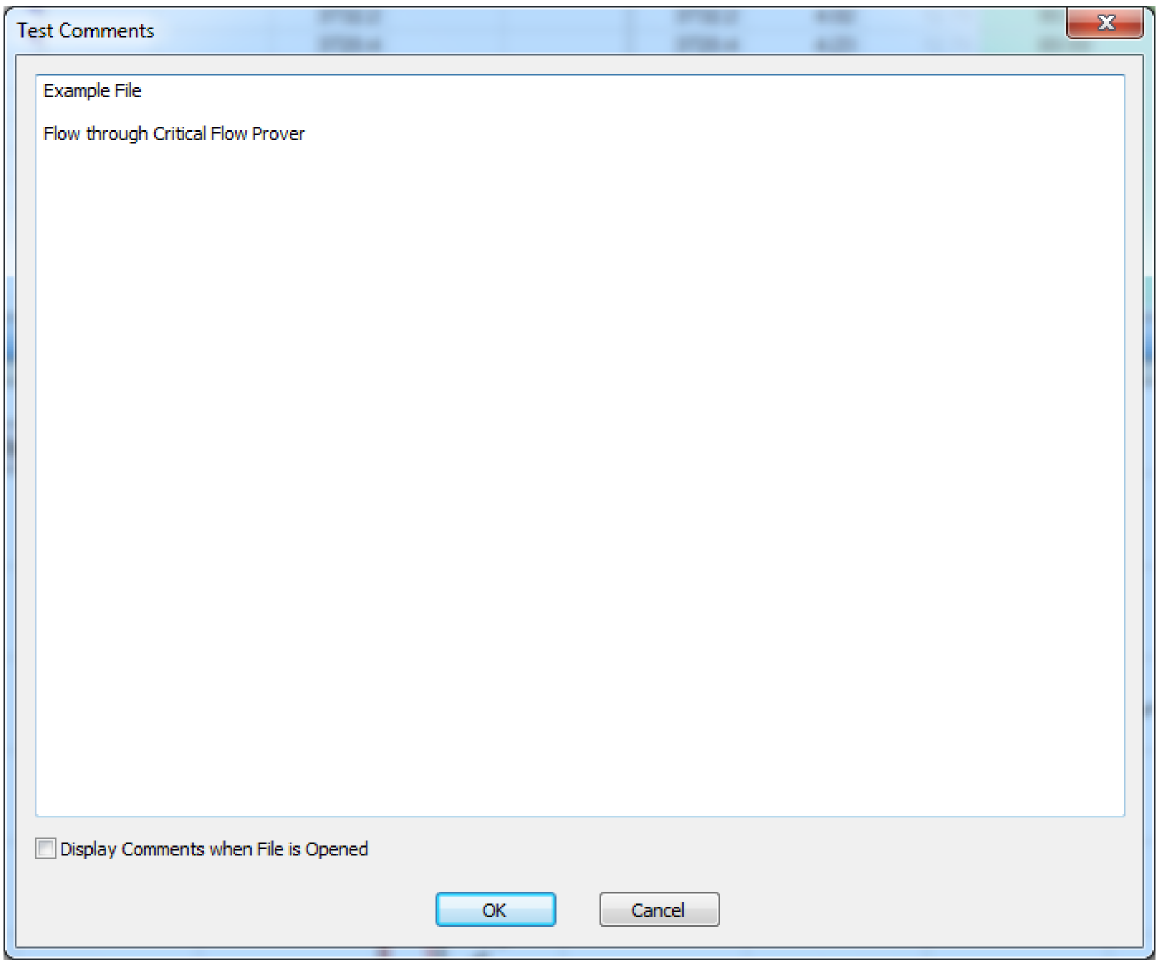
For the deviation survey, entries can be calculated or entered manually as specified by the 'Calculation Method' toolbar setting as follows:

- None (Manual Entry)
- Tangential
- Balanced Tangential
- Average Angle
- Minimum Curvature
- Radius Of Curvature

General Test Comments

The Test Comments dialog can be used to record general test notes or user instructions. The “Display Comments when File is Opened” check box, when enabled, will cause the dialog to be displayed when the file is opened. The comments entered in this dialog will appear on the PDF report as a comment annotation (see reporting section).

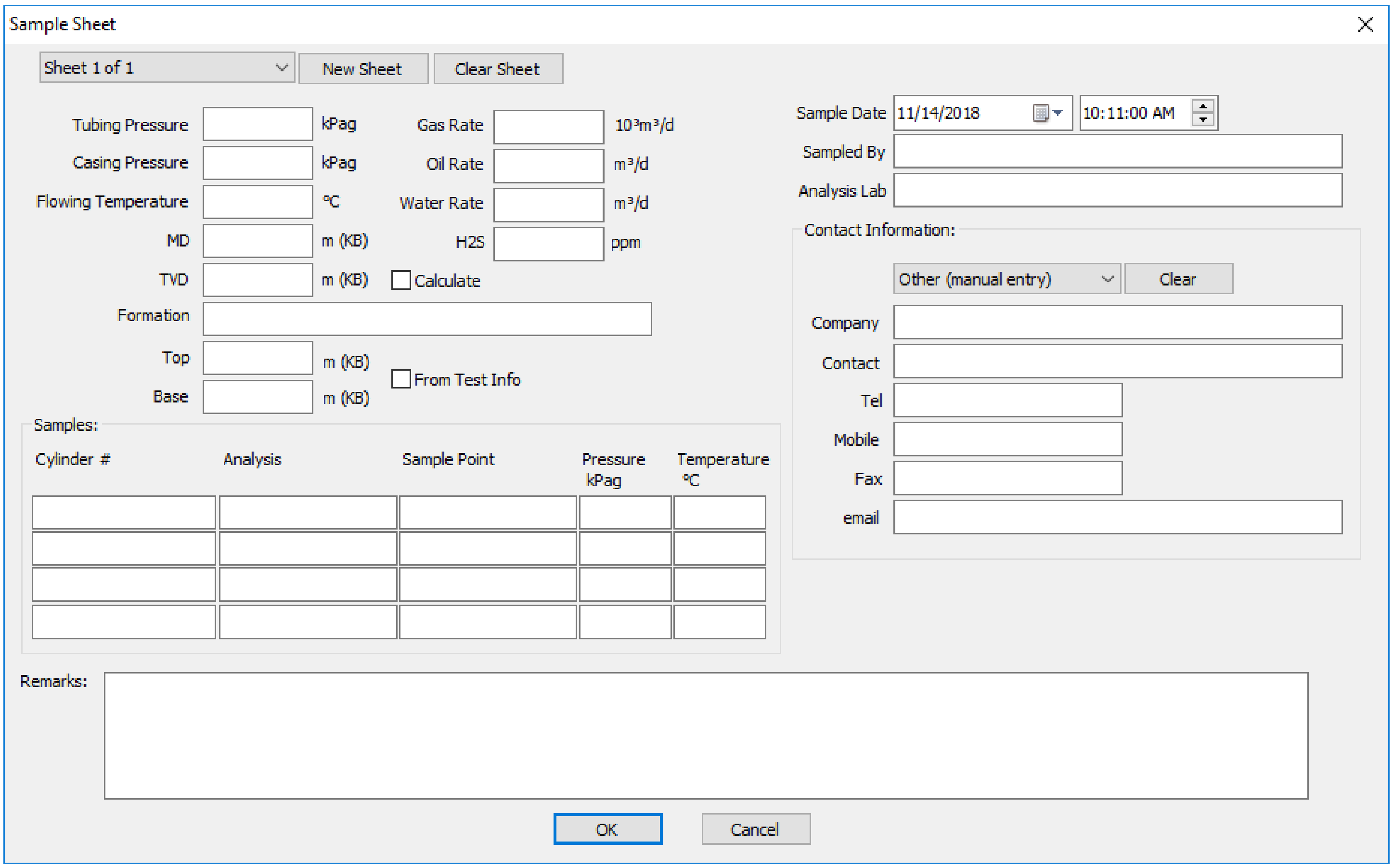
The Test Comments dialog is accessed via the Test Comments button on the main toolbar.



Sample Sheet

The sample sheet window is used to record fluid samples taken during the test. Up to 5 sample sheets can be recorded for any single test.

The sample sheet window is accessed via the Sample Sheet button on the main toolbar.

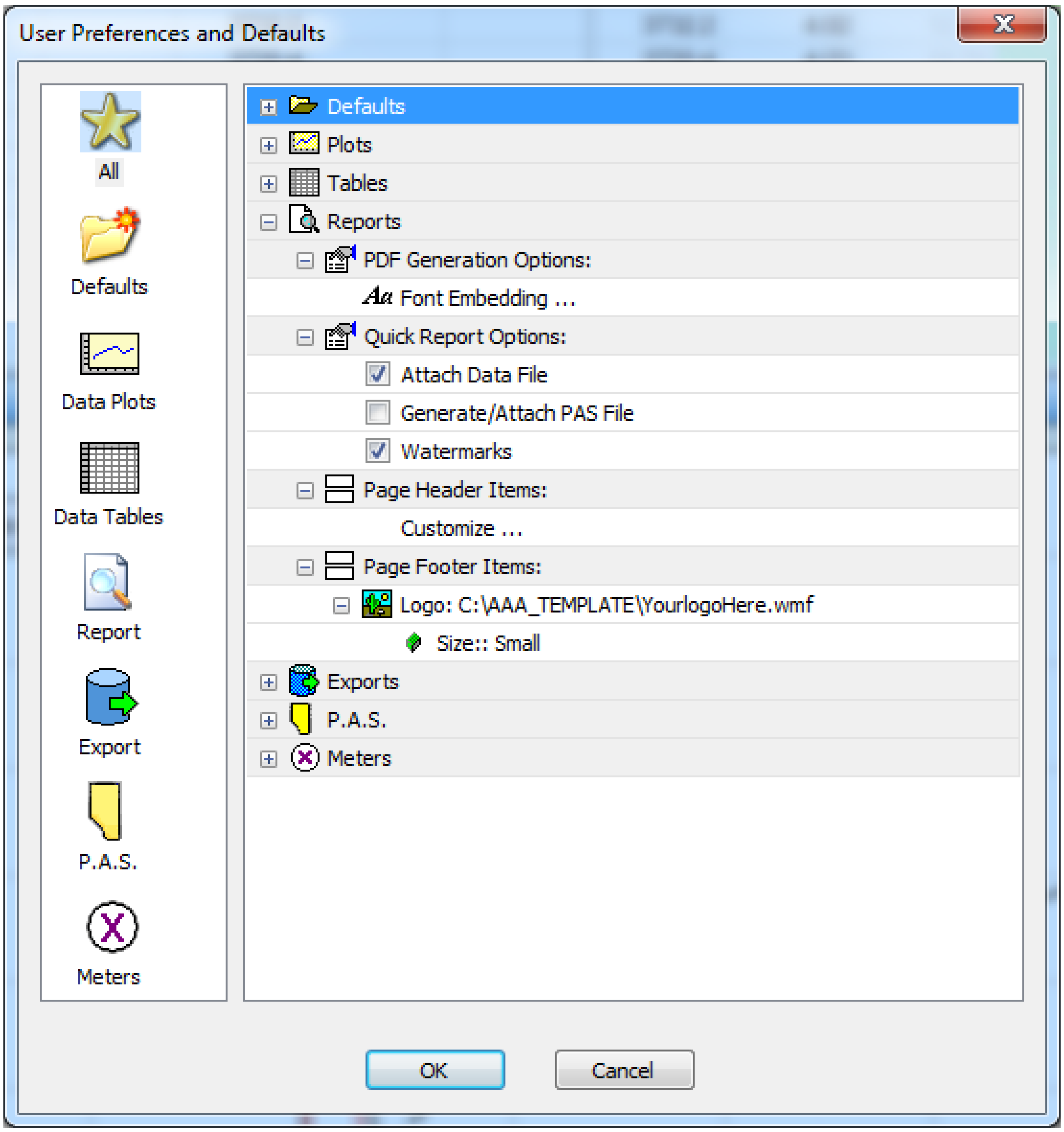


Sample sheets can be included in the PDF report by enabling (checking) the “Sample Sheet” section of the report generator. (See the reporting section below for additional information)

User Preferences and defaults

The User Preferences and defaults dialog allows defaults to be set for the various views within FlowTest.

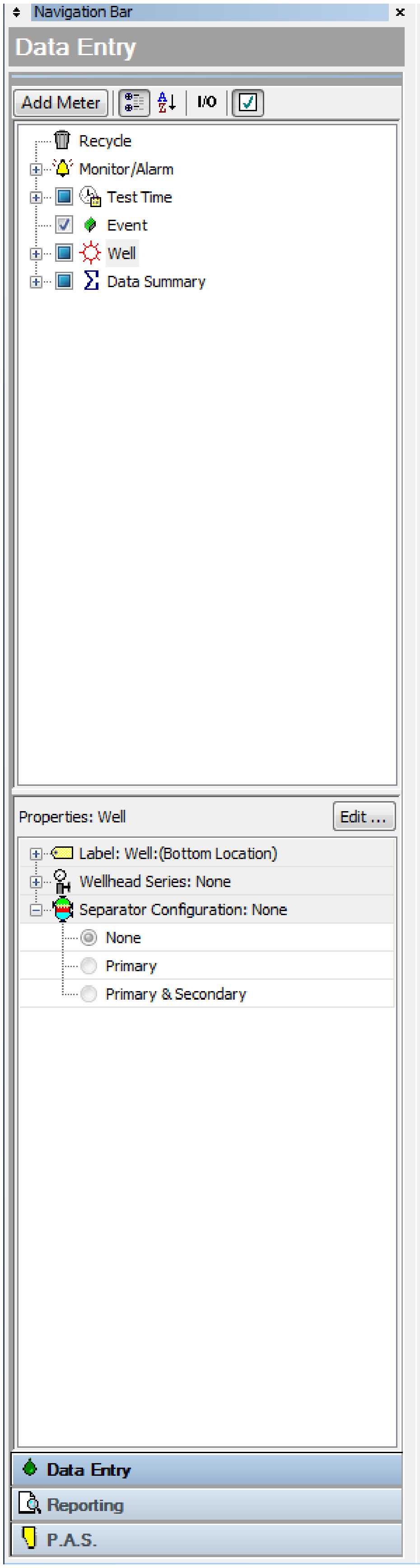
User Preferences is accessed via the Preferences button on the main toolbar.



User Preference Sections:

Data Entry View

The Data Entry Navigation bar panel contains the main data entry views. It is here where the actual test data is entered and displayed on various table and plot views.



Data Entry Options:

The Add Meter Button displays a menu of meter types that can be added to FlowTest.

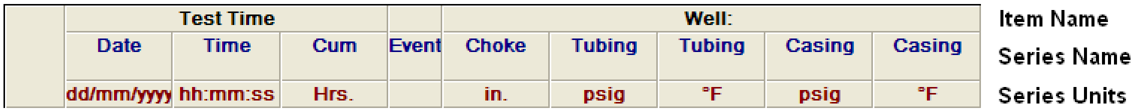
The upper pane of the Data Entry Navigation Bar displays a summary of current objects. These include all added meters, the meter data summary and the test time configuration objects. The Recycle object will contain delete objects (i.e. Meters) .

The lower pane of the Data Entry Navigation Bar will display the properties of the currently selected object in the upper pane. To edit the object properties press the Edit button on the top of the Properties pane.

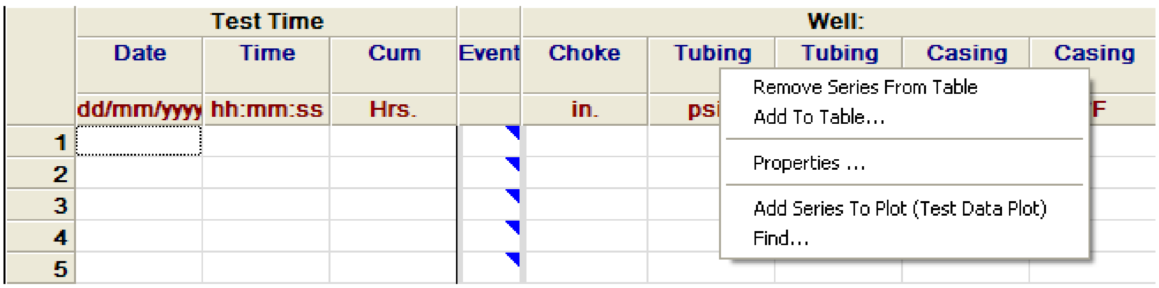
Data Table

	Test Time				Well:				
	Date	Time	Cum	Event	Choke	Tubing	Tubing	Casing	Casing
	dd/mm/yyyy	hh:mm:ss	Hrs.		in.	psig	°F	psig	°F
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									

The Data Table is the main interface to display and edit well, meter information and test comments. The columns in the table represent the objects configured in the 'Data Entry' Navigation bar.



The Data table contains three main header rows.

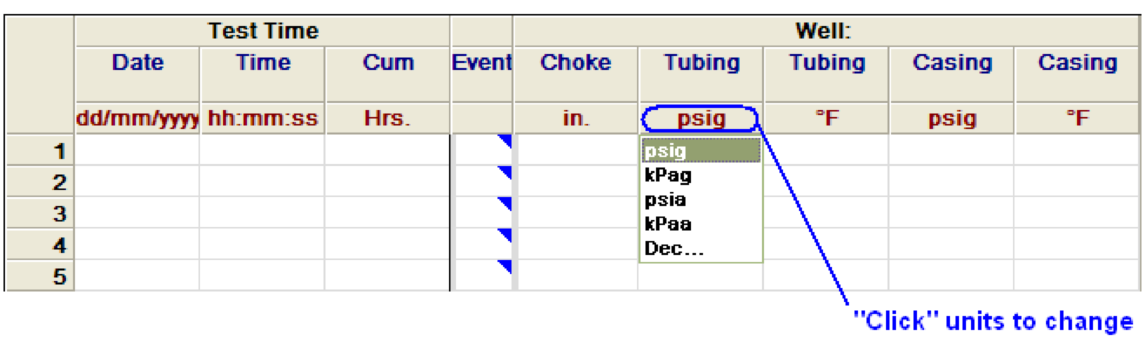


"Right Click" of the header row and column will display a context menu for the column.

Table Header Context Menu Functions:

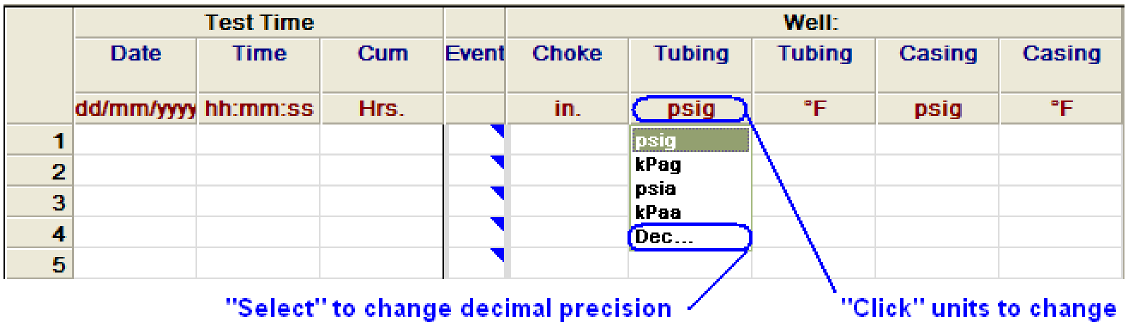
- **Remove Series Form Table** Removes the series from the table (does not delete the series)
- **Add To Table** Displays a list of all available series for addition to the table
- **Properties...** Displays the series Properties Dialog
- **Add Series to Plot** Adds the series to the plot
- **Find** Displays a window to search for values in the column

Change Units



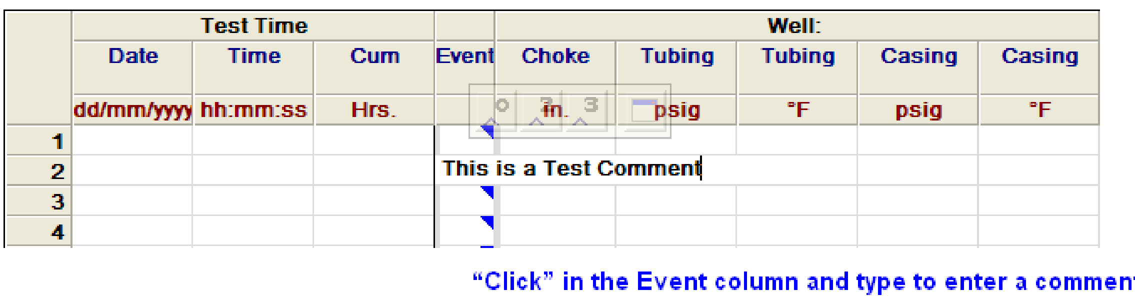
"Left Click" of the Series unit row displays a pick-list to change the column display units for the series.

Set Decimal Point



To change the number of digits displayed after the decimal point, select the "Dec…" option from the units drop down list.

Entering Test Comments



Test Comments are entered into the table by typing in the "Event" column. The comment entered spans the entire table and is displayed above any data already in the row.

When editing comments an editing toolbar is displayed above the comment. The editing toolbar provides the ability to easily insert common super script characters and also edit the comment in a separate window when enhanced editing is required.

Comment Editing/Formatting Options

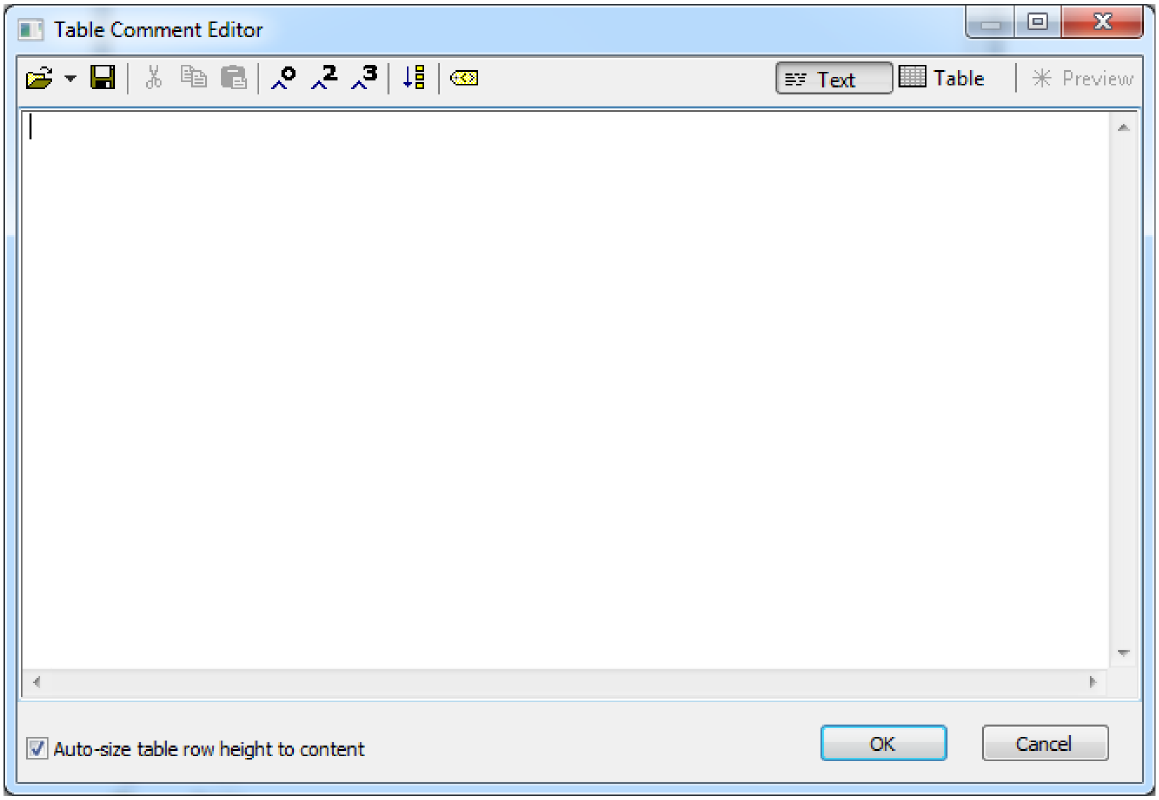


Table Comment Editor Window

Comments can be edited in a separate window making it easier to create multi-line comments and align items with tab stops; along with providing additional features like table formatting (see Table mode below) and adding smart tags (see Smart Tag section for more information).

In the Table Comment Editor, comments can be saved and recalled for easy reuse in the same or different test files.

Open saved comment
Save Comment
Cut
Copy
Paste
Deg Symbol
Super script 2
Super script 3
Stage Comment
Smart tag window

General Table Comment Editor Toolbar Buttons

Text **Freeform Text Mode**
Table **Formatted Column Mode**
Preview **Preview Mode**

Table Comment Editor Modes

Table Comments can be created in two basic formatting modes:

1) Text The freeform text mode provides a general text, editor to edit the test comment, and includes general editor abilities such as multiple lines and tab stops.

2) Table The formatted column mode (or table mode) provides greater control over the comment appearance when aligning discrete items into multiple columns and is ideal for creating test summaries with smart-tags items.

Preview *In addition to the text and table formatting modes, a preview mode is available to preview the comment in place with smart-tags converted and formatting applied.*

Formatted Column (Table) Mode

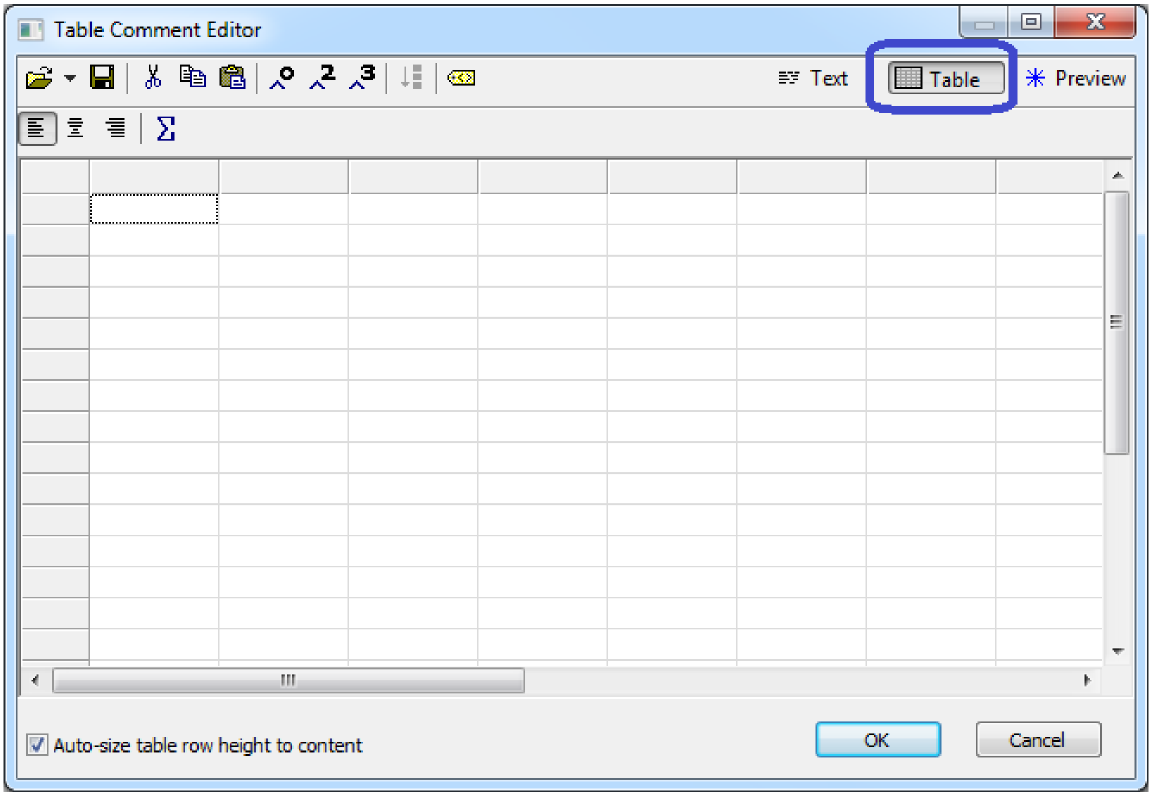


Table Comment Editor Window (Table Mode)

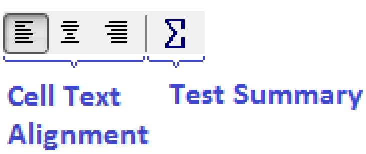
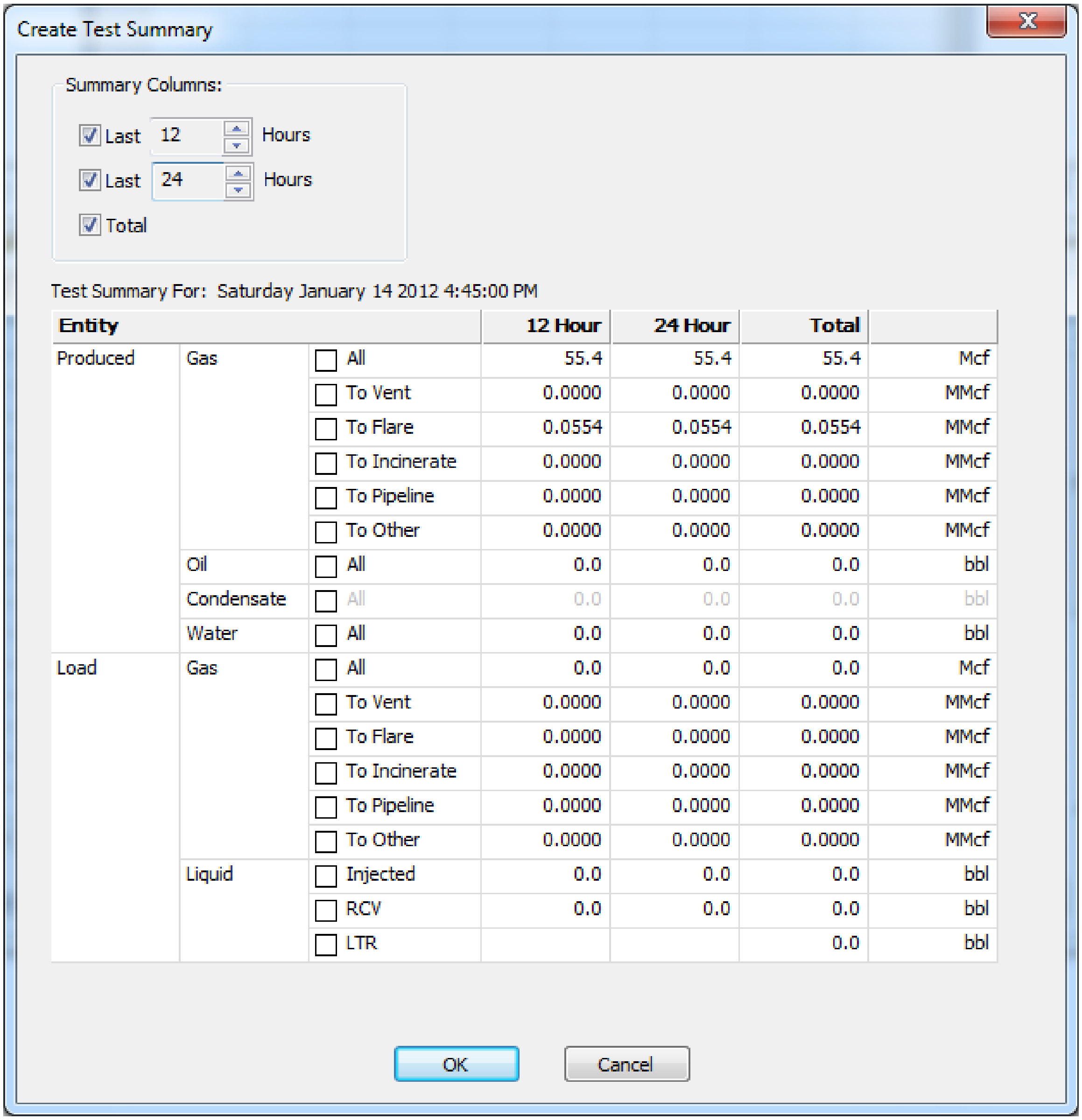


Table Mode Toolbar

Table mode formats the comment as a series of table cells. Table column widths may be sized and text alignment can be applied to individual cells making the table comment mode ideal for tabular information such as test summaries.

Table Test Summary

Σ The 'Test Summary' button on the 'Table Mode' toolbar provides a convenient means of creating a test summary. The 'Create Test Summary' window (shown below) provides various options to select fluids and times for display in the summary.



Create Test Summary window

Test summaries created using the 'Create Summary' window can contain multiple test fluid types and up to 3 summarized columns.

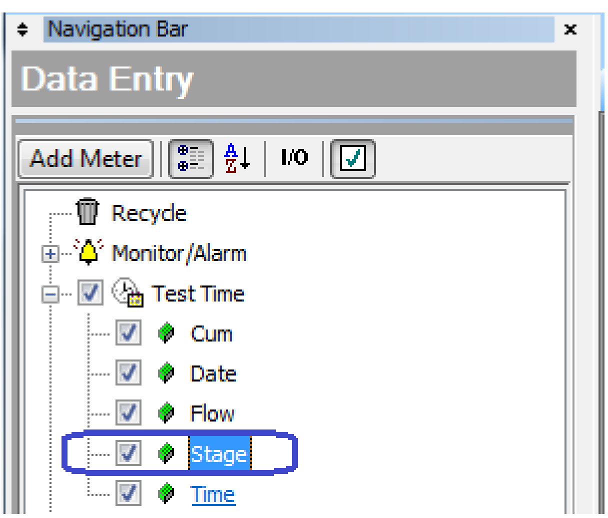
Stage Comments

Test comments can be set as a 'Stage comment' whereby the comment is displayed as vertical text in the data table stage series of the 'Test Time' group as shown below.

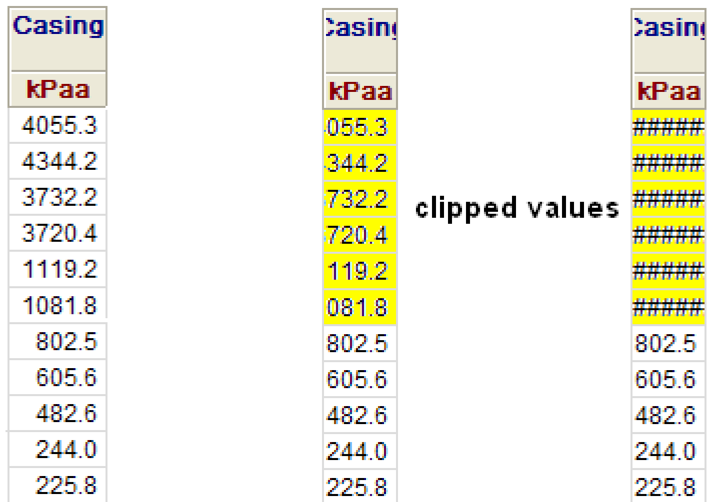
	Test Time					Well: 100/00-00-000-00W5/0				
	Date	Time	Cum	Stage	Note	Tubing	Tubing	Casing	Casing	Choke
	dd/mm/yyyy	hh:mm:ss	Hrs.			kPaa	°C	kPaa	°C	mm
0	01/03/2007	12:00:00	0.0000			90.0	15.00	96.3		
1	01/03/2007	12:00:01	0.0003	Stage 1 Comment	Stage 1 Comment					
2	01/03/2007	12:01:00	0.0167				15.00	90.0		
3	01/03/2007	12:05:00	0.0833					4215.8		
4	01/03/2007	12:10:00	0.1667					3982.5		
5	01/03/2007	12:15:00	0.2500					4055.3		
6	01/03/2007	12:30:00	0.5000					4344.2		
7	01/03/2007	12:45:00	0.7500					3732.2		
8	01/03/2007	13:00:00	1.0000		Normal Comment					
9	01/03/2007	13:00:00	1.0000					3720.4		
10	01/03/2007	13:30:00	1.5000					1119.2		
11	01/03/2007	13:31:00	1.5167					1081.8		
12	01/03/2007	14:00:00	2.0000					802.5		
13	01/03/2007	14:00:00	2.0000	Stage 2 Comment	Stage 2 Comment					
14	01/03/2007	14:30:00	2.5000					605.6		
15	01/03/2007	15:00:00	3.0000					482.6		
16	01/03/2007	15:30:00	3.5000					244.0		
17	01/03/2007	16:00:00	4.0000					225.8		
18	01/03/2007	16:30:00	4.5000					178.7		
19	01/03/2007	17:00:00	5.0000					169.1		

Stage comments are primarily intended to be a single line comment, if a multi-line comment is set as a stage comment the stage series will only display the first line.

The stage comment series must be enabled in the data table in order to make the stage comments visible.



Data table items displayed by a series of # symbols i.e. ###### (Train Tracks) indicate that the column width is to narrow to display the entire number in order to display the number increase the column width. This behavior can be disabled in the table section of the "User Preferences" dialog.

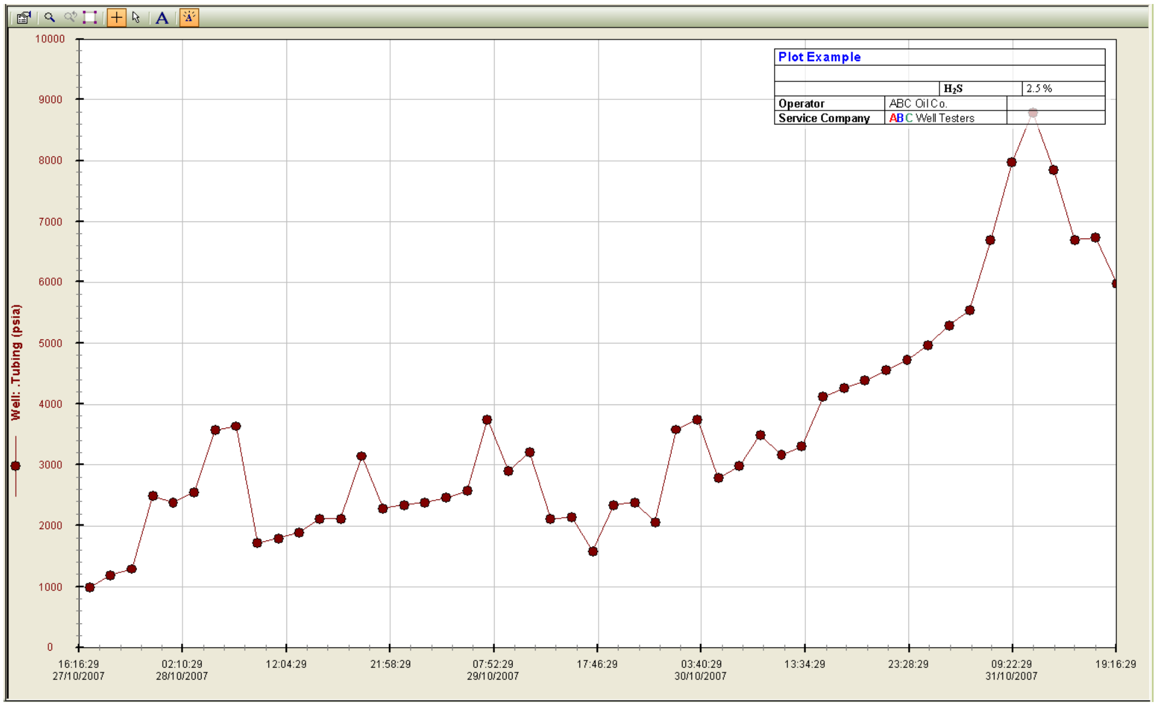


No values clipped **Train Tracks OFF** **Train Tracks ON**

As seen in the 2nd column, if a data column width is too narrow some significant digits are cut off, presenting erroneous values to the user.

Data Plot

The Data plot is a general plotting view which can plot any test series. Multiple axis are supported along with the ability to tie similar series to a common axis scale. Annotations can be added to indicate significant events.



Example plot with one series and a single annotation.

Plot configuration described below.

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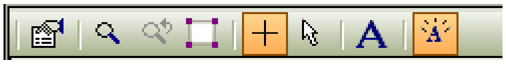
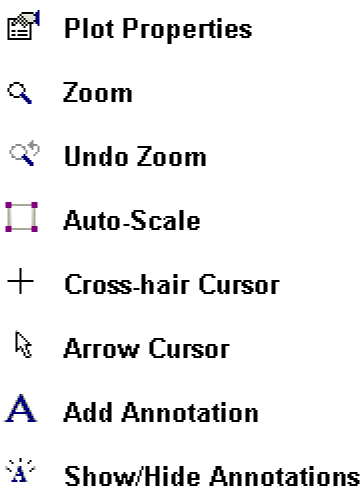
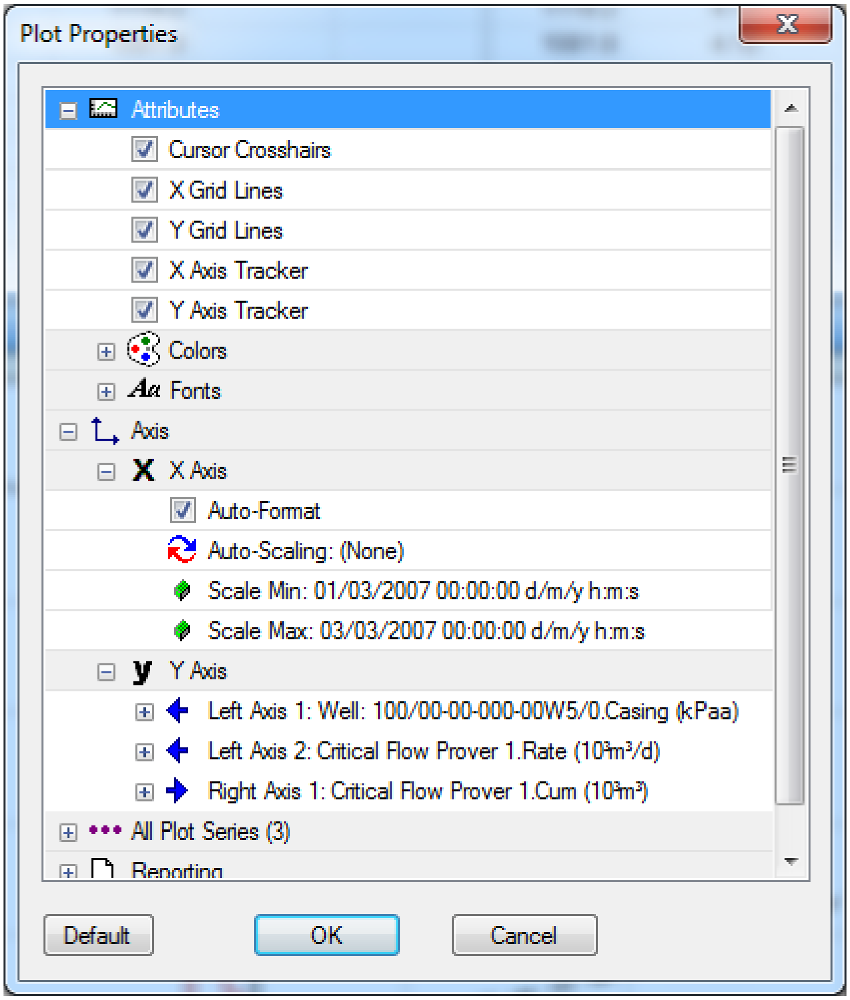
Plot Toolbar and Menu items





- Plot Properties displays the General plot Configuration Dialog:
- Zoom changes the plot cursor to a magnifying glass. Click and drag the zoom cursor in the plot to zoom the enclosed area.
- Undo-Zoom will undo successive zoom actions.
- Auto-Scale scales all plot axis to display all series
- Cross-hair Cursor displays X and Y reference lines that track the cursor movement.
- Arrow Cursor displays the plot cursor as a standard arrow pointer.
- Add Annotation adds a new annotation to the plot
- Show/Hide annotations toggles the visibility of the annotation layer.

Plot General Properties Dialog



The Plot General Properties dialog allows for configuration of all plot parameters. In this dialog the following properties can be set:

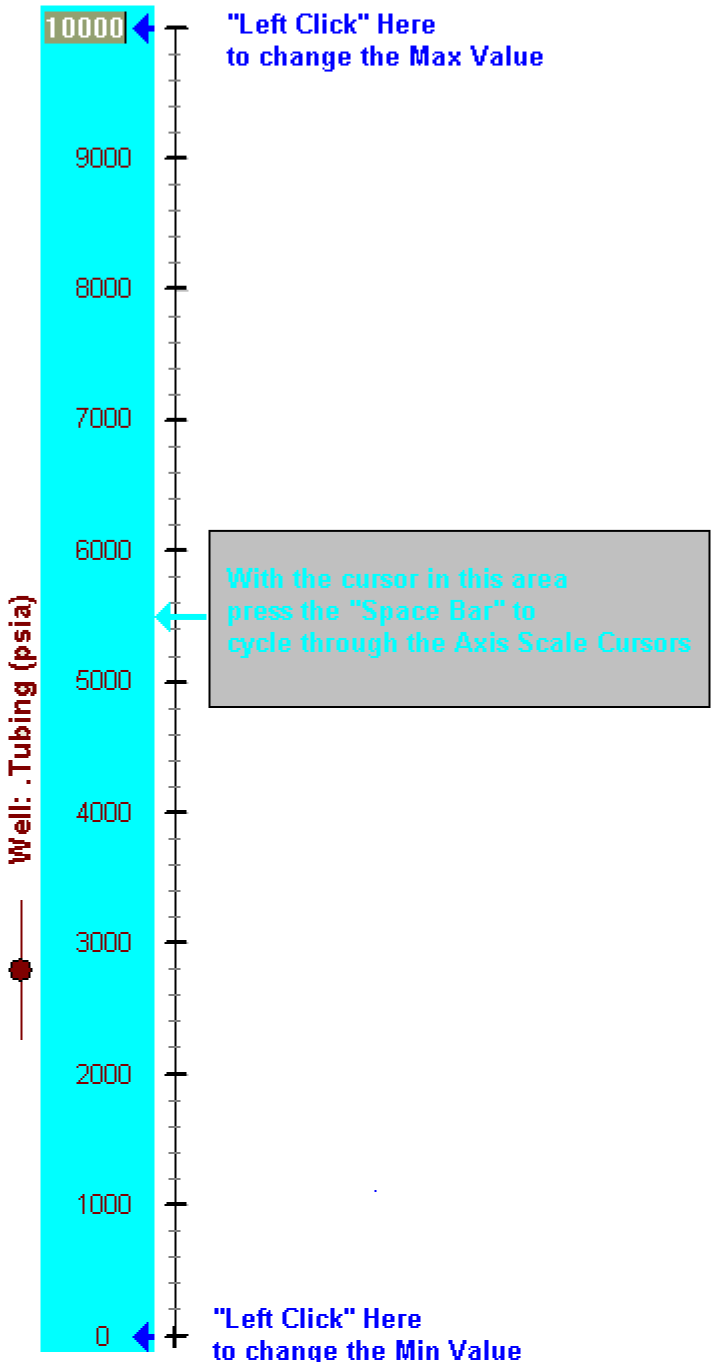
- Grid Lines
- Axis Trackers (sliding axis windows that track the cursor)
- Plot Colors
- Plot Fonts
- Axis Auto-Scaling mode
- Axis Minimum and Maximum values
- Axis positioning
- Series Line type, color and symbols

This dialog is accessed via the Plot Properties menu and toolbar button.

Plot Properties

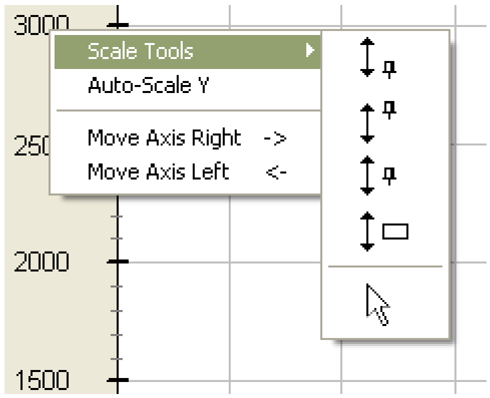
Visual Editing of the Plot Axis

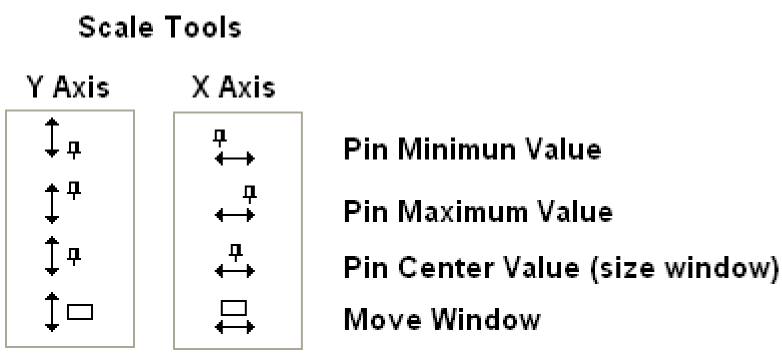
Plot scales can be set in the General properties dialog as well as visually on the plot itself.



- Method 1 Clicking on the upper or lower scale values of either the X or Y axis allows for a direct input of the scale value.
- Method 2

a) When the cursor is in the axis scale area, pressing the space-bar cycles through the access the following axis scale cursors:
b) Axis scale cursors can be accessed in the axis context menu via a “right-click” on the axis.





- Pin Minimum Value holds the minimum value constant while increasing or decreasing the maximum value depending on the cursor movement.
- Pin Maximum holds the maximum value constant while increasing or decreasing the minimum value depending on the cursor movement.
- Pin Center holds the center value constant while increasing/decreasing the minimum and maximum values depending on the cursor movement. This function may also be viewed as a window sizing function.
- Move Window pans the data while keeping the data range (max – min) constant.

To use the scale cursor:

Select the desired Cursor. “Click and drag” within the axis scale to change the scale as per the cursor function.

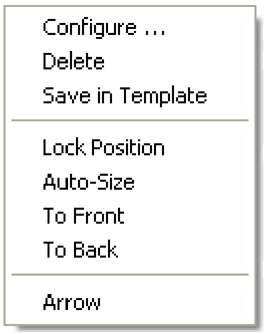
Holding the shift button down will accelerate the action.

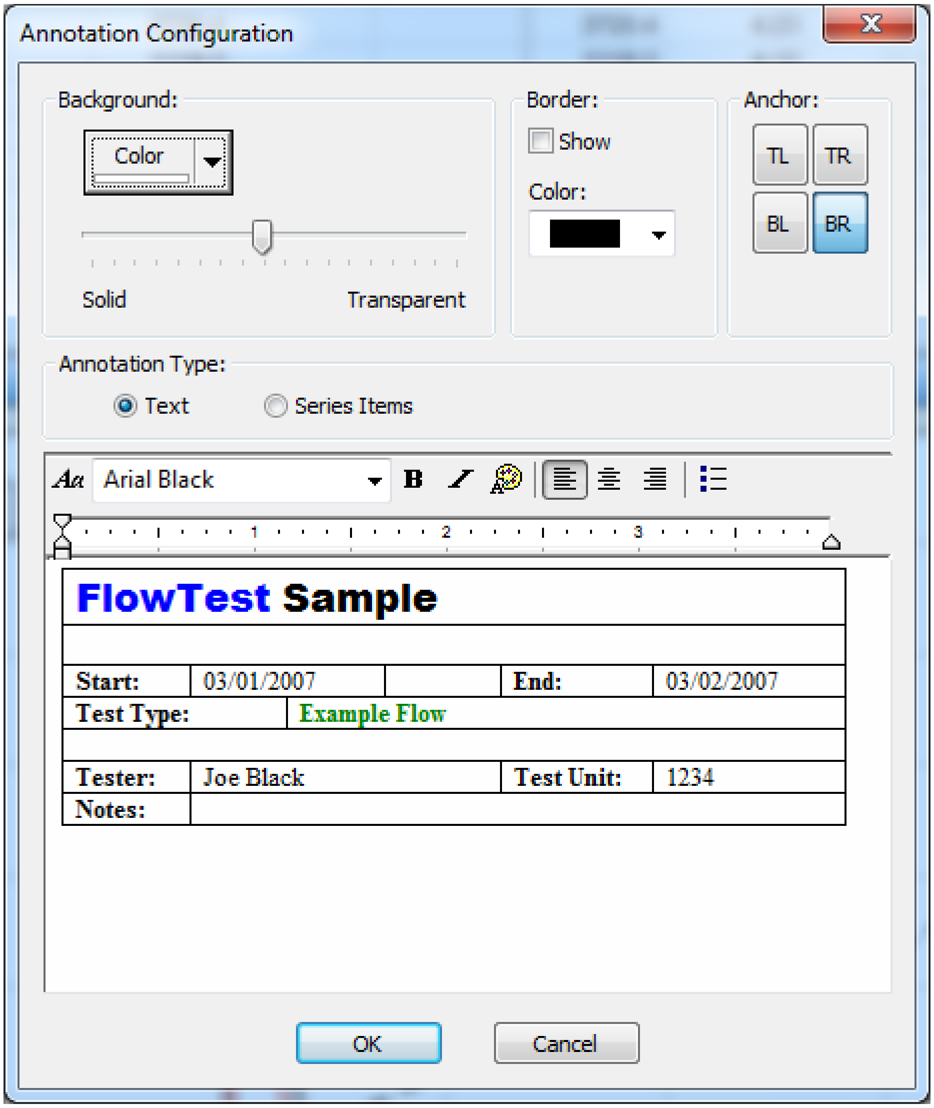
Press the “Esc” key to exit the Axis scaling action.

Plot Annotations

Annotations can be added to the plot by clicking on the "Add Annotation" button on the plot toolbar.

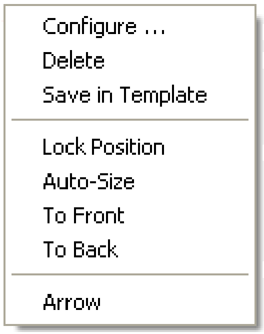

To configure an annotation, "Right Click" to display the annotation context menu and select "Configure: This displays the Annotation Configuration dialog.





The Annotation Configuration Dialog contains the following properties:

- Color (Sets the background color for the annotation)
- Opacity slider (makes the annotation transparent)
- Anchor (defines a fixed location (anchor) which remains constant to the plot when the plot is resized)
- Border (draws a thin border around the annotation using the specified color)
- Annotation Type specified as either 'Text' for General Annotations or 'Series Items' for dynamic annotations.
- Annotation Text Window (the text for the annotation standard or "Rich-Text" mode)
- Above the annotation text window is a toolbar for setting standard text formatting

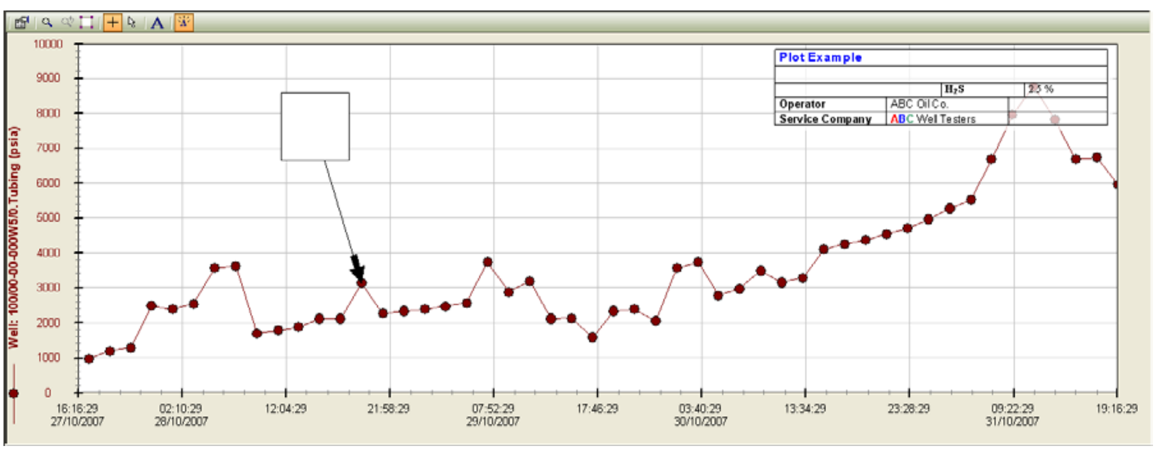


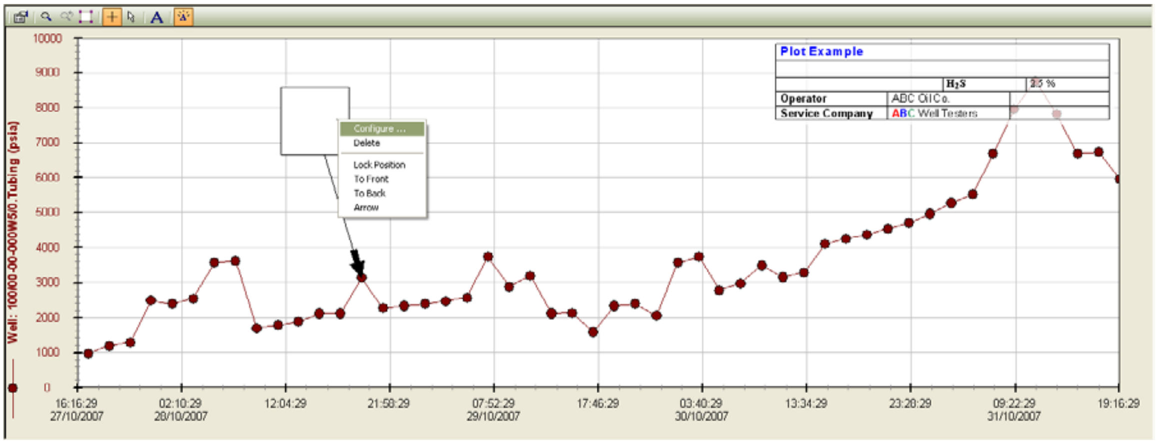
Some additional items on the annotation context menu include:

- Save in Template (Save the annotation when the file is saved as a template)
- Delete (removes the annotation from the plot).
- Lock Position (prevents the annotation from being moved on the plot).
- Auto-Size (automatically sizes the annotation the fit the contents)
- To Front, To Back (sets the position of Annotations relative to other annotations on the plot).
- Arrow (Attaches the annotation to a plot series). (described below)

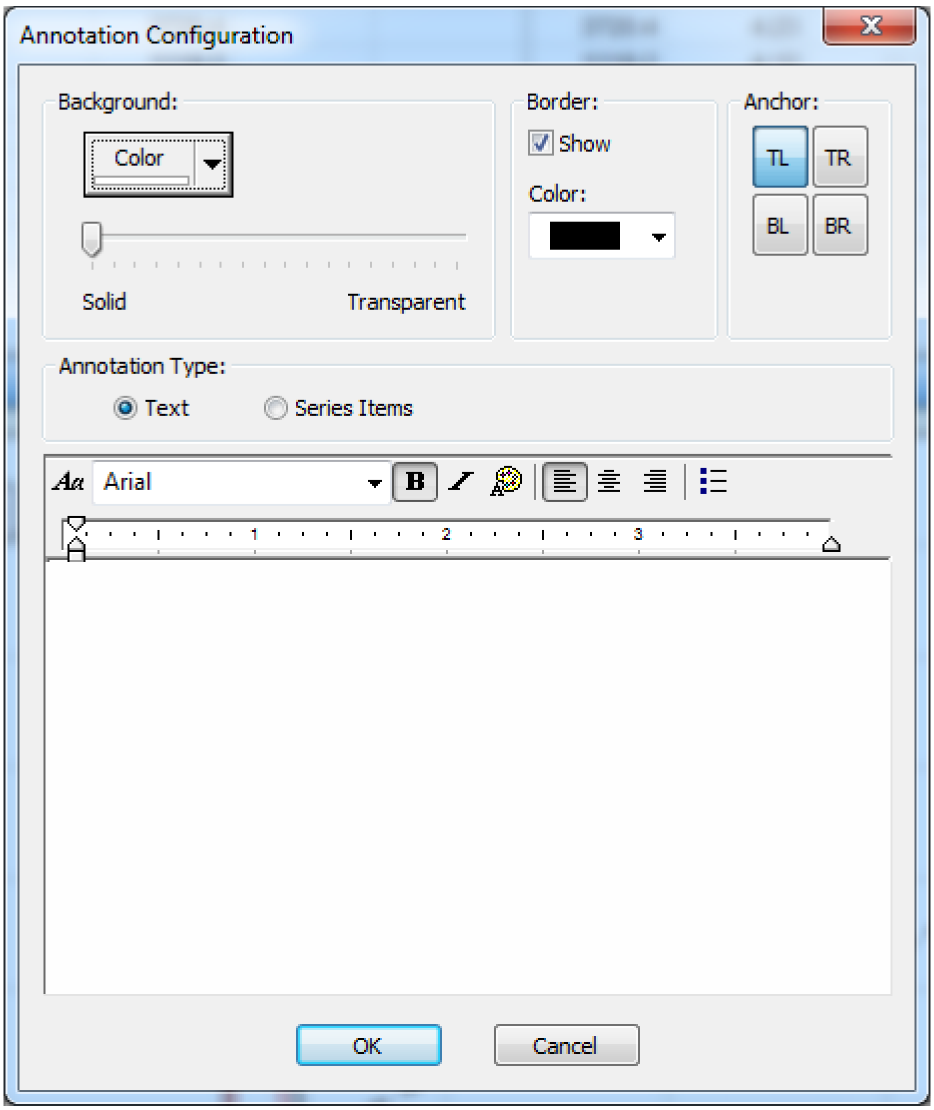
Annotation Arrows

Annotation Arrows can be added the plot annotation, effectively attaching the annotation to a point on any plot series. When the “Arrow” option is selected from the annotation context menu, the cursor will change to the Annotation arrow symbol. Use the arrow cursor the select a plot series point.



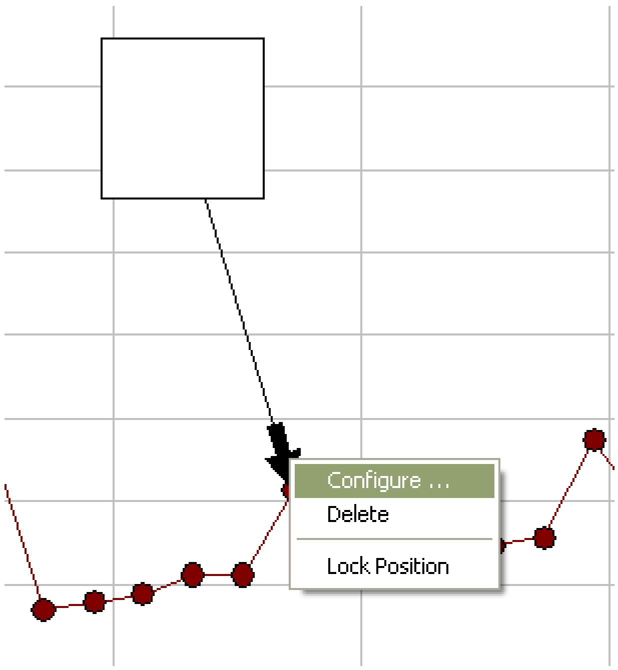


Display the configuration dialog for the new annotation.

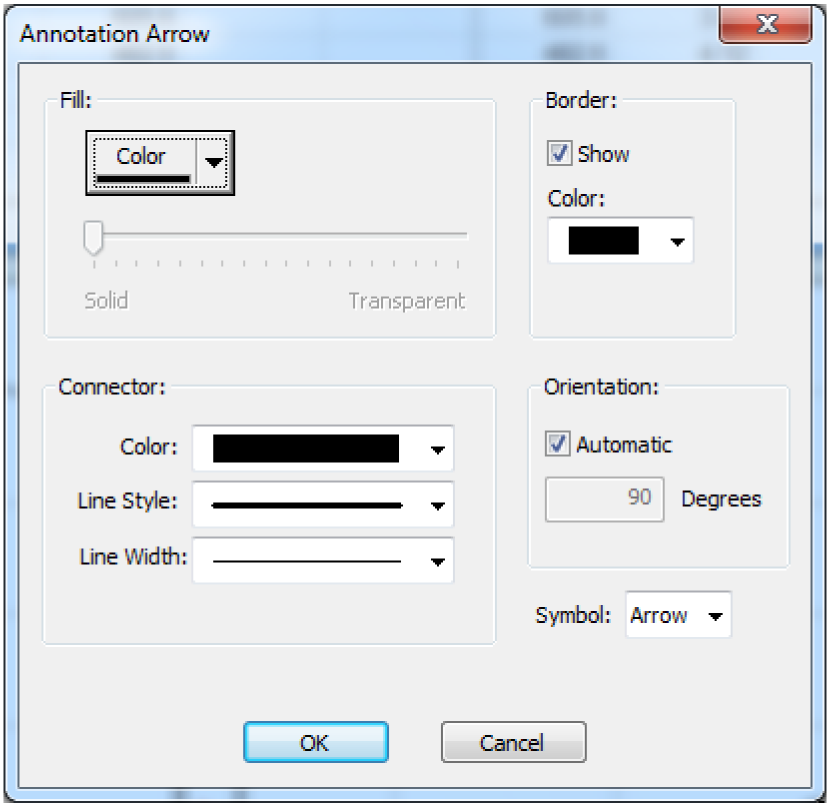


Annotations with attached arrows have an additional anchor option. The arrow anchor option will keep the annotation positioned relative the arrow. If the annotation arrow is repositioned or the plot is rescaled the annotation will reposition itself relative to the new arrow position. If any of the other anchors are selected the annotation will remain in a fixed location irrespective of the arrow location.

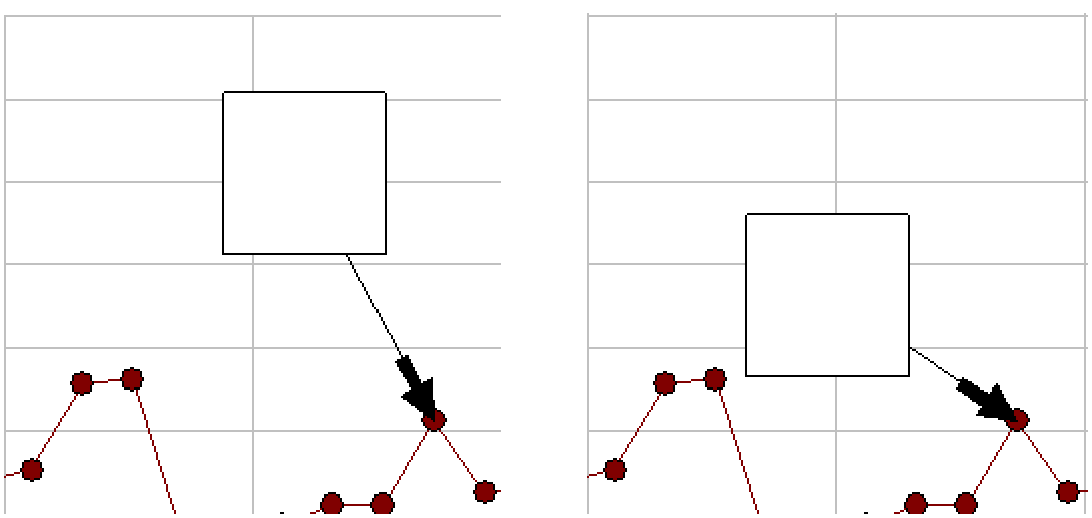
Once an arrow is positioned, the arrow can be moved either by dragging the arrow to a new location (or series) with the mouse or selecting the arrow and using the keyboard (arrow keys) to reposition the arrow.



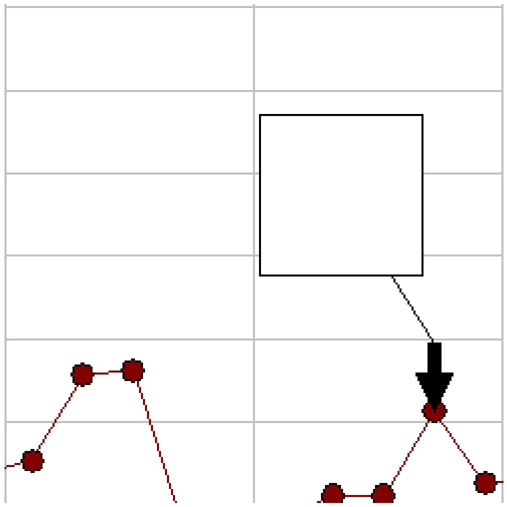
The annotation arrow has configuration options available via a context menu on the arrow itself.



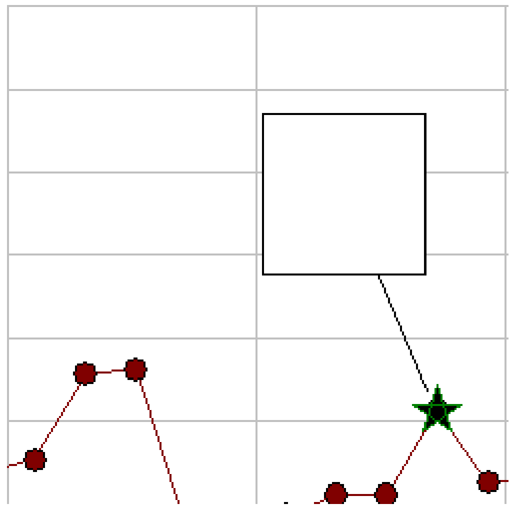
- Fill sets the arrow color
- Border specifies a border and border color for the arrow
- Connector specifies the attributes of the line connection the arrow to the annotation.
- Orientation allows for a fixed arrow position (where the “Automatic” option maintains the arrow parallel to the connector line).
- Symbol The arrow image can be replaced by a symbol



Automatic arrow orientation maintains the arrow parallel to the connector line.



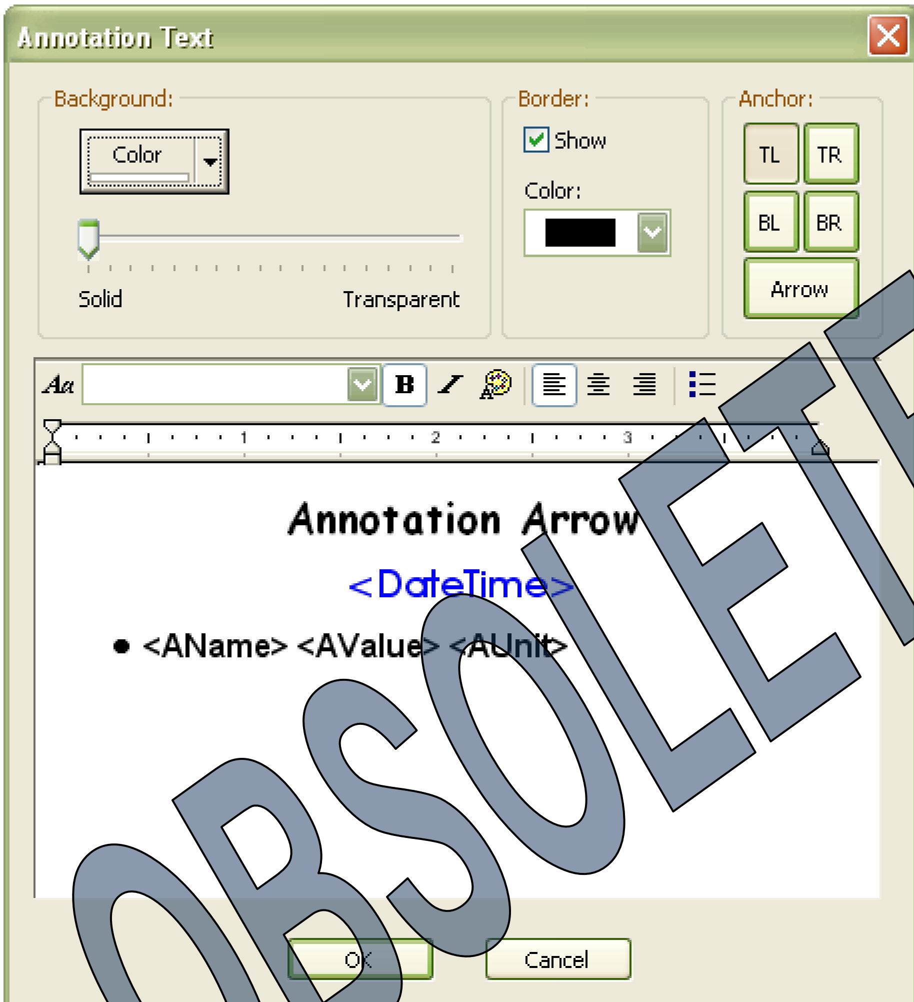
Arrow position fixed at 90 °



Arrow symbol set

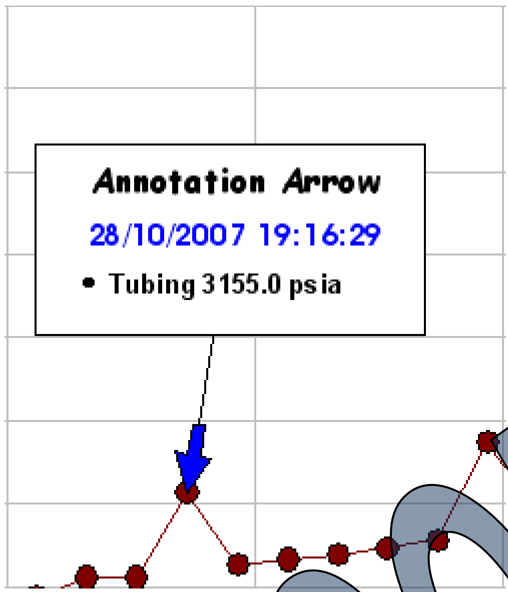
Adding Content to Annotations with attached Arrows

Arrow specific content can be added to the annotation through the use of pseudo variables. In the Annotation configuration dialog annotation pseudo variables can be used to display information about the arrow location



Arrow Pseudo variables:

- **<DateTime>** Date and Time of the arrow location.
- **<Date>**Date of the arrow location.
- **<Time>** Time of the arrow location.
- **<AName>** Series name the arrow is attached to.
- **<AValue>** Series data value at the arrow location.
- **<AUnit>** Series units (current plot units)

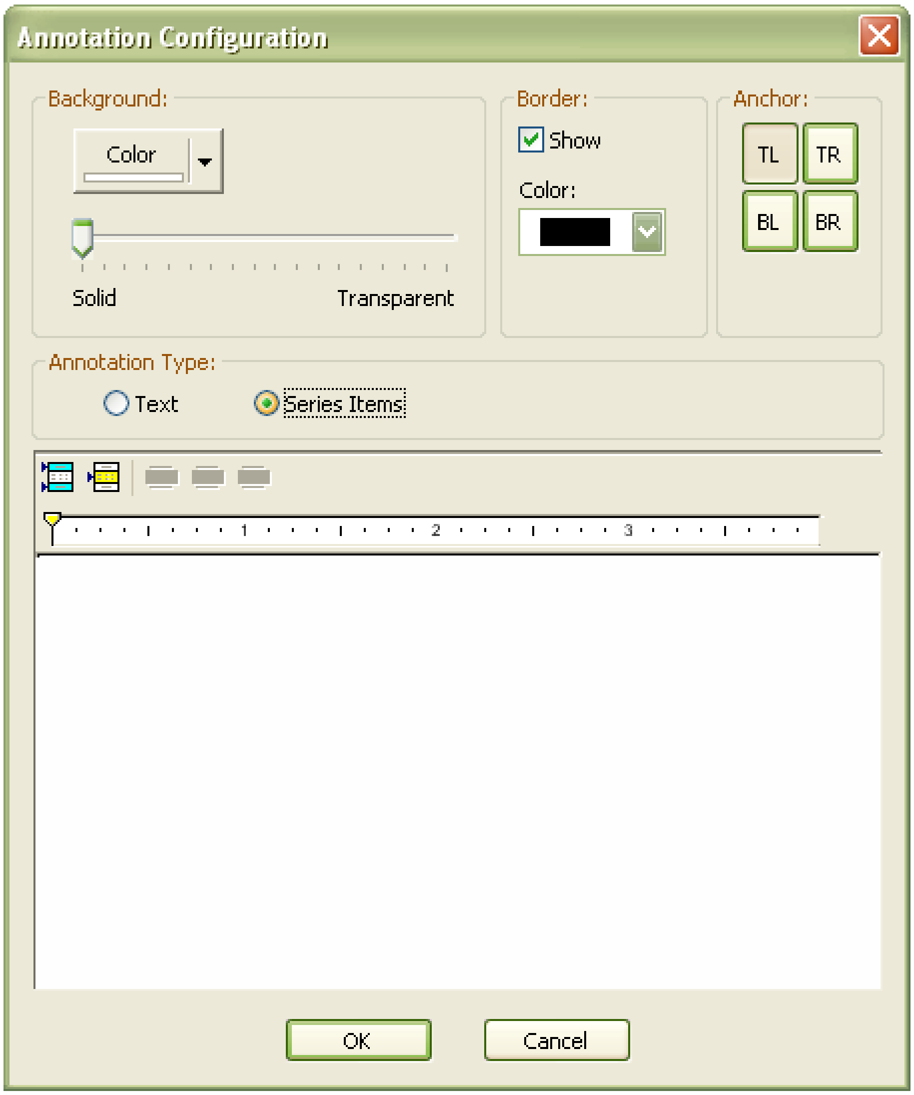


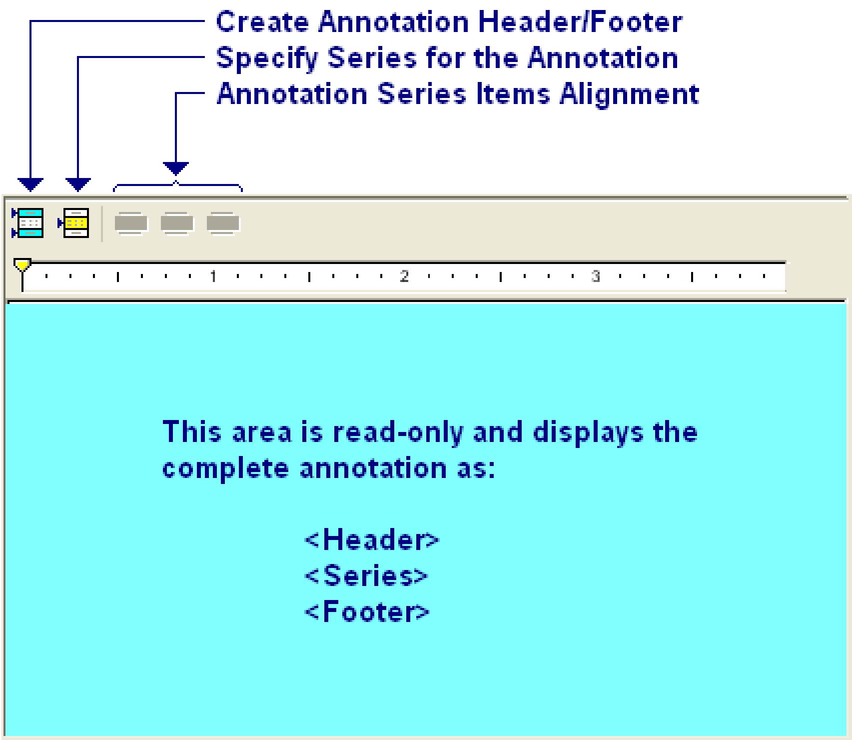
The resulting annotation and arrow in the plot.

Pseudo variables are replaced with the actual series data and are updated if the arrow is reposition

Series Annotations (with Annotation Arrows)

Series Annotations work in conjunction with annotation arrows to display dynamic content for any data series. On the main annotation interface, select the 'Series Items' option to display data values for series at the arrow location.

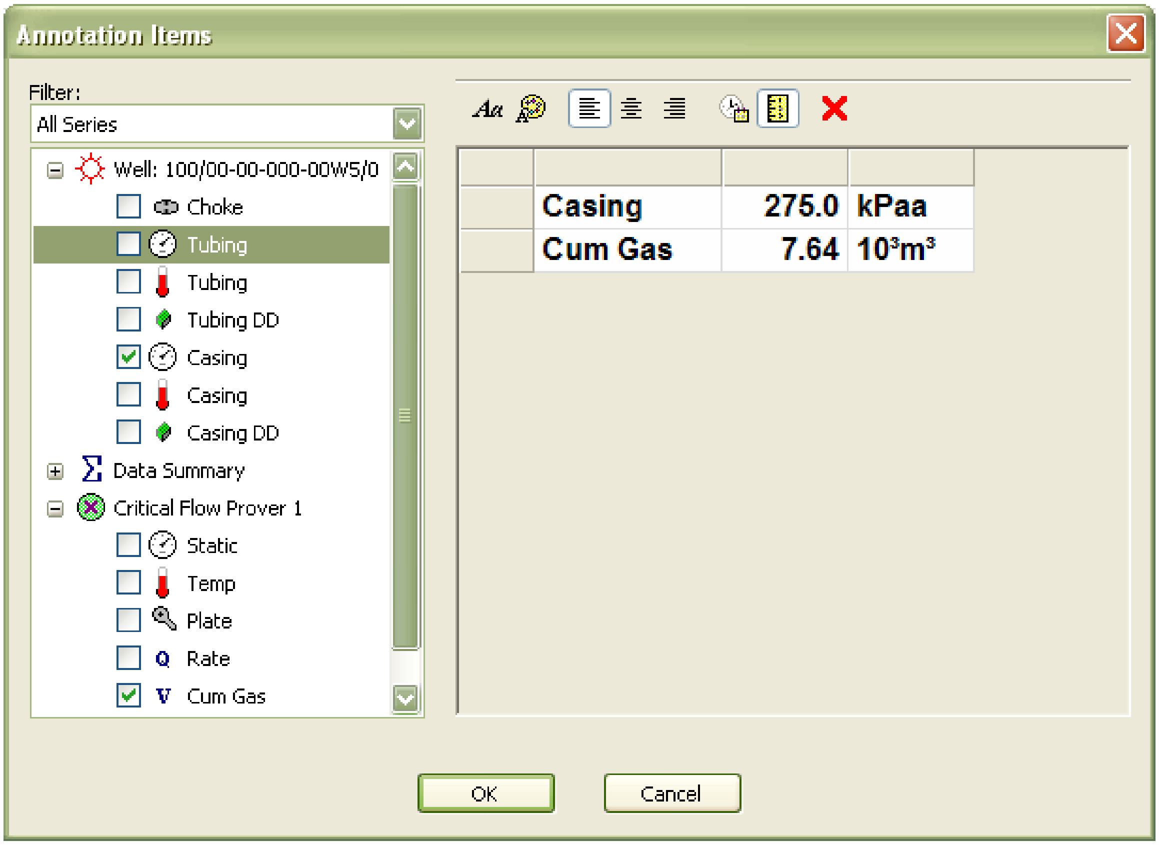




The annotation contains 3 main sections:

- Header (text displayed at the top of the annotation)
- Series Items (values of selected series at the arroe location)
- Footer (text displayed at the bottom of the annotation)

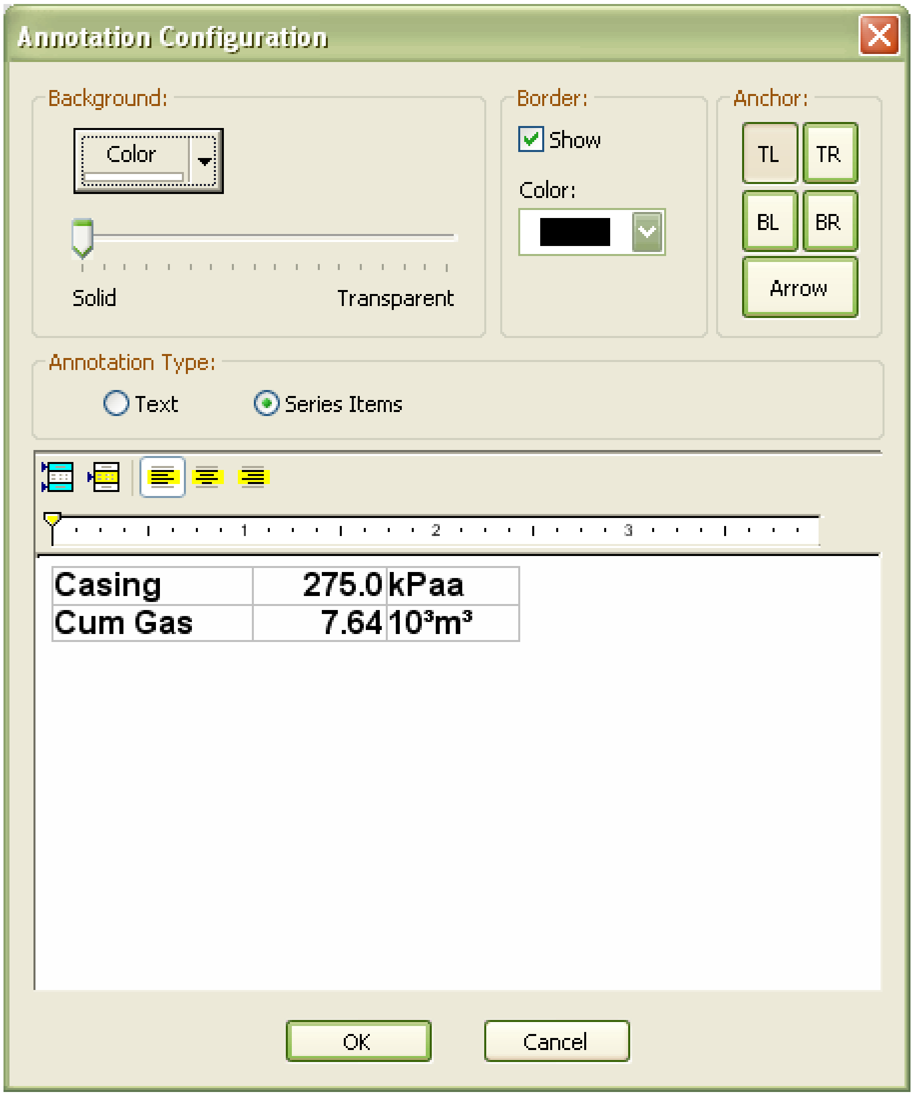
Press the ‘Edit Data Items button to add or remove series from the annotation.



Select the desired series in the left tree view.
(note: no data values will appear in the table to the right if the annotation does not currently have an attached arrow. The arrow can be attached before or after the annotation is defined and the annotation will update accordingly see add annotation arrow above)

Use the toolbar items above the annotation table to specify font, color and other formatting options. To format individual items, (in the table) select only those items, then apply the formatting for those items.

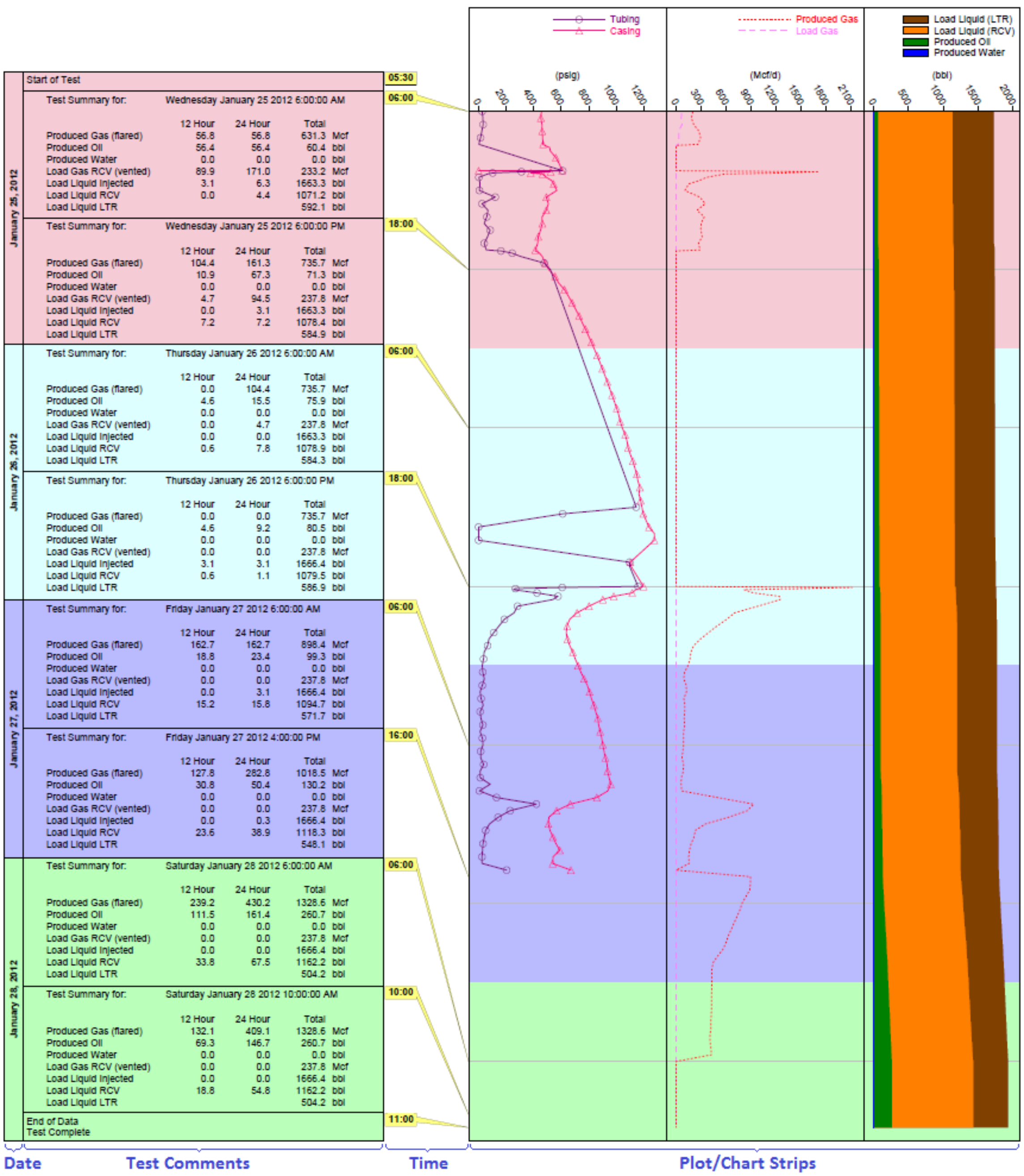
Select OK to view the annotation.



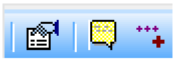
Use the 'Edit Header/Footer' button to add additional annotation text.

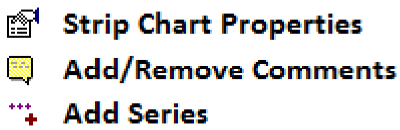
Data Strip Chart

The strip chart provides a unique view of the test data by combining the visual effectiveness of a data plot along with the descriptive qualities of the test comment annotations.



Strip Chart Toolbar and Menu items





- Strip Chart Properties, displays the general strip chart configuration window.
- Add/Remove Comments, selects the test comments to be displayed within the comment section of the strip chart.
- Add Series, selects data series to be displayed within the plot/chart strip section of the strip chart.

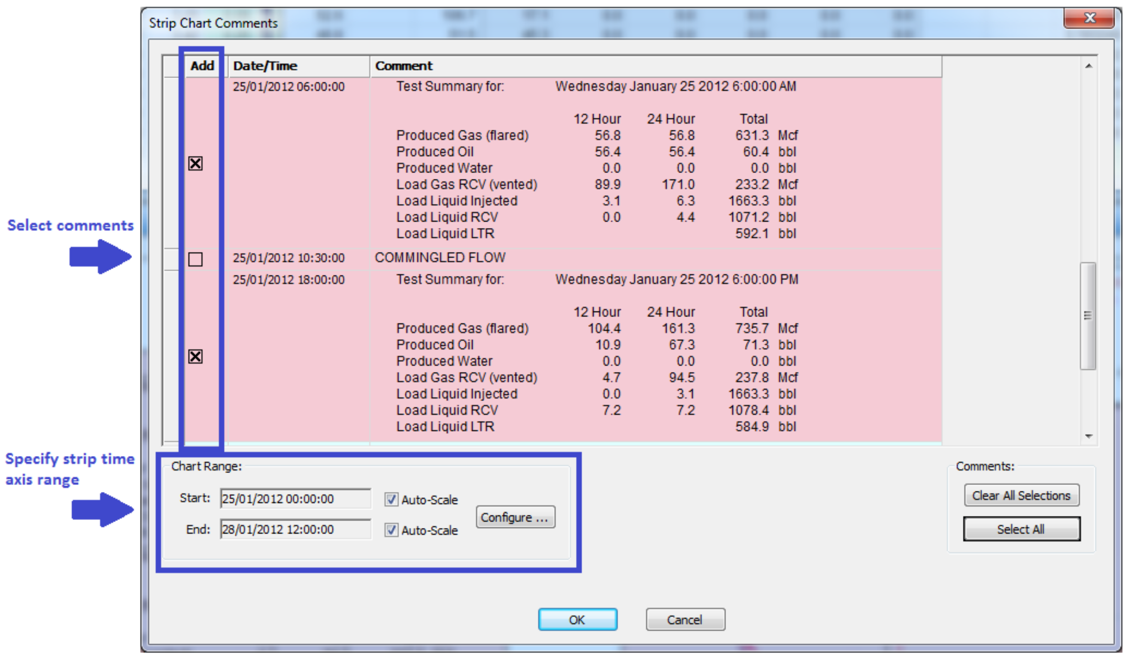
Configuring the Strip Chart

Configuring the strip chart is done in two basic steps:

1) Select the test comments to display.
2) Select the data series to display in the chart strips.

Selecting Comments:

Use the ‘Add/Remove Comments’ button to display the ‘Strip Chart Comment’ window.



Within the comment window specify the comments to display by selecting the appropriate boxes under the ‘Add’ column.

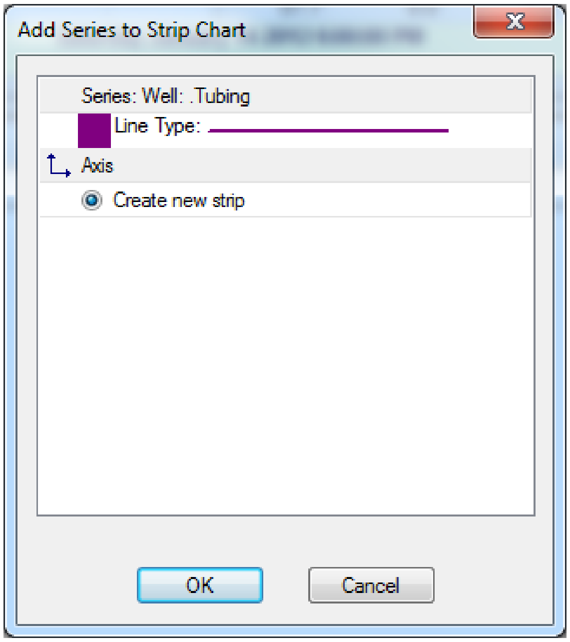
The Chart/Range section is used to specify the start and end time range for the chart. Use the ‘Auto-Scale’ options to automatically set the range to encompass selected comment range.

Adding Data Series:

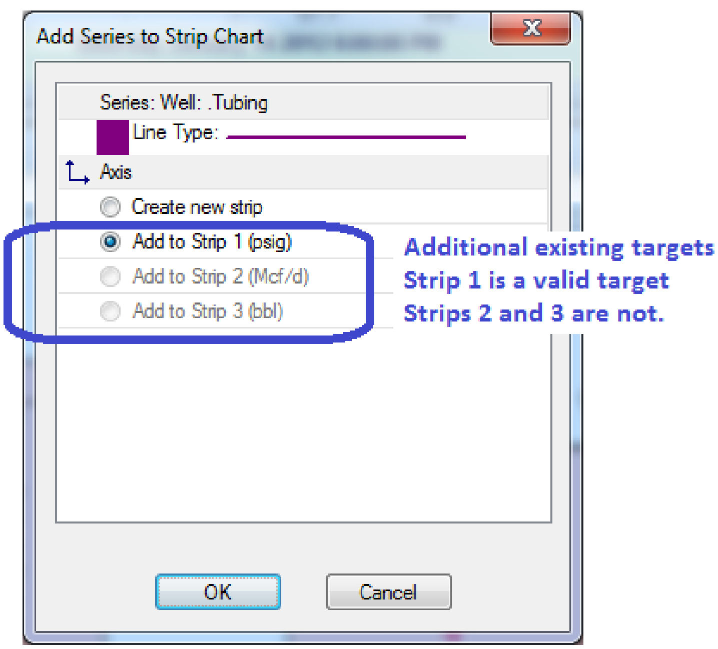
Data series can be added (and removed) from the strip chart in much the same way as in the data plots; three different methods include:

1) Right click data columns in the data table and select ‘Add to Strip Chart’.
2) Select the strip chart and enable the series from the ‘Navigation window’.
3) Use the ‘Add Series’ button to select the data series from all available series.

Once a series has been selected, to add to the strip chart, the “Add Series to Strip Chart” window is displayed to configure and position the series within the chart strips.



Line style properties can be specified by clicking on ‘Line Type’. Radio select options under the ‘Axis” section list all existing strips in the chart, any strips that are not valid targets for the new series will be grayed out (unavailable). In addition to all existing strips, a ‘Create new strip’ option is always available to create a new strip for the series.

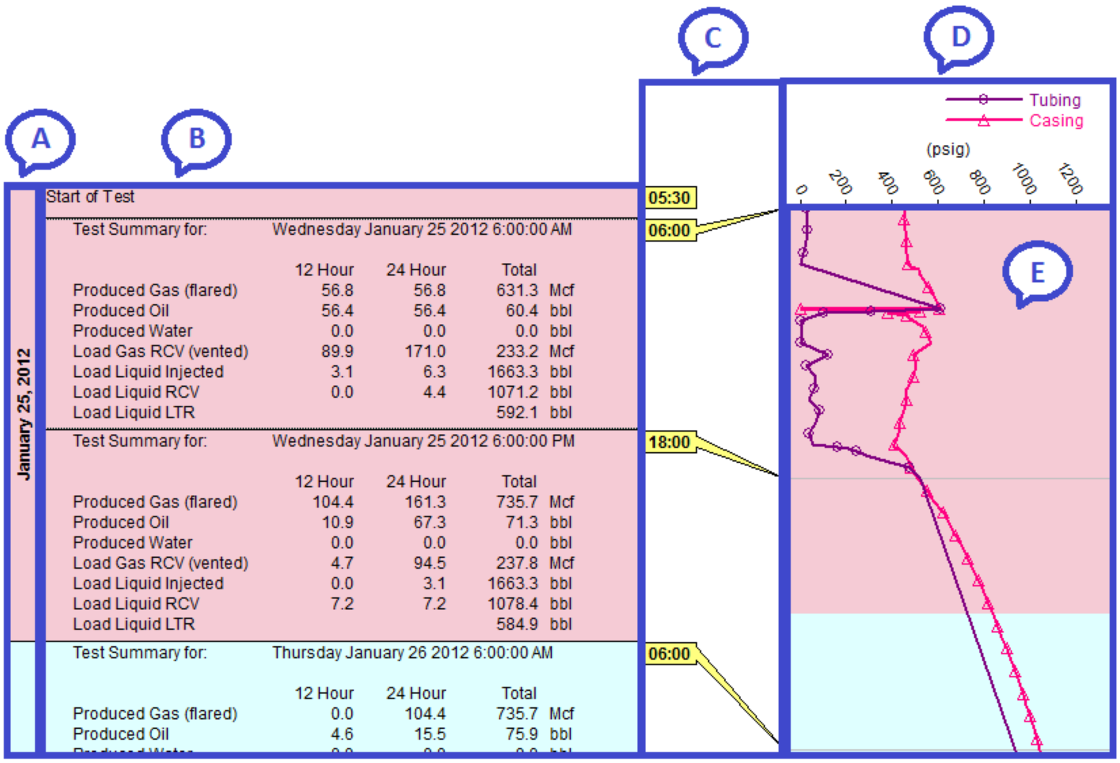


Add Series window displaying 3 existing strips.

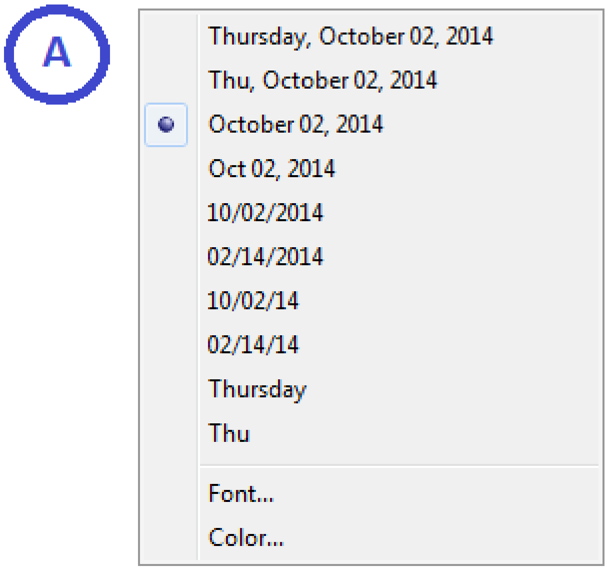
Strip Chart Properties

Context Properties

Many of the properties found in the strip chart properties window can be accessed directly from the strip chart via a “right-click” context menu popup on the appropriate chart section (as detailed below).

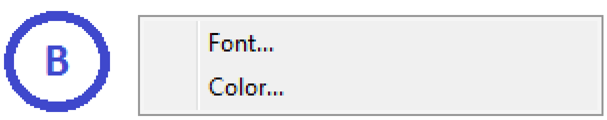


Strip chart context menu sections.



Date Menu:

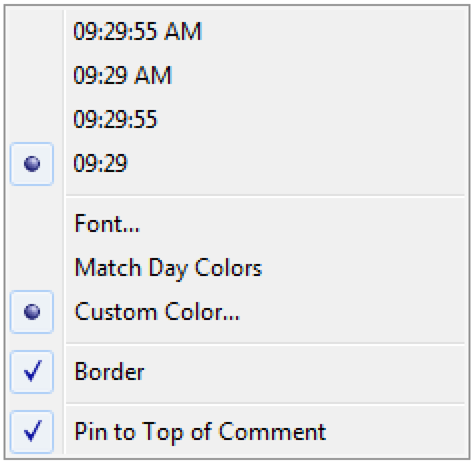
- The top section of the context menu provides a range offormatting options for the date display.
- Font… specifies date font properties (style, size, color)
- Color… specifies the background color for the day.



Comment Menu:

- Font… specifies the comment font properties (style, size, color)
- Color… specifies the background color for the day.

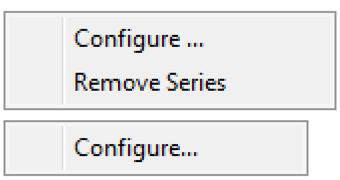
C



Time Menu:

- The top section of the context menu provides a range of formatting options for the time display.
- Font… specifies time font properties (style, size, color)
- Match Day Colors, When selected, the background color of the time tags will match the given day background color.
- Custom Color… specifies a background color for the time tags.
- Border, outlines the time tag with a black border.
- Pin to Top of Comment, when selected the time tag is positioned vertically at the top of the corresponding comment. When not selected, the time tag vertical position is determined automatically as to minimize the length of the tag stem.

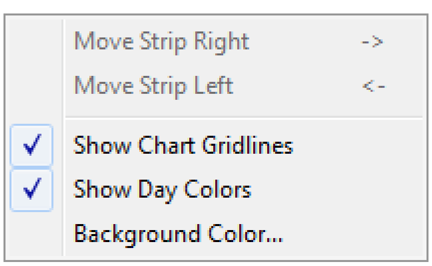
D



Strip Axis Menu:

- Two context menus are available within the strip axis, the first is available when positioning over a series label and provides options to configure or remove the series. The second strip axis context menu 'Configure…' provides a quick shortcut to the strip chart properties window.

E



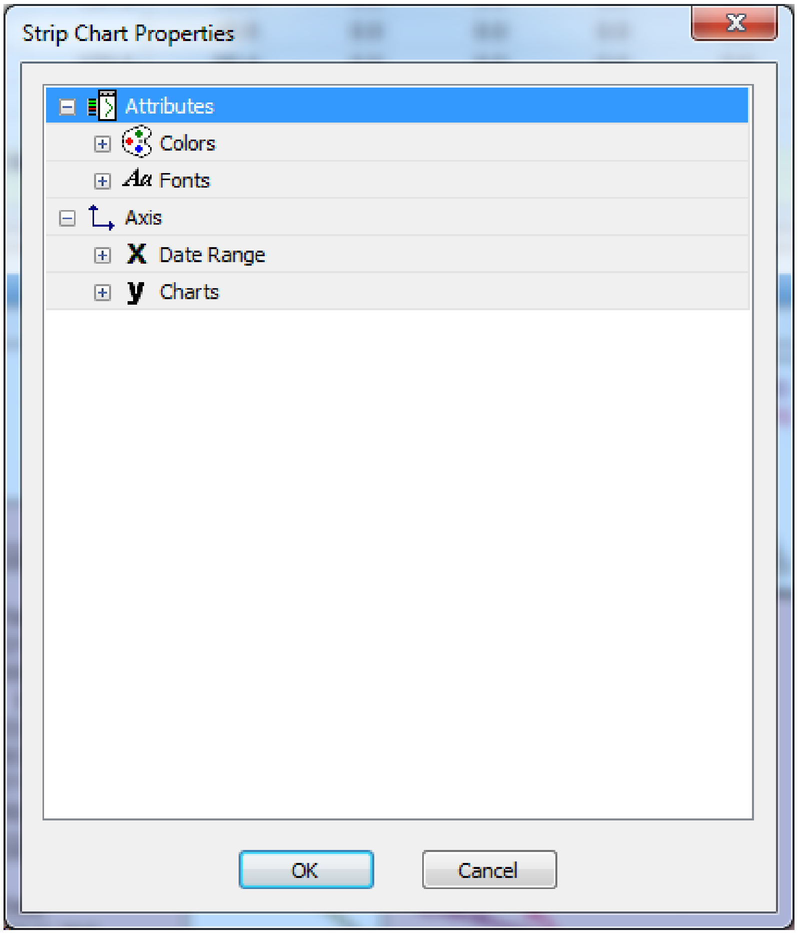
Strip Body Menu:

- Move Strip Right, Move Strip Left, provide a quick means of repositioning the strip ordering.

- Show Chart Gridlines, show or hides the gridlines.
- Show Day Colors, When selected, the strip background color will be filled with the corresponding day colors.
- Background Color, specifies a background color for the strip body.

Property Window

Use the 'Properties' button on the strip chart tool bar to display the strip chart properties window.



The strip chart properties window provides a convenient place to view and edit most of the strip chart properties. The main sections include:

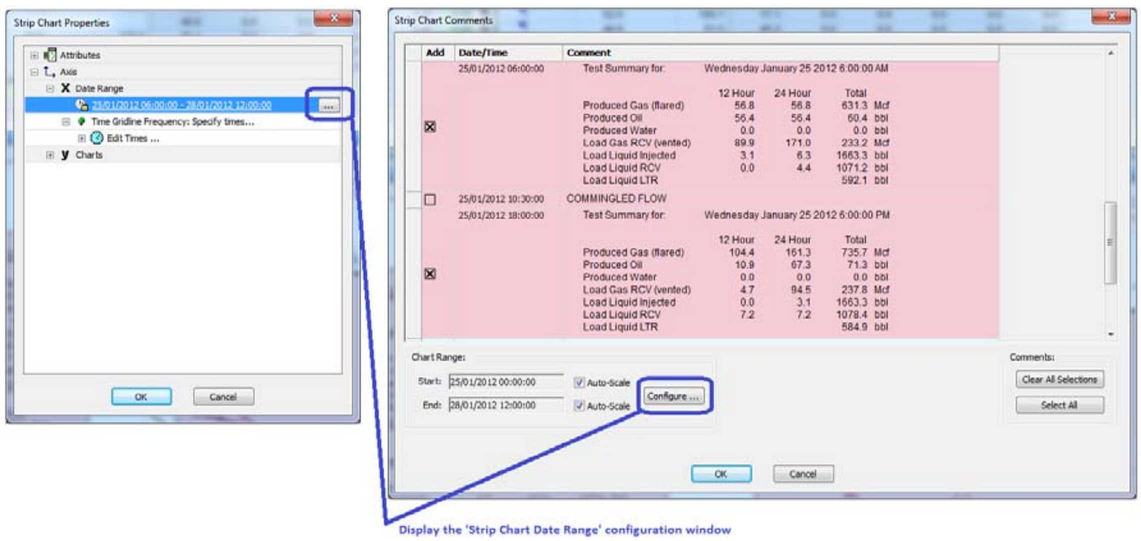
- Attributes, the attributes section contain appearance properties basically fonts and colors for the entire strip chart.
- Axes, the axis section contain 'x' and 'y' subsections and contain settings to specify strip axis ranges and the series they contain.

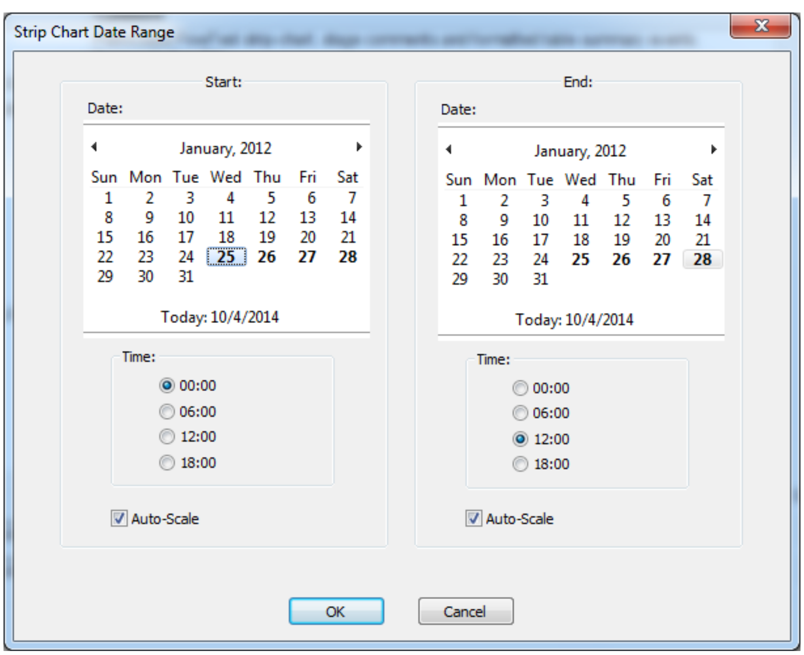
Most of the commonly used strip chart properties are available via context menus from the strip chart window; however the strip chart properties window provides a convenient place to view and edit all properties together.

Additional Strip Chart Properties

Specifying the chart date start and end range

The chart date range is specified via the ‘Strip Chart Date Range’ window, which can be accessed from either the ‘Properties’ window or the ‘Strip Chart Comment’ window.



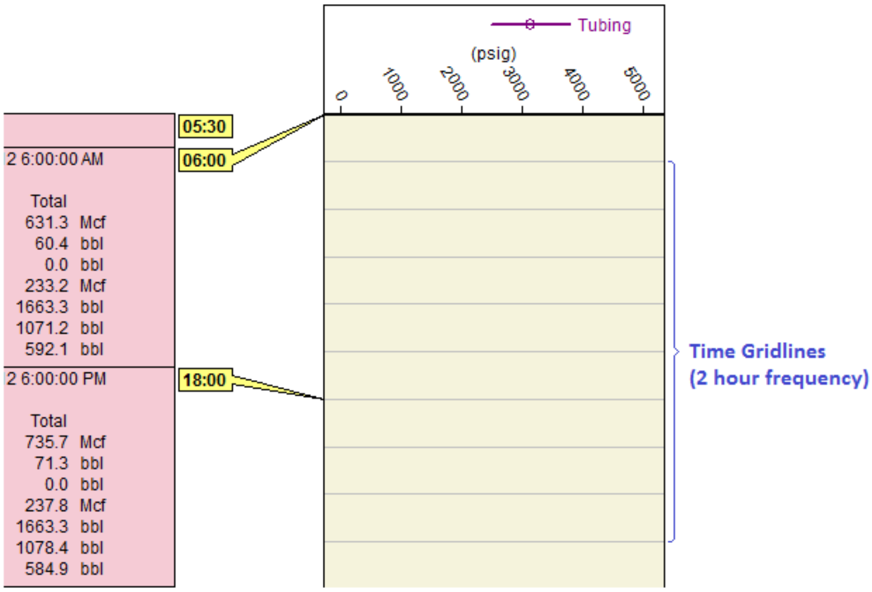


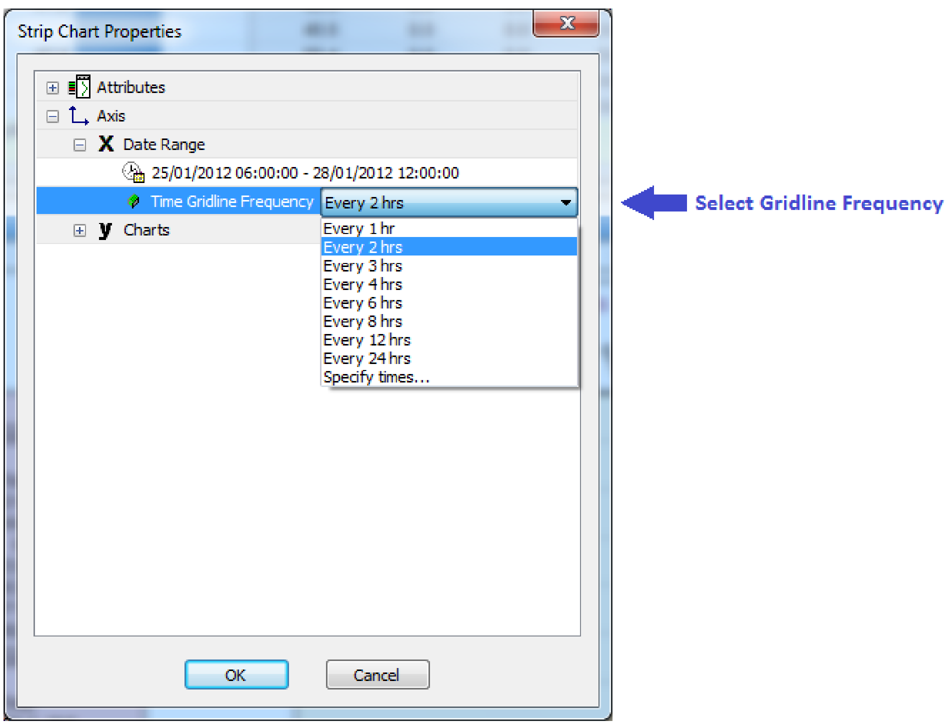
Setting the Strip Chart Date Range

The ‘Strip Chart Range’ window provides calendar and time options to manually specify a start and end date or an auto-scale option that will automatically select an appropriate scale.

Chart Time Gridlines

Horizontal time gridlines can be displayed on the chart at either fixed or variable intervals.



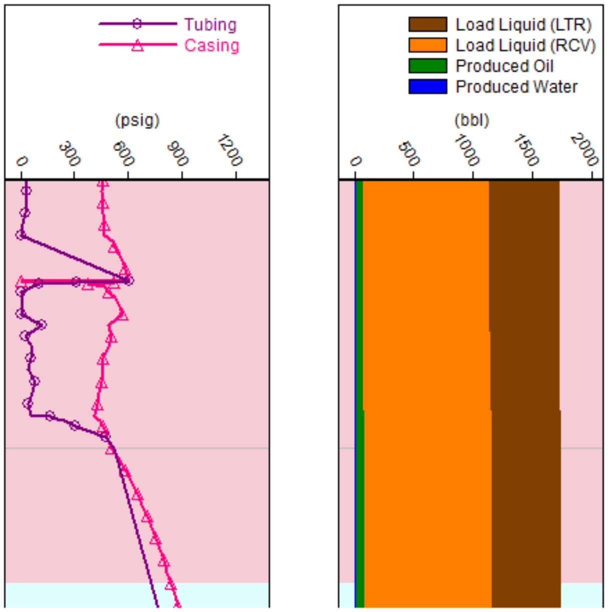


Property Window Gridline Configuration

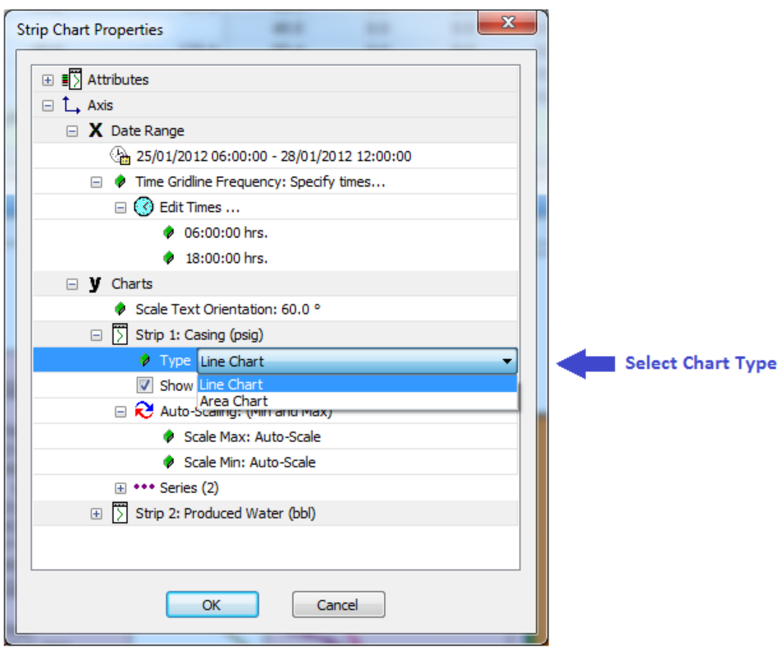
The 'Specify times…' option provides a means of specifying non-repeating or daily cut-off times.

Chart Type and Axis Configuration

A chart strip can be configured as either a line or stacked area chart with the differences illustrated in the diagram below:

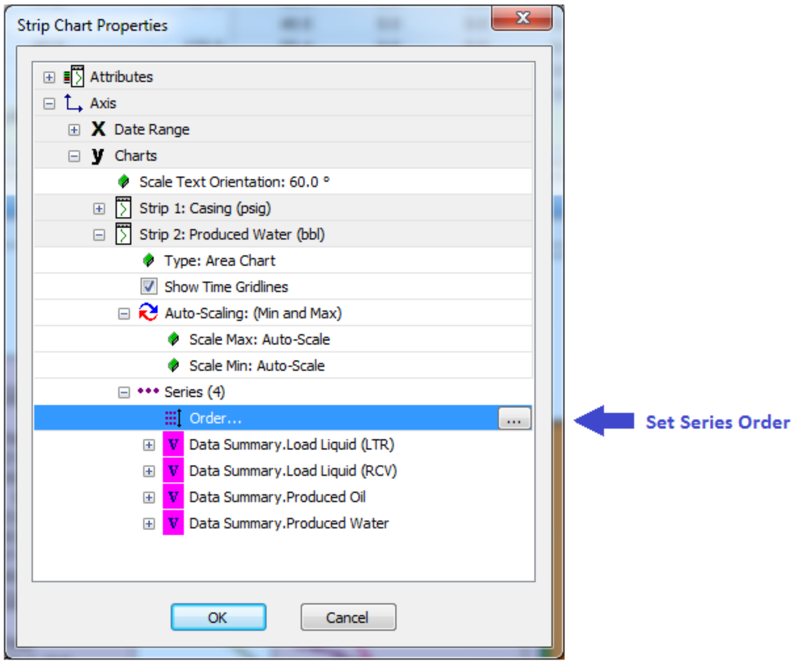


Line Chart Area Chart



Selecting the Chart Type

The Chart type is specified from the 'Properties' window and is configured on a per-strip basis.



Changing the Series Order

The order of the series displayed in the chart can be specified in the series 'Order' option of the 'Properties' window. The series order may be important when using the stacked area chart type.

Chart Scale Configuration

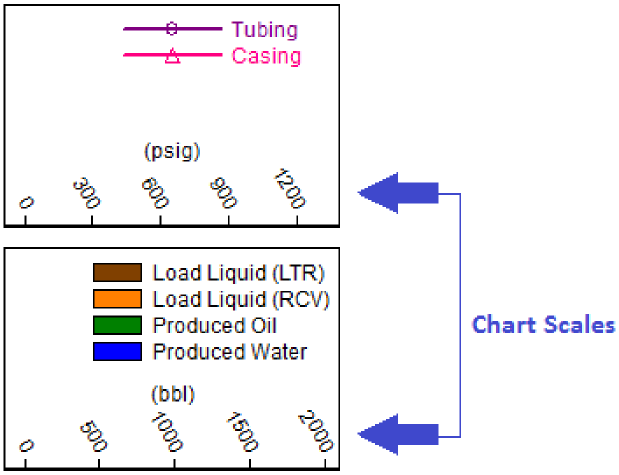
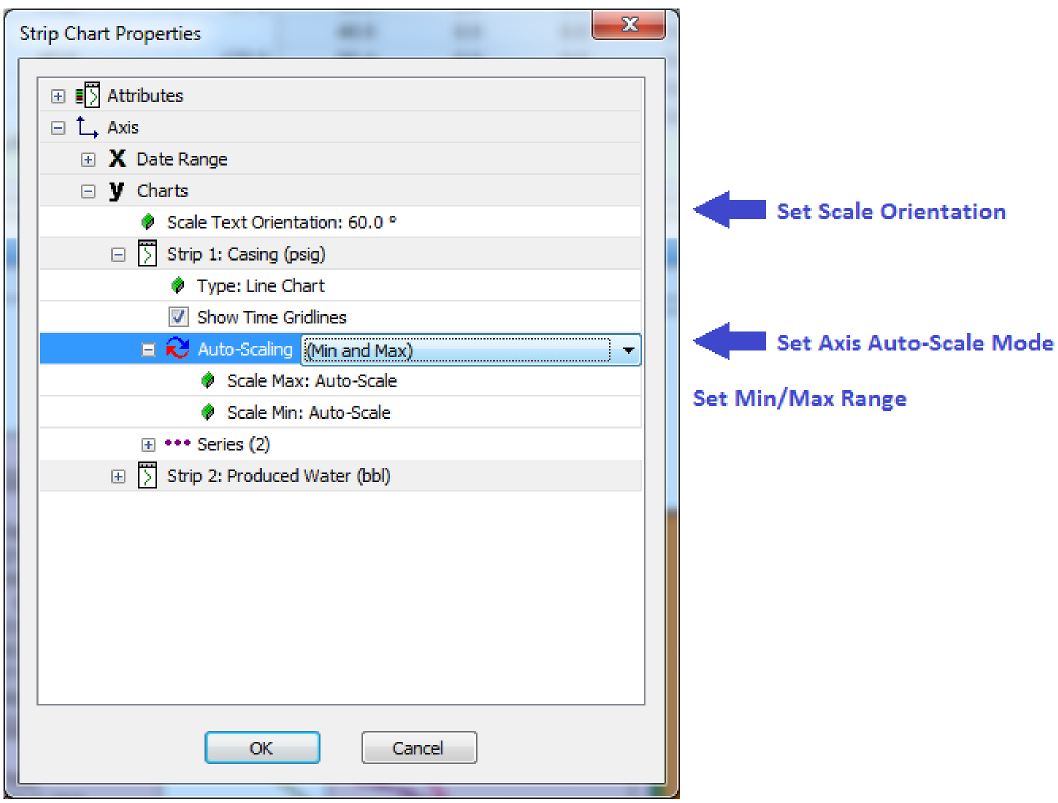


Chart Scales Line and Area Charts

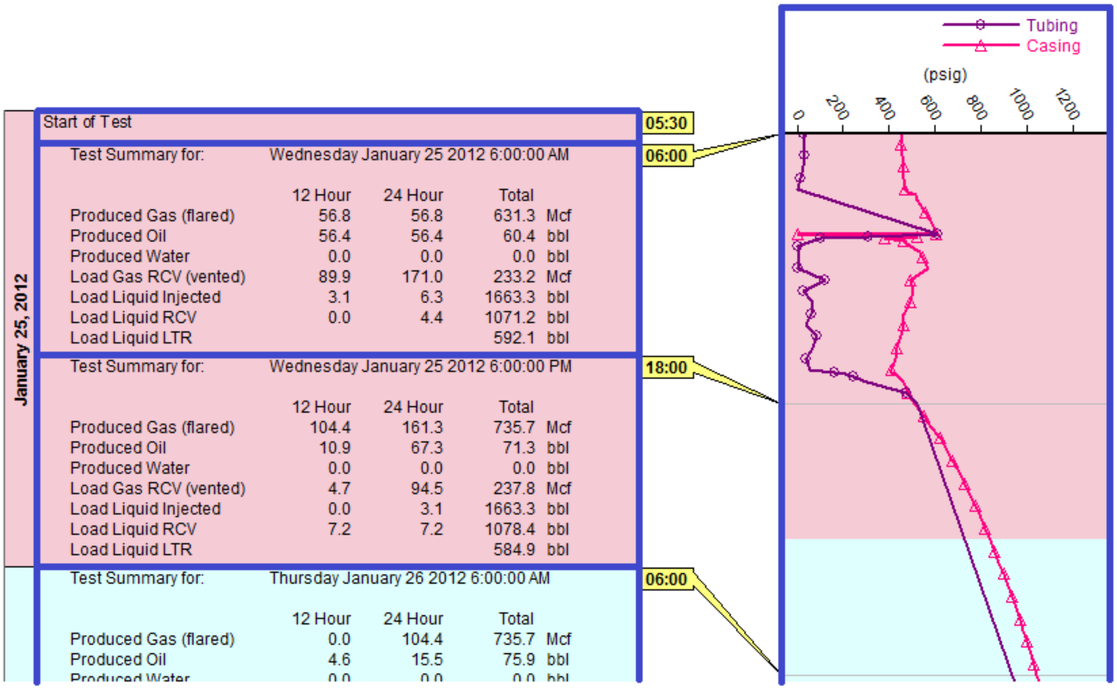
The following options are available for configuring the strip scales:



- Scale Orientation, specifies the orientation (rotation) of the scale values. The default is 60°.
- Auto-Scaling, specifies the minimum and maximum values for the scale.

Sizing the Strip Chart

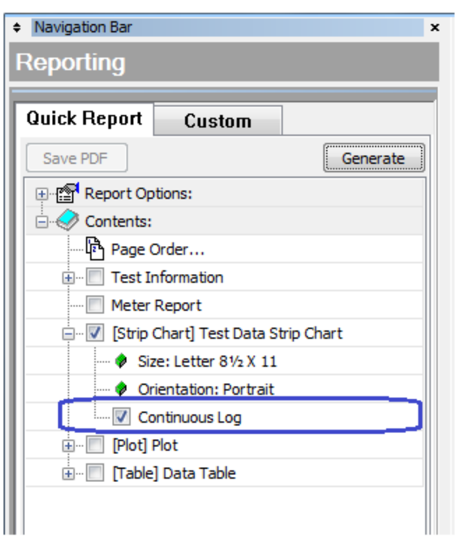
The strip chart components can be moved/sized along the blue lines indicated below.



Strip Chart Move/Sizing Lines

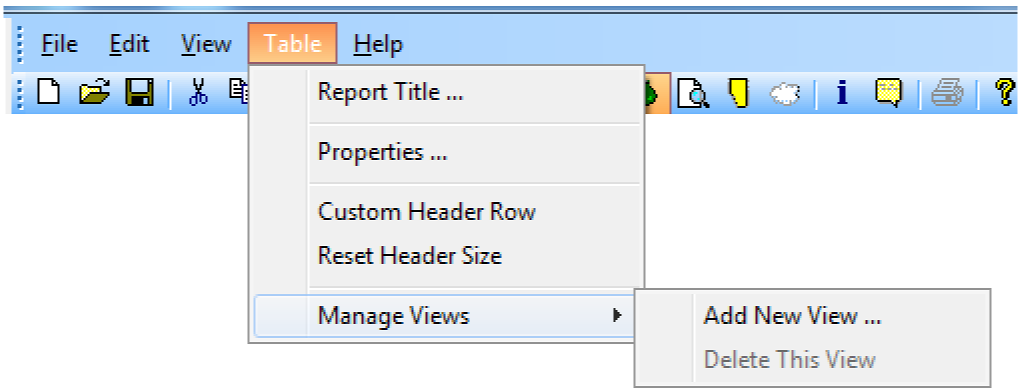
Strip Chart Reporting Options

In addition to the standard report generation options, the strip chart provides the option to scale the chart to fit a single page or automatically size the page height to provide a continuous form (or log) report.



Creating Additional Plots, Tables and Strip Charts

Additional views (plot, table, strip chart) can be created by accessing the ‘Manage Views’ section in the main menu.



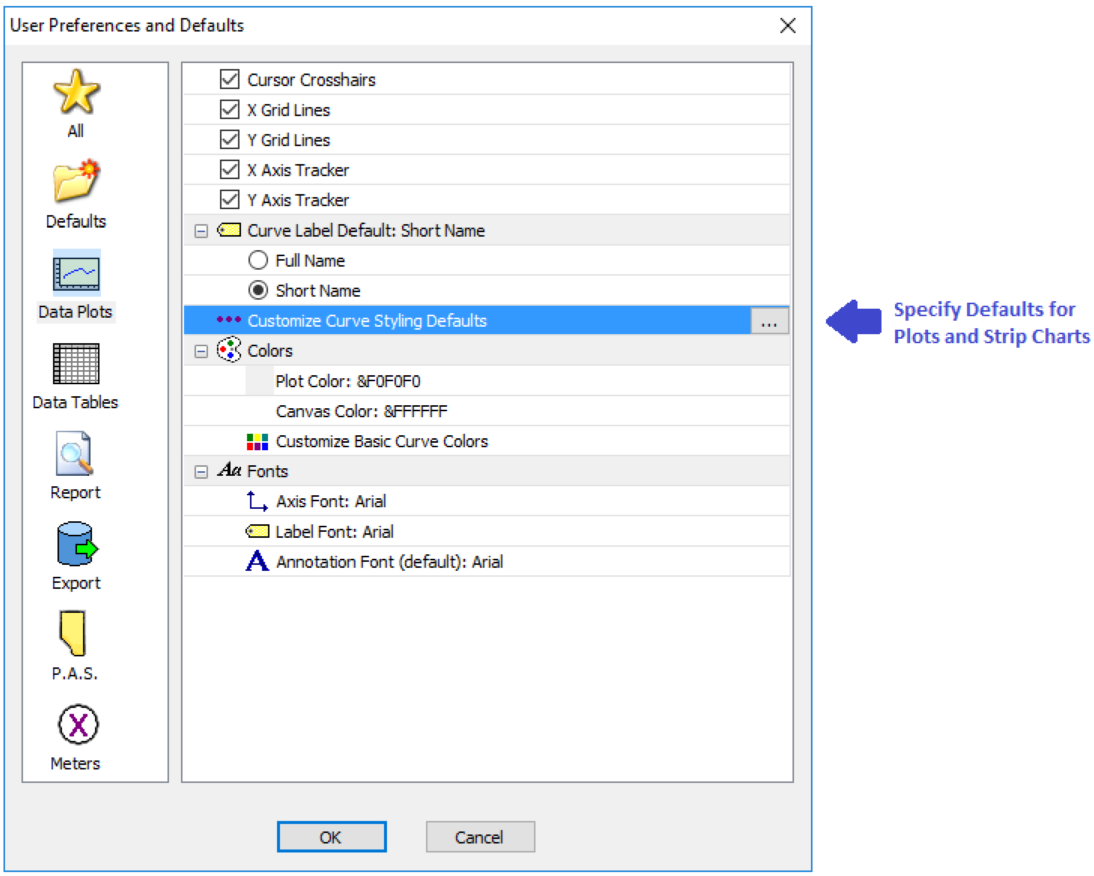
Manage Views

In the diagram above ‘Manage Views’ is found under the ‘Table’ heading (of the main menu) however the heading name is dependent upon the active view and could also be named ‘Plot’ or ‘Strip Chart’. Additional views are added to the active view as additional tab panes.

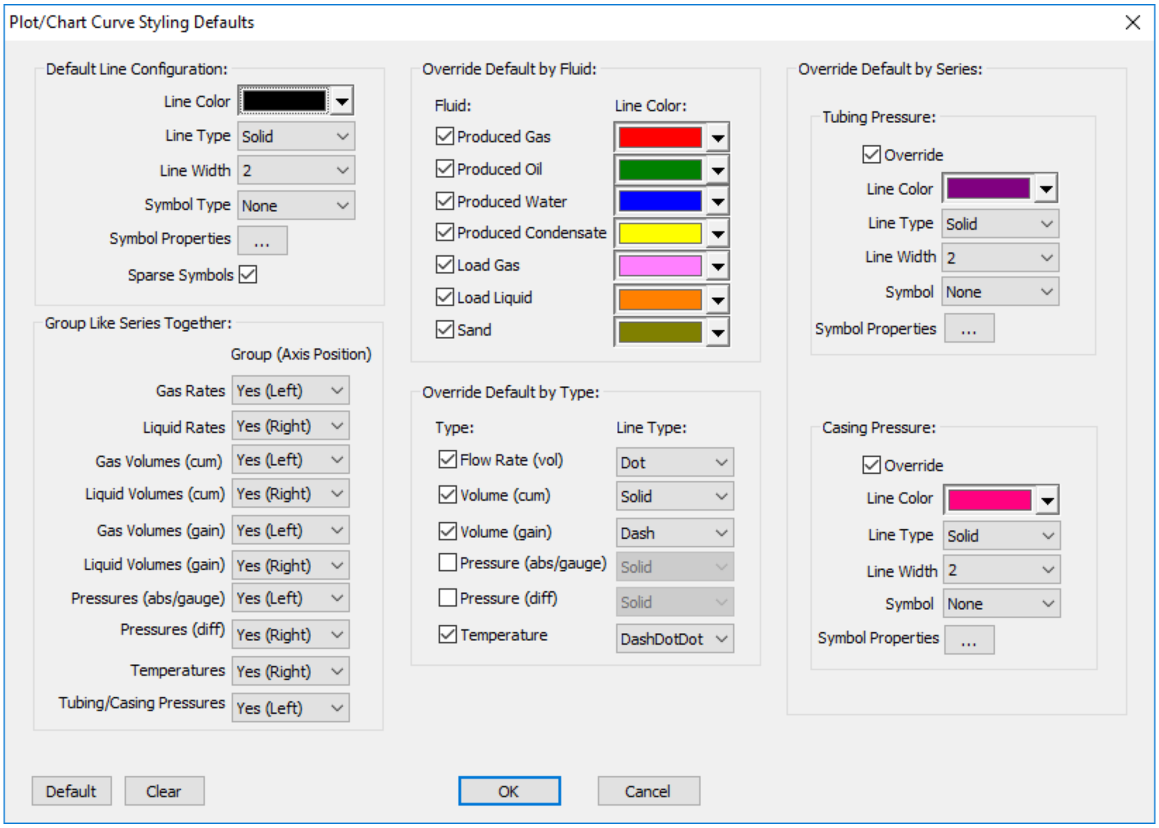
Curve Styling Defaults for Plots and Strip Charts

In the 'User Preferences" window default attributes can be specified for the plot and strip chart series. The defaults include:

- Default: line color, line width, line style and symbols for different series types.
- Axis position and grouping. i.e. group tubing & casing pressures together & place them on the left plot Y axis.
- Series types can be categorized by:
    - Unit Type (pressure, temperature, gas rate …)
    - Fluid Type: (gas, oil, water, load …)



Use Preferences Window to access the Styling defaults.



The Curve Styling Default Window

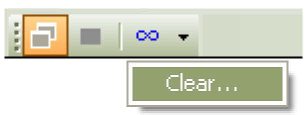
The defaults are arranged as a set of hierarchical rules that are applied whenever a new series (curve) is added to either a plot or strip chart.

User Interface Design Mode

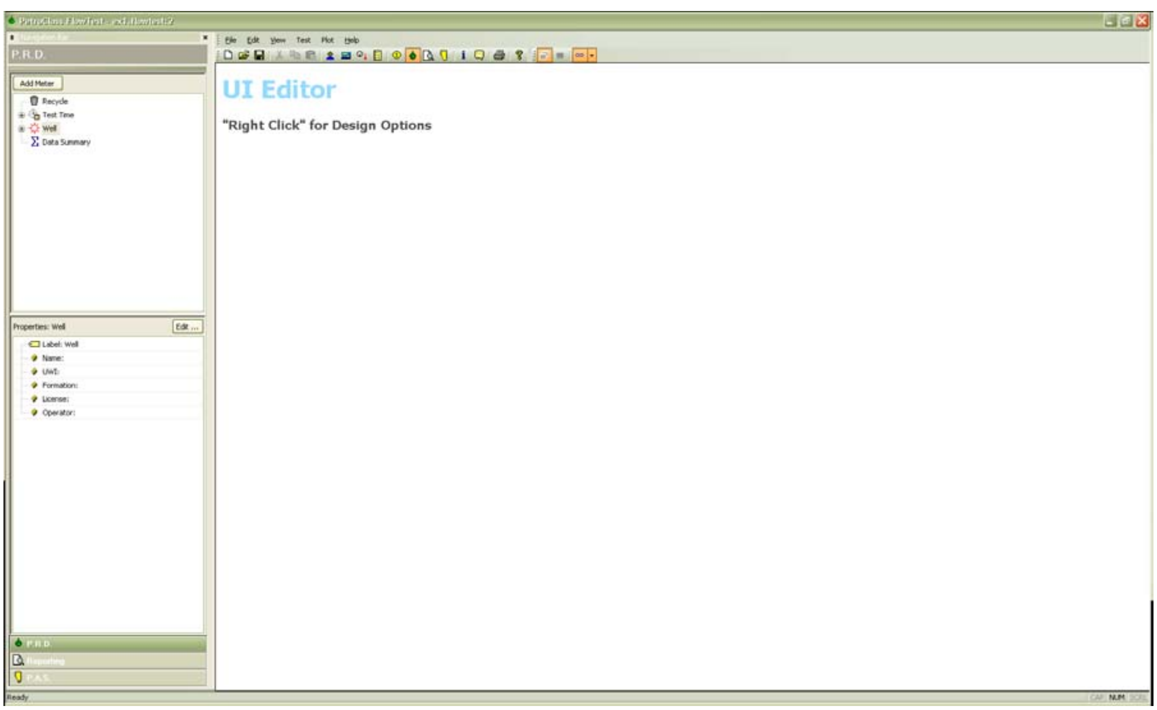
The main 'Data Entry' view is fully user configurable and may contain any number of plot and tables. Configurations can be customized for a particular test type, making it easy for field staff to partition different test aspects.

The following procedure illustrates how to create a custom UI from scratch.

Enter the UI designer by pressing the infinity button on the PRD Toolbar.

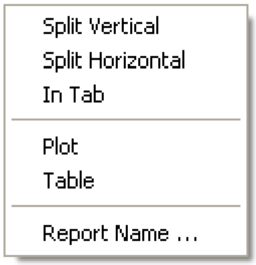


Press the down arrow of the Infinity toolbar button and select "Clear" to clear any UI views. This will leave a blank view as shown below.



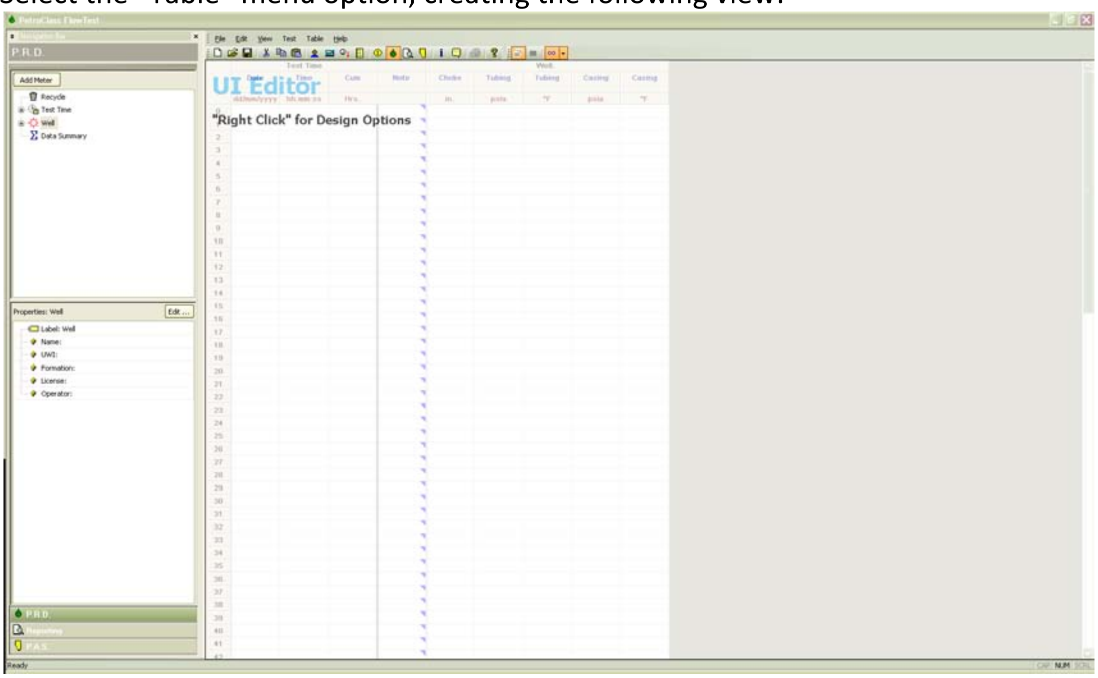
Blank User Interface

“Right Click” in the Blank UI View displays the following context menu:

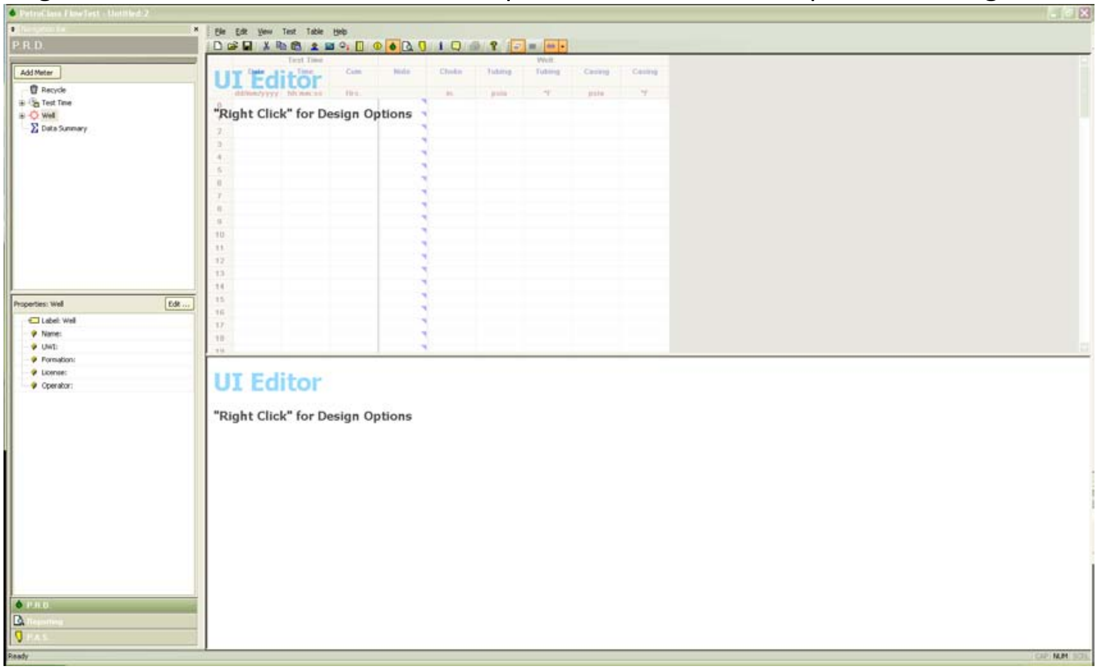


The PRD UI currently consists of Plot and Table views as well as UI container elements consisting if Tab and splitter elements. The views and containers can be infinitely nested creating a unique design of plot and table views.

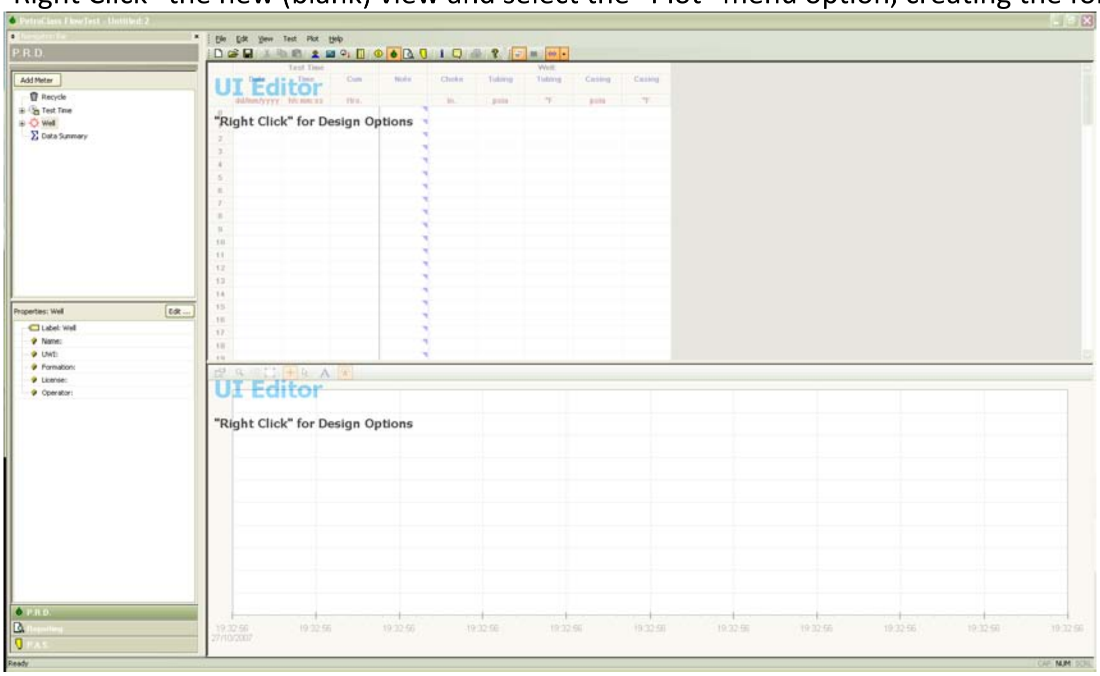
Select the “Table” menu option, creating the following view:



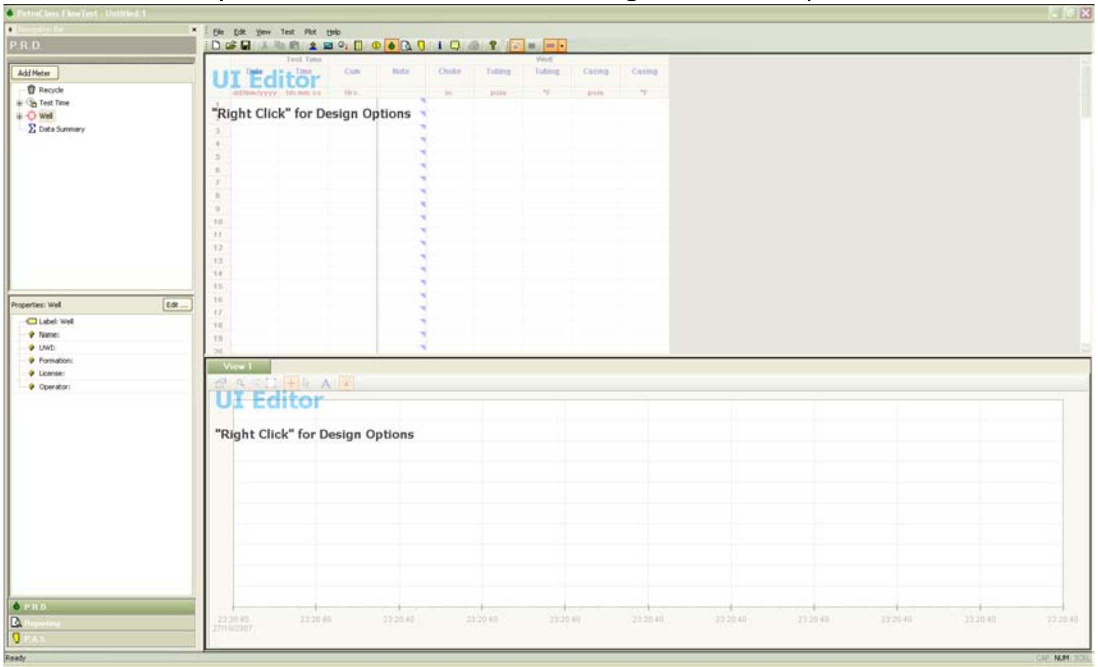
“Right Click” the view and select the “Split Horizontal” menu option, creating the following:



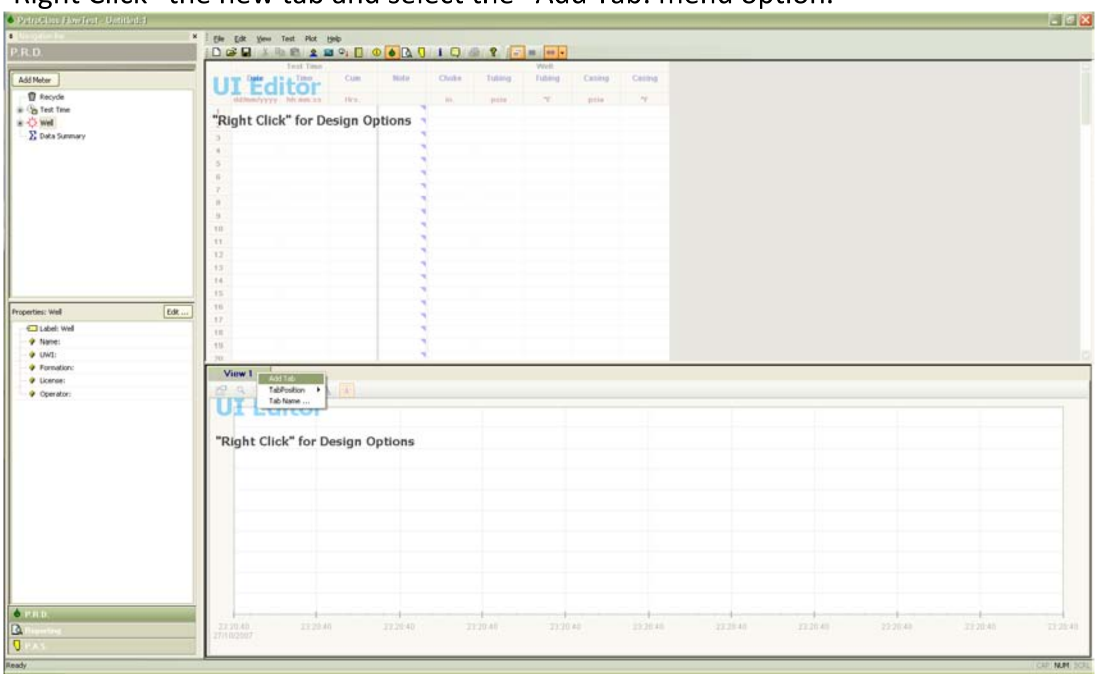
“Right Click” the new (blank) view and select the “Plot” menu option, creating the following:



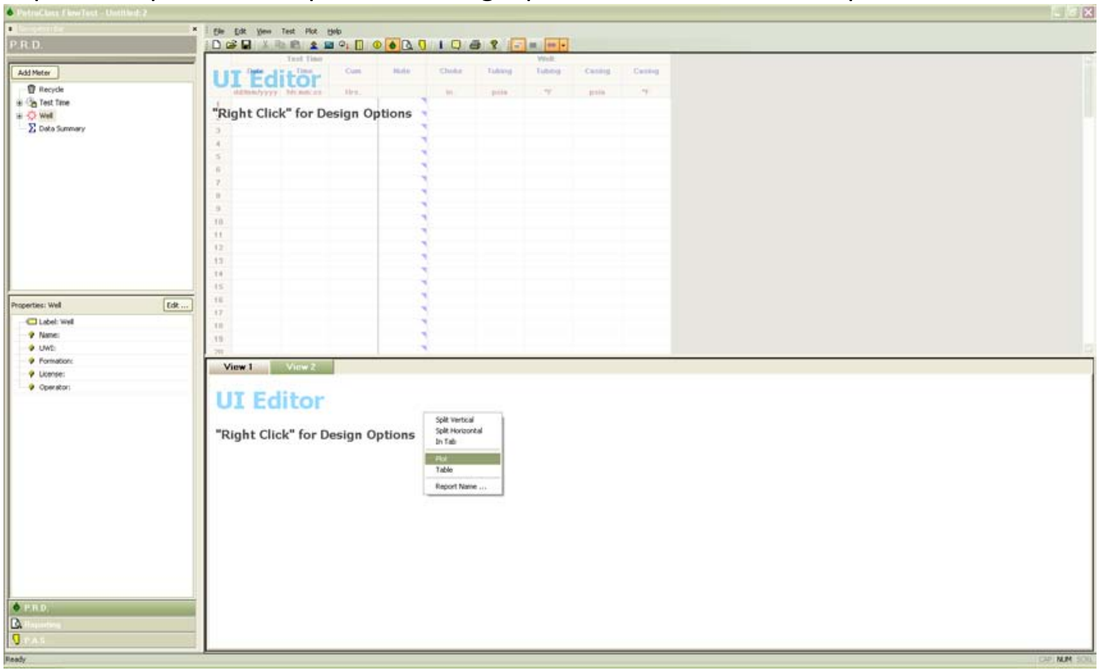
To add a second plot, within a tab container, “Right Click” the plot view and select the “In Tab” menu option.



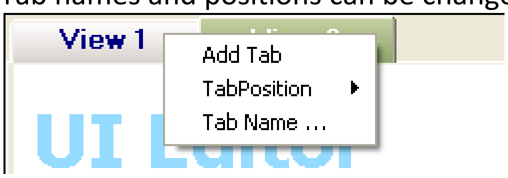
“Right Click” the new tab and select the “Add Tab: menu option.



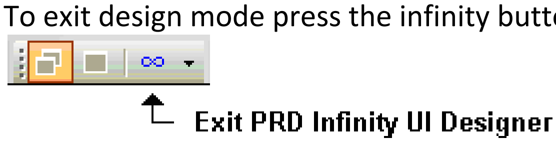
Repeat the previous steps for creating a plot view in the new tab pane



Tab names and positions can be changed context menu by clicking on the appropriate tab

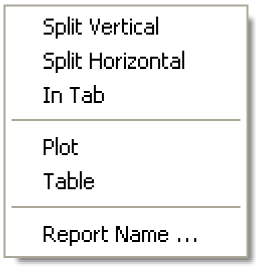


To exit design mode press the infinity button on the PRD Toolbar



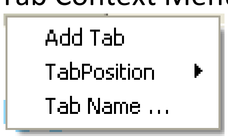
The following is a summary of the commands available in the UI designer context menus:

View Context Menu ("Right Click" on a View)



- Split Vertical (Splits the current view vertically adding a second view)
- Split Horizontal (Splits the current view horizontally adding a second view)
- In Tab (Places the current view inside a new Tab container)
- Plot (Changes the current view to a plot view)
- Table (Changes the current view to a table view)
- Report Name (Edit the name that will appear on reports for the current view)

Tab Context Menu ("Right Click" on a Tab Pane)



- Add Tab (Add a new view to the current Tab Container)
- Tab Position (Set the location of the tabs)
- Tab Name (Edit the tab name)

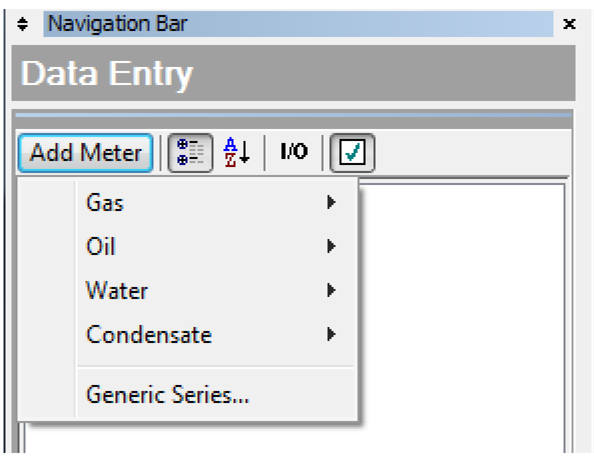
Meters

FlowTest provides a large suite of meters to measure produced gas and liquids. The meter types can be classified as follows:

- Gas Meters
- Liquid Meters of type:

    Oil
    Water
    Condensate
    Oil/Water (with a 2 phase separator)

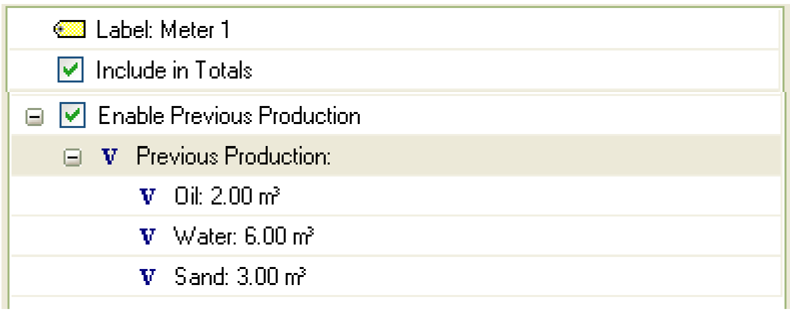
Meters are added via the “Add Meter” button on the ‘Data Entry’ pane of the Navigation Bar, displaying a menu to select the meter type.



A meter configuration dialog will be displayed to configure the specified meter (as detailed below).

Common Meter Options:

The following options are common to all meter types (gas and Liquid):



- The label field is the display name for the meter and can be changed to reflect any naming convention desired.
- The 'Include in Totals' option determines whether the meted fluids are included in the 'Data Summary' (see the Data Summary section)
- "Enable Previous Production" allows for the inclusion of fluids prior to the beginning of the test. The fluid types listed under the "Previous Production" node are specific to the meter type and additional options enabled.

Previous Production:

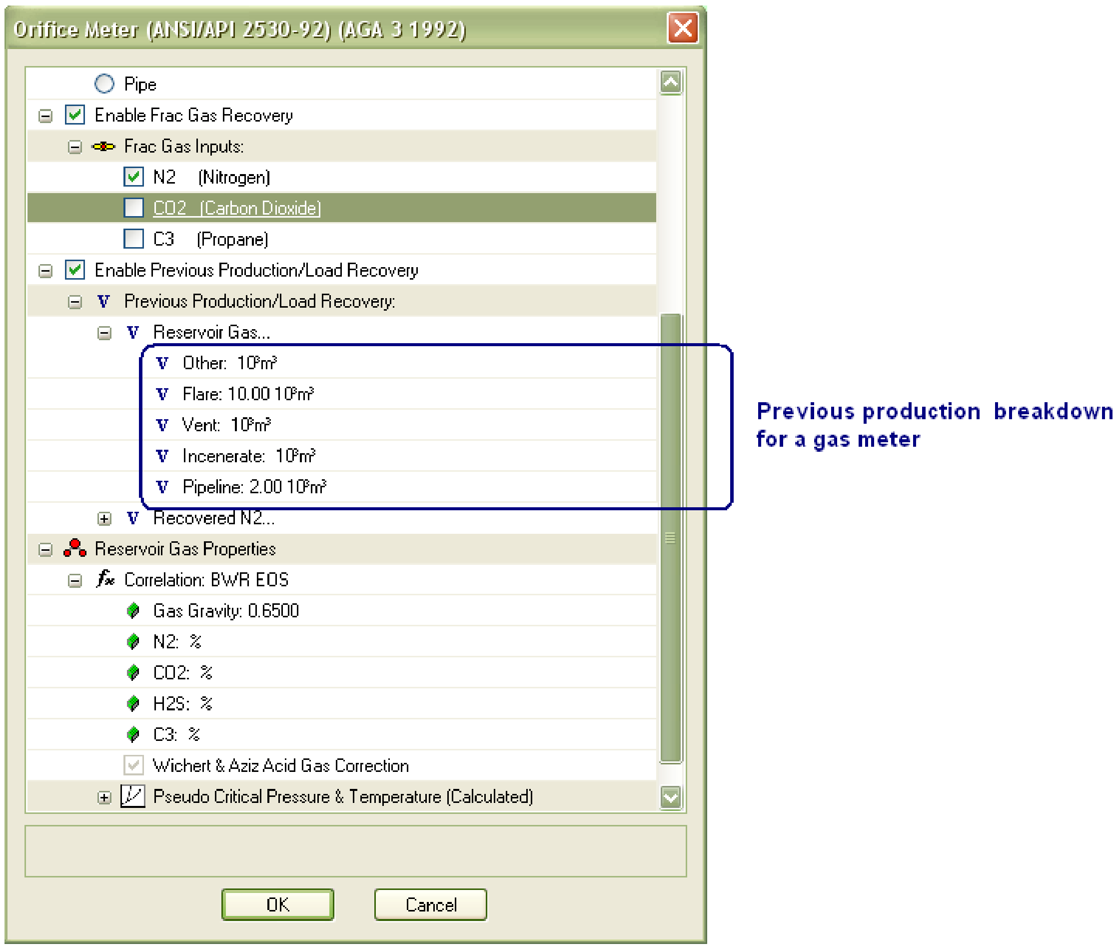
<u>Liquid Meter:</u>

Previous Production for a liquid meter is entered directly into each field (for each fluid type the meter produces (as shown in the diagram above).

<u>Gas Meter:</u>

Previous Production for a gas meter can be input according to the gas destination (or sink) *refer to section: Gas To: Flare, Vent, Pipeline, Incinerate, Other.*

If you do not track the gas destination (or do not know) all previous production can be entered into the "Other" field.

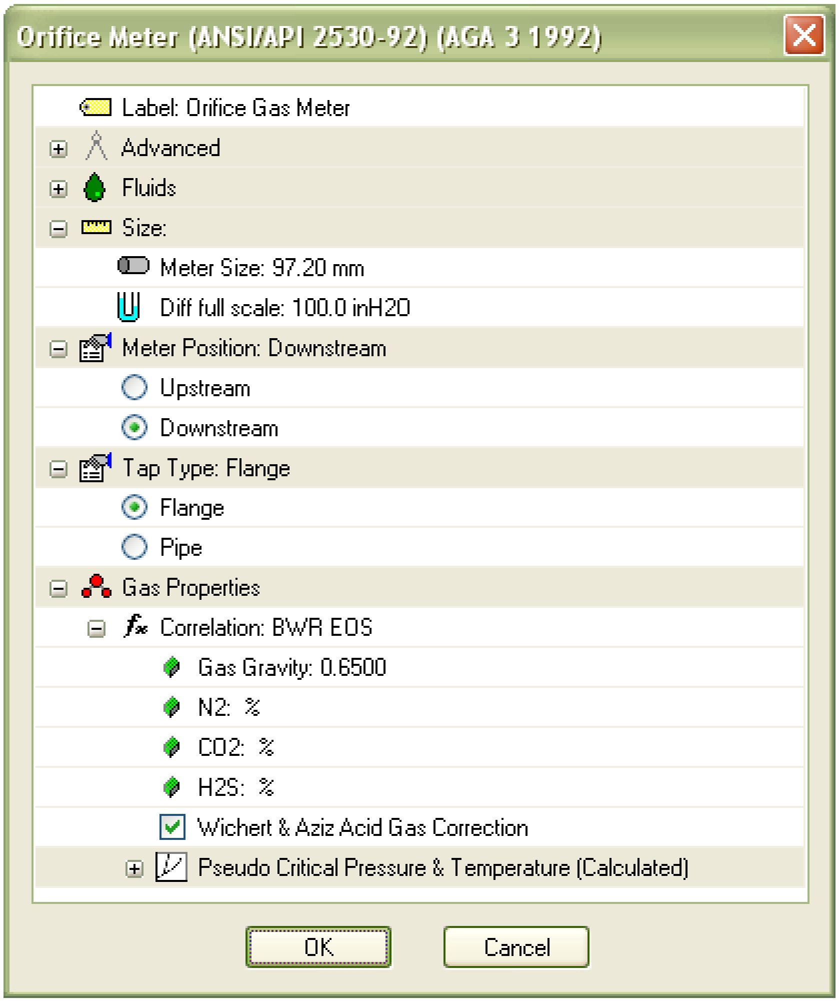


Previous Production for a Gas meter

Gas Meters:

Orifice Meter

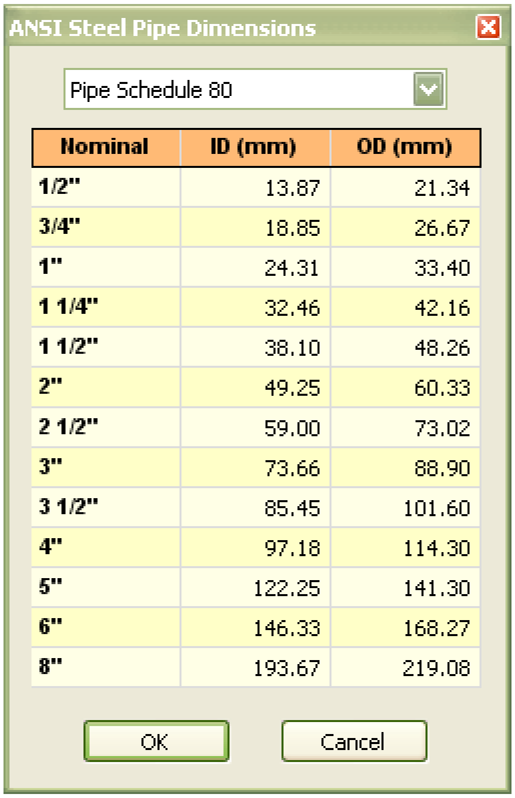
The Gas Orifice meter calculations are based on the AGA 3 (1992) or ANSI/API 2530-92 specification.



The Gas Orifice meter contains the following configuration variables:

- Meter Size (the internal diameter of the orifice tube) the "…" button in the entry field displays a common list of pipe dimensions to choose from.
- Diff full scale (an optional entry to specify the maximum differential pressure transducer range) see plate sizing below.
- Meter Position (static pressure tap Upstream or Downstream of the orifice plate)
- Tap Type (Flange or Pipe location of the differential pressure taps on the tube)
- Gas Properties (see Gas Properties)

Under the Advanced section the Orifice meter has additional entries for plate and tube composition to correct for thermal expansion of the plate and tube



Nominal	ID (mm)	OD (mm)
1/2"	13.87	21.34
3/4"	18.85	26.67
1"	24.31	33.40
1 1/4"	32.46	42.16
1 1/2"	38.10	48.26
2"	49.25	60.33
2 1/2"	59.00	73.02
3"	73.66	88.90
3 1/2"	85.45	101.60
4"	97.18	114.30
5"	122.25	141.30
6"	146.33	168.27
8"	193.67	219.08

Orifice Tube size selector (displayed in current units)
(accessed via. the “Meter Size” button in the configuration dialog.)

Plate Sizing

The orifice meter has a plate sizing option available to aid in the changing and sizing of orifice plates from the data table.

In the Data Table "right click" the orifice meter plate size. The following "Plate Selector" dialog is displayed:

Orifice Gas Meter					
Orifice	Static	Diff	Temp	Gas Rate	Cum
mm	kPag	kPa	°C	$10^3m^3/d$	10^3m^3
TEST EQUIPMENT					
0.00	0	0.00	0.00	0.000	0.0000
44.45	4206	9.90	4.00	92.723	0.4829
				110.185	1.5397

Plate	mm	Diff (kPa)	Diff (%)
1 1/8	28.58	61.40	247
1 1/4	31.75	39.94	161
1 3/8	34.92	27.00	109
1 1/2	38.10	18.85	76
1 5/8	41.27	13.54	54
1 3/4	44.45	9.91	40
1 7/8	47.63	7.38	30
2	50.80	5.58	22
2 1/8	53.97	4.26	17
2 1/4	57.15	3.29	13
2 3/8	60.33	2.56	10
2 1/2	63.50	2.00	8
2 5/8	66.67	1.57	6

Operating Point:

26/01/2008 08:45:00
Static 4206 kPag
Temp 4.00 °C
Qout 92.723 $10^3m^3/d$

The columns are defined as follows:

- Plate (standard plate sizes in fractional inches)mm (decimal value of the plate in the current units)
- Diff (differential pressure for the specified plate at the operation point)
- Diff (%) (Differential % full-scale value for the specified plate, at the operation point) *requires a Diff full scale value to be entered in the Orifice meter configuration dialog.*

The operation point is either the current point or the previous flow point. If there is no current or previous flow calculation, the operating point is blank and the differential pressures are not calculated.

The “Plate Selector” dialog readily indicates the effect different plates will have, on the differential pressure, for the current flowing conditions, allowing the user to select the most appropriate plate by keeping the differential in the optimum operating range.

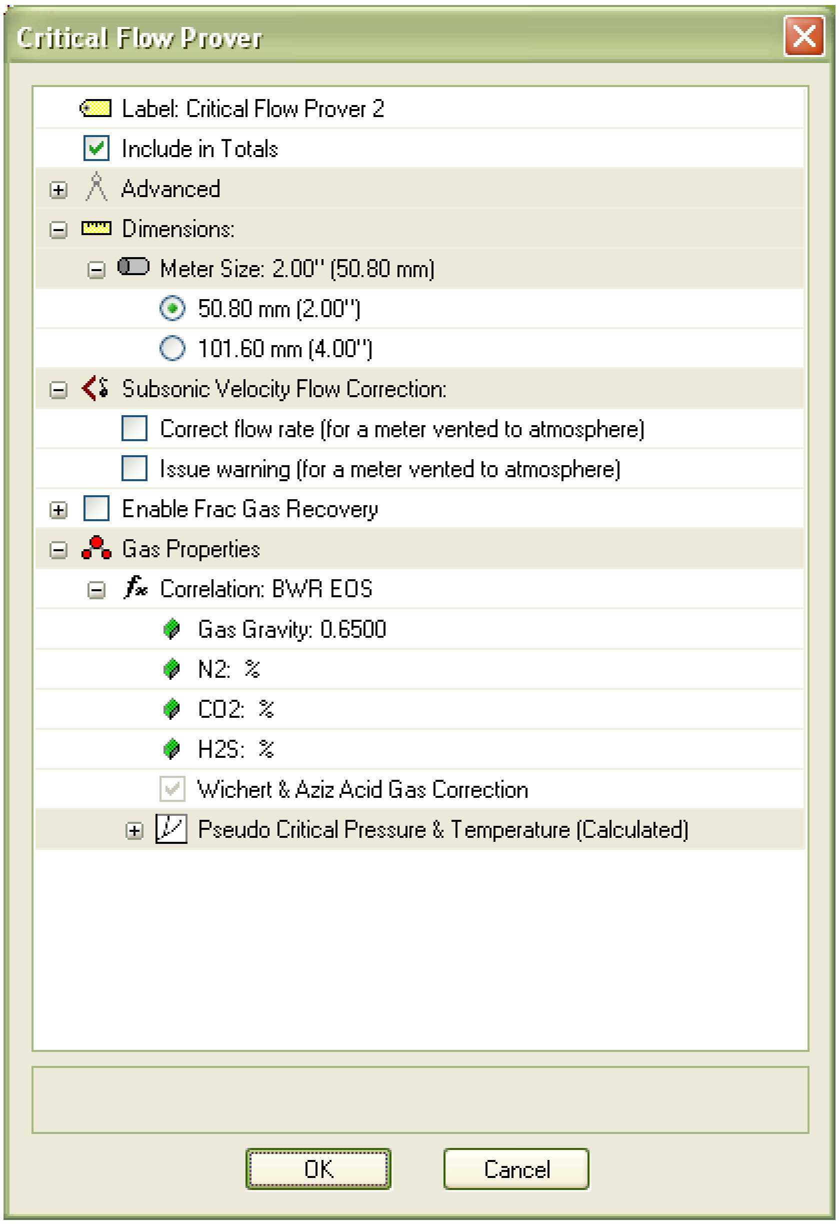
To select a new plate simply click on the plate, the dialog will close, and the plate will be entered into the table. To cancel the dialog, click off the dialog.

The differential pressure calculations use the following assumptions:

- *Sub critical flow (choked flow upstream of the meter)*
- *Constant flowing temperature*
- *Semi-constant back pressure (+- the differential pressure)*

Critical Flow Prover Meter

The Gas Critical Flow Prover meter calculations are based on specifications from the Railroad commission of Texas.

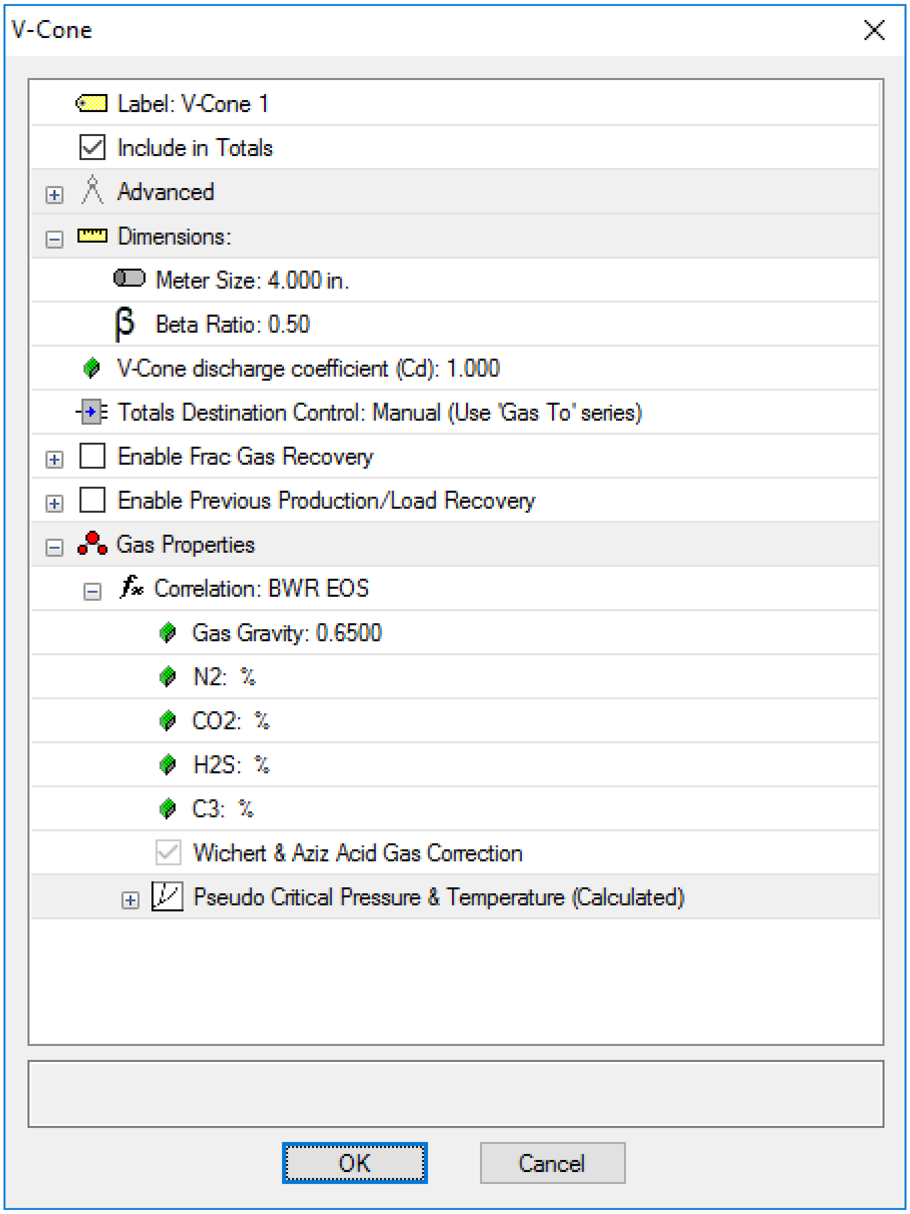


The Gas Critical Flow Prover meter contains the following configuration variables:

- Meter Size (the internal diameter of the prover tube either 2 or 4 inch ID)
- Subsonic Velocity Flow Correction
    - Correct flow rate applies a correction to the calculated gas rate when the meter is below critical flow. *This flow correction assumes that the meter downstream pressure is constant and at atmospheric pressure.*
    - Issue Warning will issue an alarm when the meter drops below critical flow. *Critical flow is calculated based on a constant meter downstream pressure at atmospheric pressure.*
- Enable Frac Gas Recovery (see: 'Frac Load Gas Recovery' section)
- Gas Properties (see Gas Properties)

V-Cone Meter

The Gas V-Cone meter calculations are based on standard V-Cone specifications.



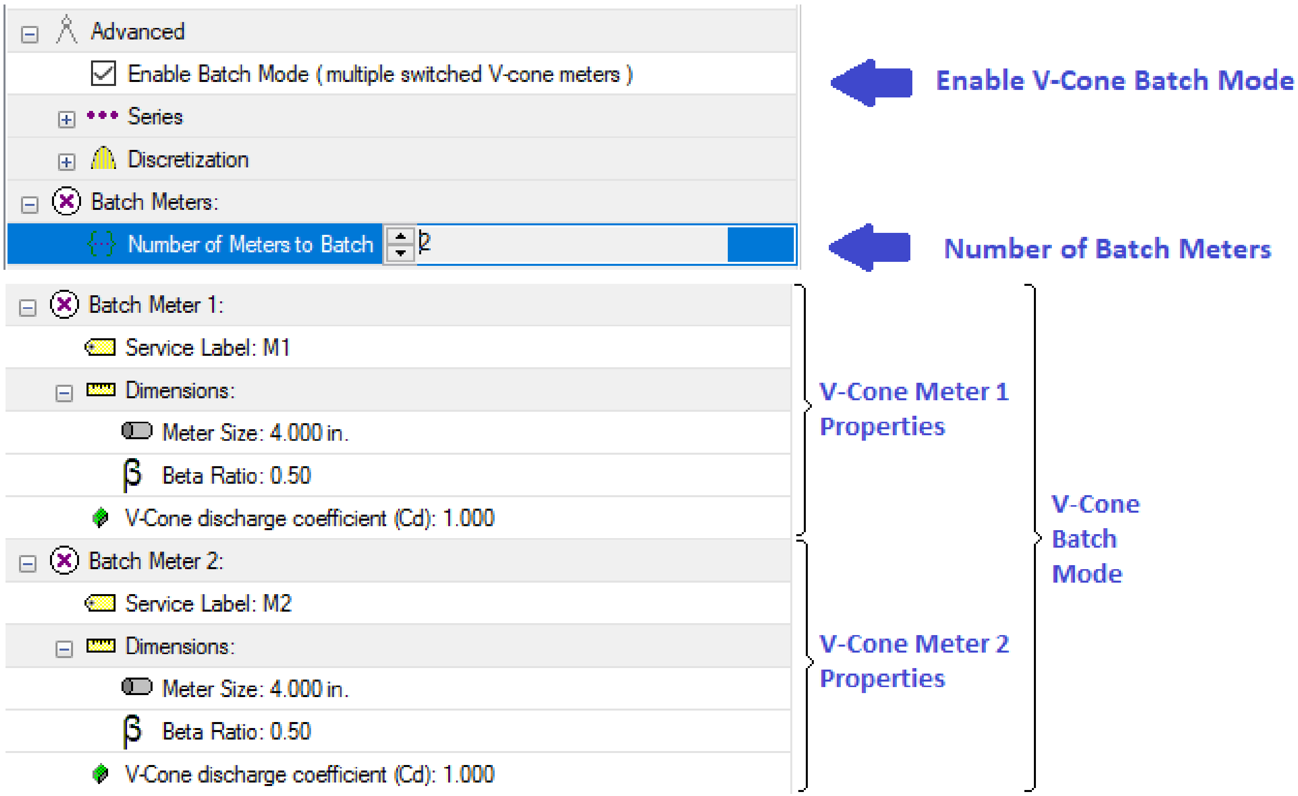
The gas V-Cone meter contains the following configuration variables:

- Meter Size (the internal diameter of the V-Cone tube) the "…" button in the entry field displays a common list of pipe dimensions to choose from.
- Bata Ratio (a constant relating the diameter of the cone to the Tube ID)
- Discharge Coeff. (specified by the manufacturer)
- Gas Properties (see Gas Properties)

V-Cone Batch Mode

The gas V-Cone provides a 'batching' option that essentially allows you to combine multiple V-Cone meters into a single interface. The idea behind batching is that you can have two (or more) different size V-Cone meters (typically a 2" and 4" meter) and select the active meter based on current flowing conditions. Batched meters have separate meter configurations but share a common set of gas properties.

The V-Cone batching option is enabled by selecting the 'Batch Mode' option under the 'Advanced' meter properties.



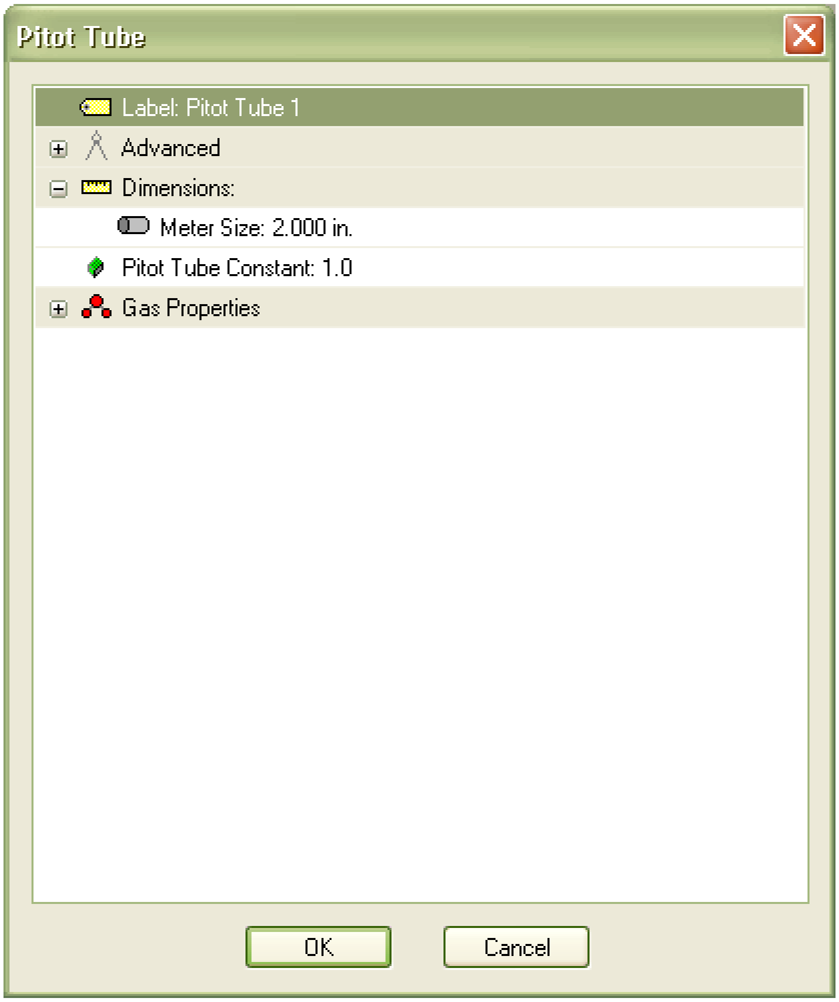
The V-Cone batch creates two independent meter configurations identical to the non-batched (single meter) configuration with the addition of the 'Service Label' for each meter. Batch mode adds an additional 'In Service' column to the data table where the active meter can be selected via the service label.

V-Cone 1					
In Service	Static	Temp	Diff	Rate	Cum
	psig	°F	psi	MMcf/d	MMcf
M1					
M1					
M1					
M1					

Data table with 'In Service' column to select the active meter.

Pitot Tube Meter

The Gas Pitot Tube meter calculations are based on standard Pitot Tube specifications

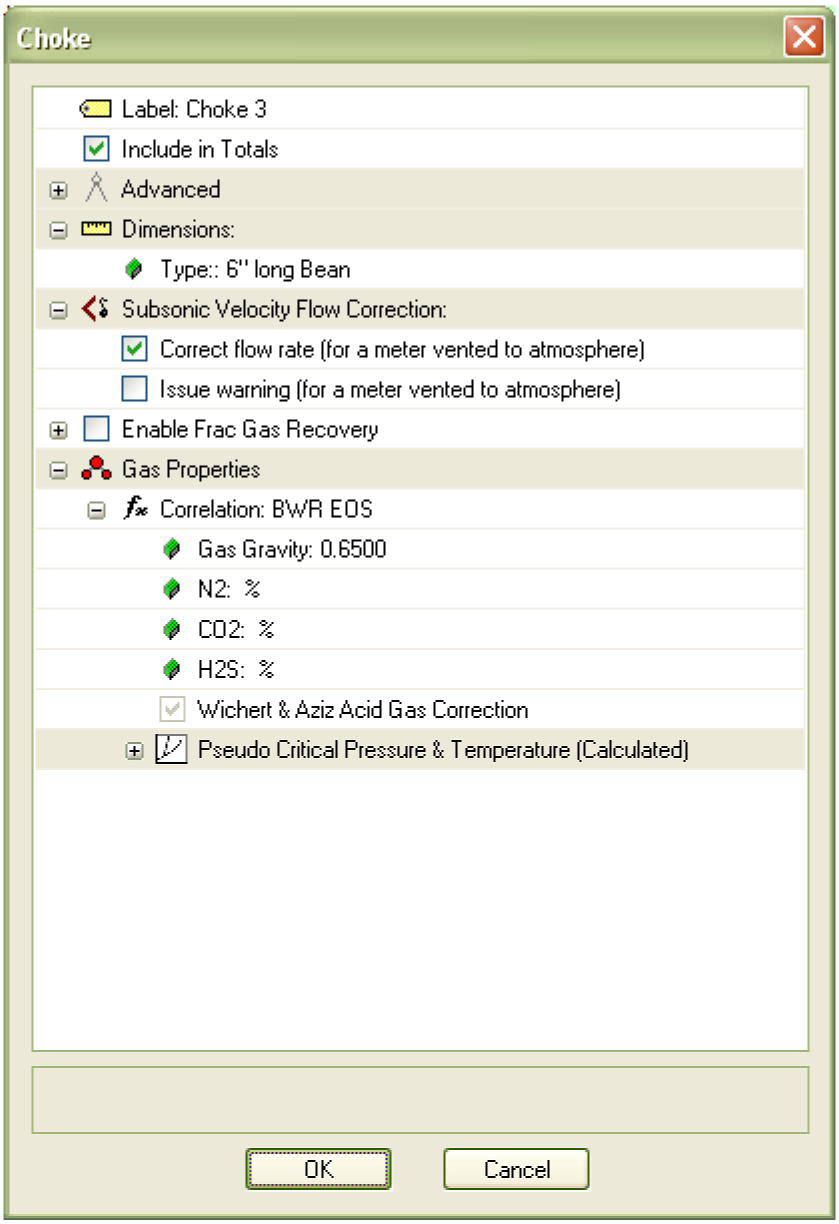


The Gas Pitot Tube meter contains the following configuration variables:

Meter Size (the internal diameter of the pipe containing the Pitot Tube) the "…" button in the entry field displays a common list of pipe dimensions to choose from.
Pitot Tube Constant. (specified by the manufacturer)
Gas Properties (see Gas Properties)

Choke Meter

The Gas Choke meter calculations are based on specifications from the Railroad commission of Texas for Bean and nipple chokes in critical flow.

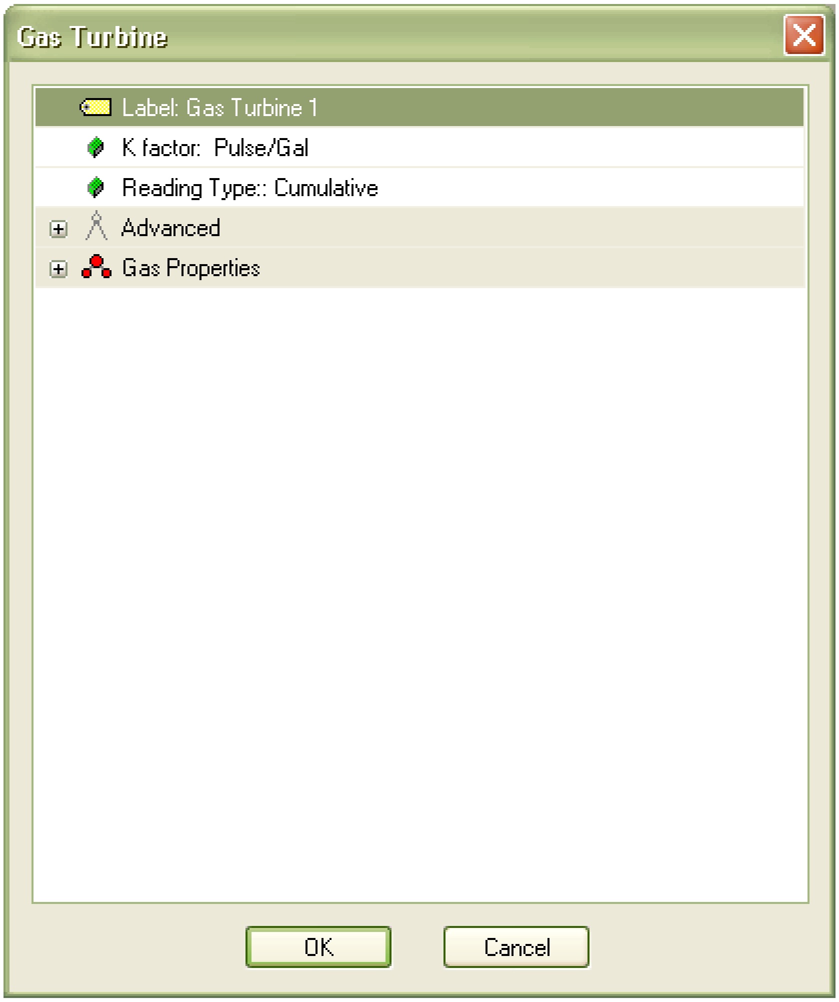


The Gas Choke meter contains the following configuration variables:

- Type (the Choke Type selections are either a 6” Bean Choke or 1-1/2” nipple)
- Subsonic Velocity Flow Correction
    - Correct flow rate applies a correction to the calculated gas rate when the meter is below critical flow. *This flow correction assumes that the meter downstream pressure is constant and at atmospheric pressure.*
    - Issue Warning will issue an alarm when the meter drops below critical flow. *Critical flow is calculated based on a constant meter downstream pressure at atmospheric pressure.*
- Enable Frac Gas Recovery (see: ‘Frac Load Gas Recovery’ section)
- Gas Properties (see Gas Properties)

Turbine Meter

The Gas Turbine meter calculations are based on the AGA 7 specification The Gas Turbine may also be used to calculate flow rates through a Vortex meter.

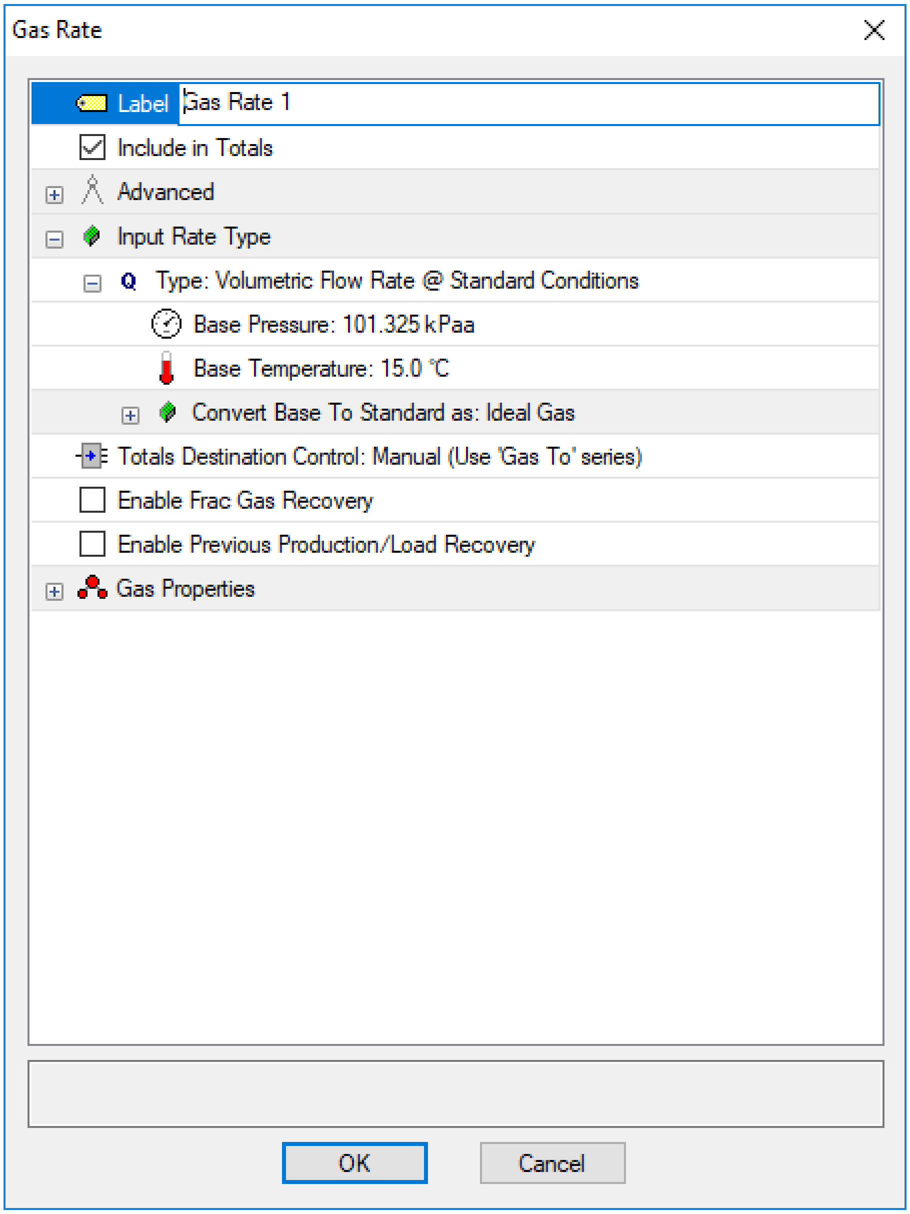


The Gas Turbine meter contains the following configuration variables:

- K factor (specified by the manufacturer)
- Reading Type (specifies the pulse reading type and can be either cumulative input readings or incremental input readings)
- Gas Properties (see Gas Properties)

Measured Rate Meter

The Gas Measured Rate meter calculations are based on standard PVT property calculations allowing corrections to gas rates and volumes from flowing conditions, other reference conditions or mass flow rates to standard conditions.



The Gas Measured Rate meter contains the following configuration variables:

- Input Rate Type (specifies the input type to be converted to a standard conditions)
  The Following Options are available:

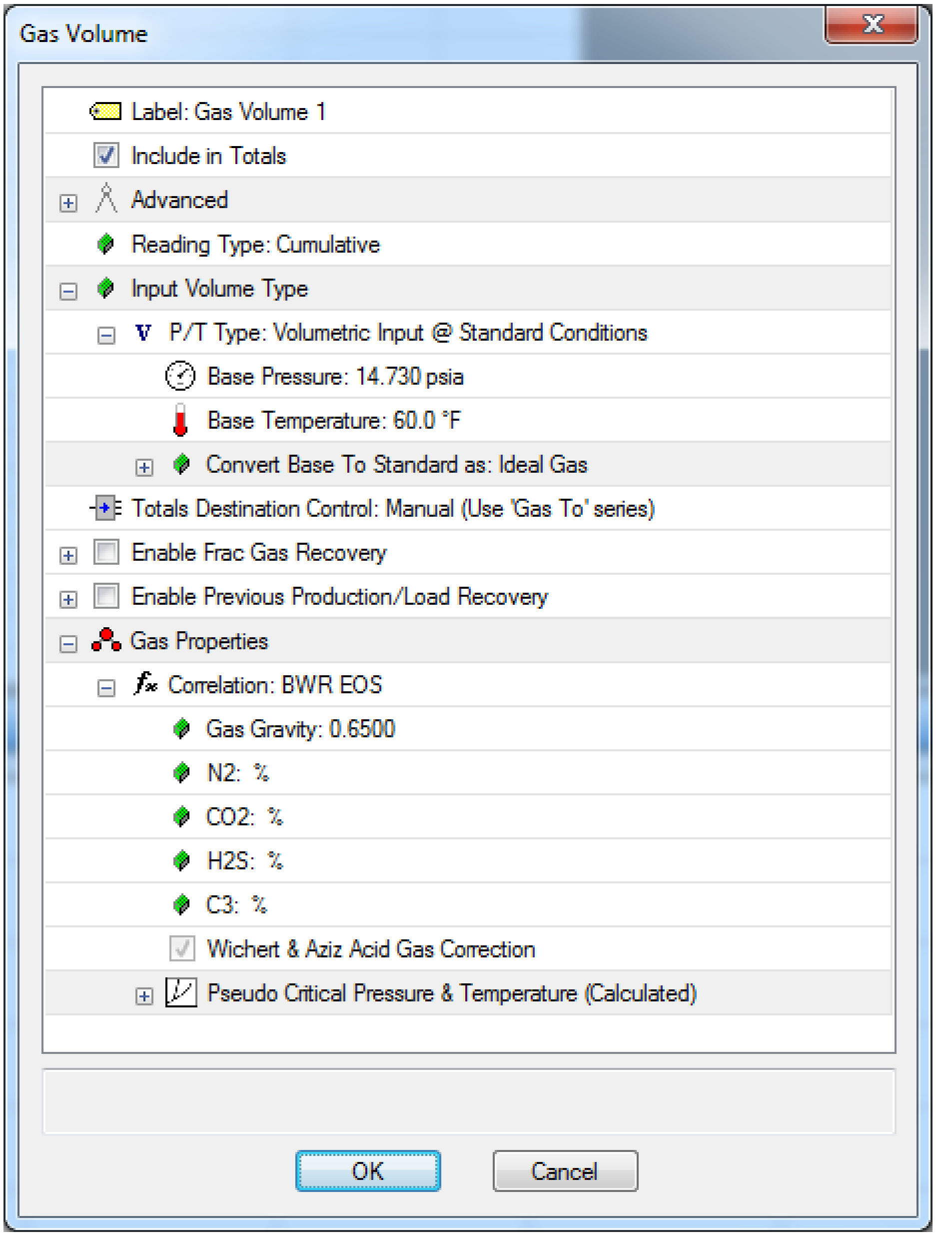
- Volumetric Flow Rate @ Standard Conditions
  The input gas rate(Qin) is a standard rate at the base conditions specified by the Base Pressure and Base Temperature entries. The Input Rate is converted to standard conditions by either of the following equations depending upon the setting of the 'Convert Base to Standard as:'
  $Qs = Qin(Pb1/Ps)(Ts/Tb1)$ ideal gas
  $Qs = Qin(Pb1/Ps)(Ts/Tb1)(Zb1/Zs)$ real gas
  Where *the input reference conditions are Pb1 and Tb1*
  Pb = 14.73 psia, Tb = 60.0 °F
  The standard rate is converted to local unit base conditions via the non-rigorous (ideal gas) equation:
  $Qb = Qs(Ps/Pb)(Tb/Ts)$ (see Standard Conditions section)
  Where Pb and Tb are the unit base conditions
- Volumetric Flow Rate @ Flowing Conditions
  The Input gas rate is at (variable) flowing conditions and is converted to Standard Conditions.
- Mass Flow Rate
  The Input gas rate is a Mass flow rate and is converted to a volumetric flow rate at Standard Conditions.
- Constant Fpv
  The input gas rate is at the standard conditions of Ps = 14.73 psia and Tf = 60.0 °F. However the gas rate is calculated with the fixed (constant) Fpv specified for all flowing pressures and temperatures.
  The input rate is first converted back to flowing conditions:
  $Qf = Qs/(Pf/Ps*Ts/Tf*Zterm)$ where $Zterm = (Const\_Fpv)^2$ and (Zb in the Fpv calculation = 1.0)
  The gas rate at flowing conditions) is then converted to standard conditions using option 2(Volumetric Flow Rate @ Flowing Conditions).
- Input Proxy Flow Rate @ Standard Conditions
  The input rate (Qin) is an existing series being a volumetric flow rate @ standard conditions. This mode is useful when you have an existing series of flow rates for use as the meter input.

*** The static pressure and flowing temperature inputs are only required if "*Volumetric Flow Rate @ Flowing Conditions" mode is selected.

- Gas Properties (see Gas Properties)

Measured Volume Meter

The Gas Measured Volume meter calculations are based on standard PVT property calculations allowing corrections to gas rates and volumes from flowing conditions, other reference conditions.



The Gas Measured Volume meter contains the following configuration variables:

- Reading Type (specifies the input type for the meter and can be either a cumulative input or an incremental input)
- Input Rate Type (specifies the input type to be converted to a standard conditions)
  The Following Options are available:

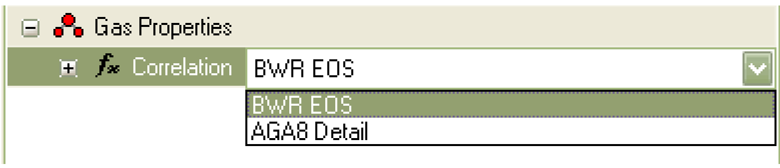
  - <u>Volumetric Flow Volume @ Standard Conditions</u>
    The input gas volume (Vin) is a standard rate at the base conditions specified by the Base Pressure and Base Temperature entries. The Input Rate is converted to standard conditions by either of the following equations depending upon the setting of the 'Convert Base to Standard as:'
    Vs = Vin(Pb1/Ps)(Ts/Tb1) ideal gas
    Vs = Vin(Pb1/Ps)(Ts/Tb1)(Zb1/Zs) real gas
    Where *the input reference conditions are Pb1 and Tb1*
    Pb = 14.73 psia, Tb = 60.0 °F
    The standard rate is converted to local unit base conditions via the non-rigorous (ideal gas) equation:
    Vb = Vs(Ps/Pb)(Tb/Ts) (see Standard Conditions section)
    Where Pb and Tb are the unit base conditions
  - <u>Volumetric Flow Volume @ Flowing Conditions</u>
    The Input gas volume is at (variable) flowing conditions and is converted to Standard Conditions.
  - <u>Input Proxy Volume @ Standard Conditions</u>
    The input volume (Vin) is an existing series being a volume @ standard conditions.
    This mode is useful when you have an existing series of incremental (gains) or cumulative volumes for use as the meter input

  *** The static pressure and flowing temperature inputs are only required if "*Volumetric Flow Volume @ Flowing Conditions" mode is selected.

- Gas Properties (see Gas Properties)

Gas Properties

All Gas Meters contain gas properties in the meter configuration dialog. The gas properties describe the gas flowing through the meter, and are used by the meter calculations to correct the gas flow rates and volumes to standard conditions.



Gas properties contain two different correlation types, available in the Correlation options under Gas Properties.

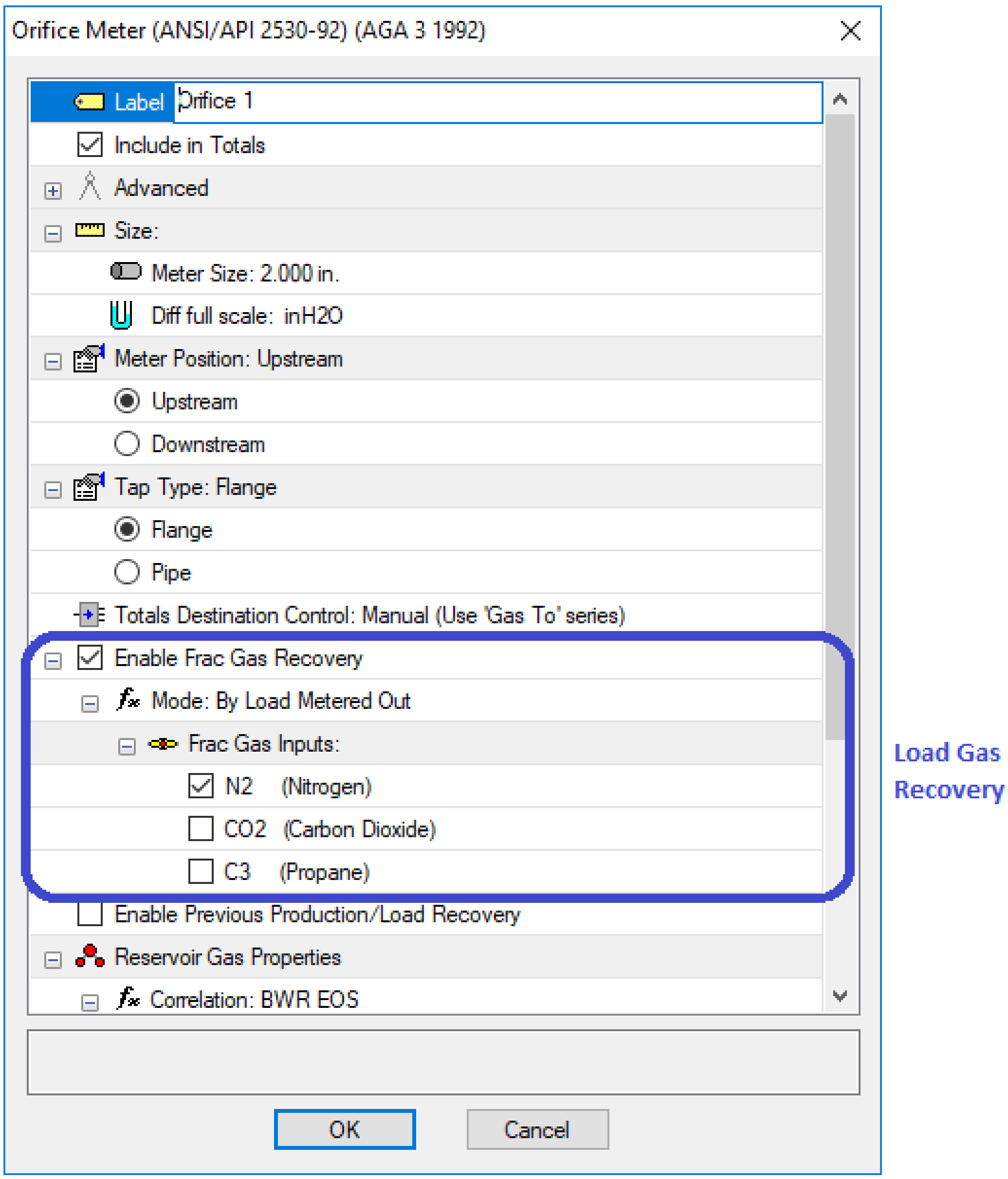
- BWR EOS is a generally accepted correlation with and optional correction for acid gas impurities.
- AGA 8 Detailed is a correlation based on the American Gas Association Report # 8 (1992) and requires a full compositional gas analysis.

Frac. Load Gas Recovery

All gas meters have an option to separate load gas and produced gas from the metered gas stream via the "Enable Frac. Gas Recovery" option.

The Load Gas Recovery option performs two basic functions:

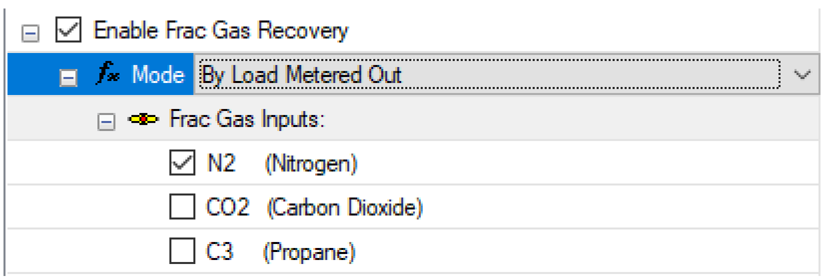
- Allows metered gas properties to vary, in real time, as differing volumes of reservoir and load gasses are comingled in the metered stream.
- Separates the load gasses and produced gas from metered stream, reporting the relative volume of each type.



There are two measurement modes for load gas recovery:
As shown below in the ‘Mode’ dropdown.

The measurement mode essentially specifies how the load gas is metered where:
‘By Load Metered Out’ requires a measured input specifying the proportion of load in the metered output stream.
‘By Load Injected In’ requires a measured injected load gas rate input.

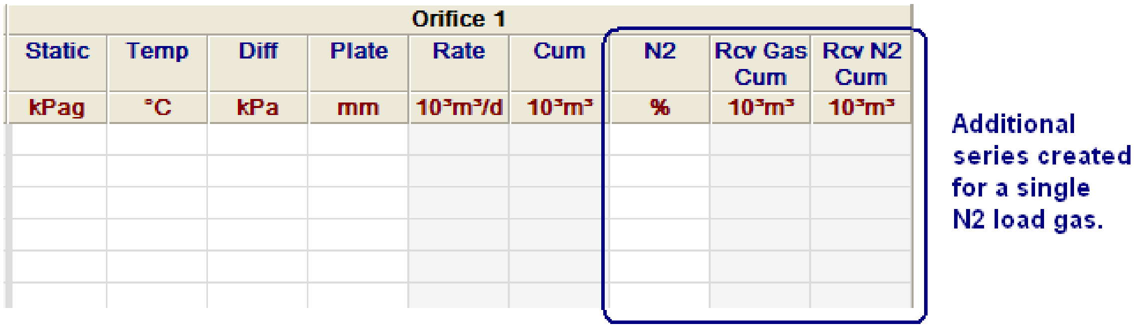
Mode: By Load Metered Out



The choices for load gas can be; N2, CO2, C3 or (both N2 and CO2).

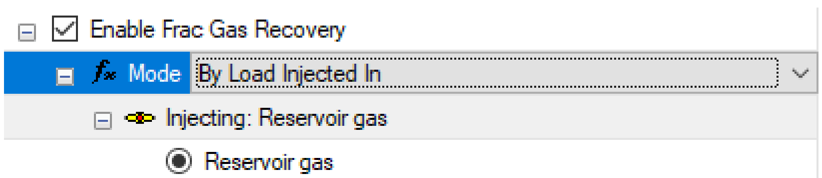
The “Frac. Gas Inputs” specify the load gas(s) present in the test. For each load gas selected, the following table series will be created for the meter:
Percent Load Gas (input)
User input to specify the amount of the specified load gas (N2, CO2, C3) in the metered stream.
Recovered Load Gas (calculated cumulative volume)
Cumulative volume of recovered load gas (N2, CO2, C3).
Recovered (Reservoir) Gas (calculated cumulative volume)
Cumulative volume of produced reservoir gas.

<u>The meter gas properties should be configured to reflect the reservoir gas properties only</u>. These gas properties will be dynamically adjusted to take in account for the amount of load gas in the metered stream.

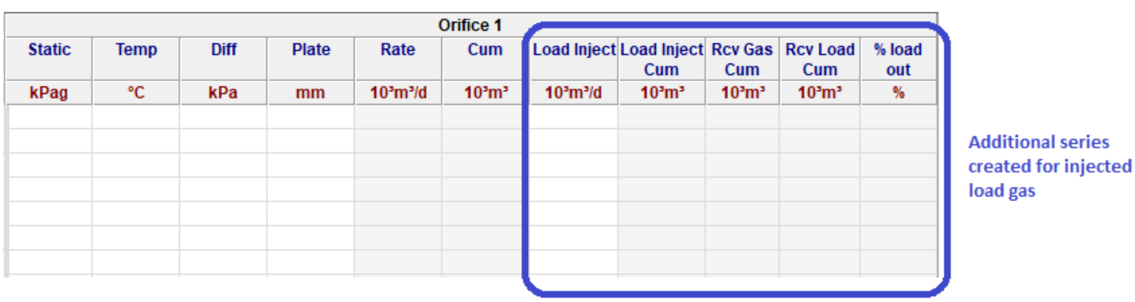


Orifice 1								
Static	Temp	Diff	Plate	Rate	Cum	N2	Rcv Gas Cum	Rcv N2 Cum
kPag	°C	kPa	mm	10³m³/d	10³m³	%	10³m³	10³m³

Mode: By Load Injected In



The 'by injection' mode is useful when you have a known pumping rate if the injected load gas.

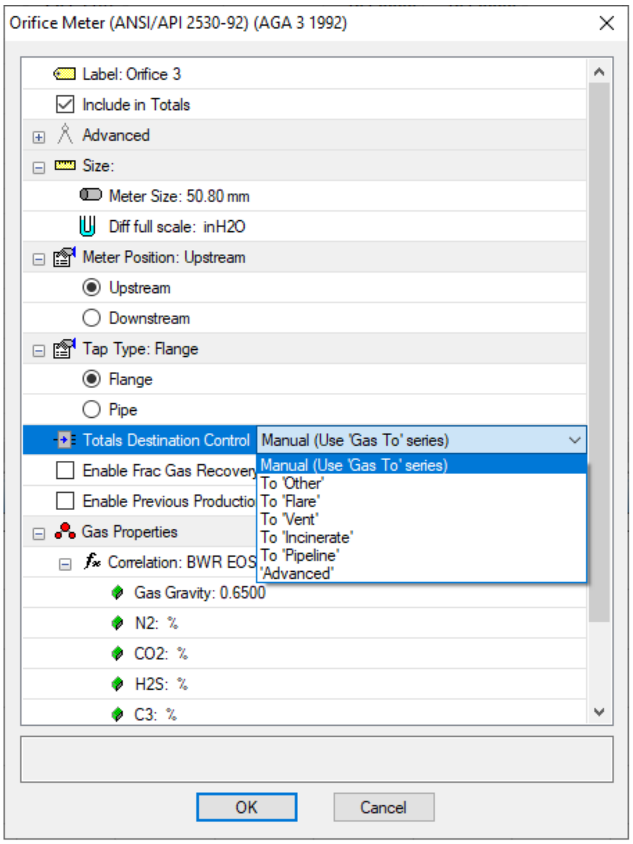


Orifice 1										
Static	Temp	Diff	Plate	Rate	Cum	Load Inject	Load Inject Cum	Rcv Gas Cum	Rcv Load Cum	% load out
kPag	°C	kPa	mm	10³m³/d	10³m³	10³m³/d	10³m³	10³m³	10³m³	%

The load injection rate is entered and the metered gas stream is separated into reservoir gas and recovered load along with a %load calculation.

Gas To: Flare, Vent, Pipeline, Incinerate, Other

For a gas meter with the 'Include in Totals' option checked, the produced and recovered load gas will be added to the totals and classified as either flared, vented… via the 'Gas To' series in the 'Data Summary' group. This behavior can be overridden at the meter level to route all metered gas to a specific destination.



Gas Destination Control (click to change)

Options for the metered gas destination:

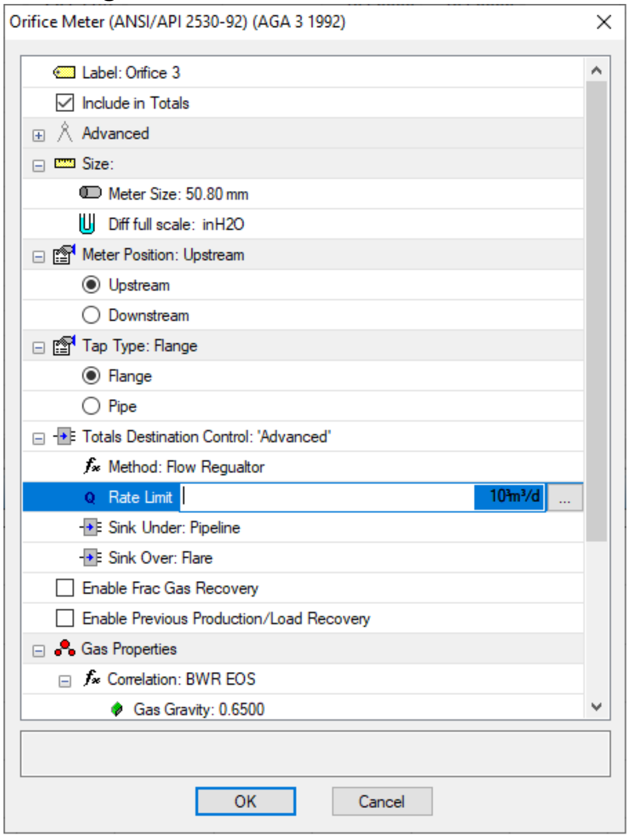
Manual (Use 'Gas To' series)	Destination is controlled by the 'Data Summary Gas To' series.
To 'Other'	All metered gas classified as 'Other'
To 'Flare	All metered gas classified as 'Flared'
To 'Vent	All metered gas classified as 'Vented'
To 'Incinerate	All metered gas classified as 'Incinerated'
To 'Pipeline	All metered gas classified as 'Pipelined'
'Advanced'	Provides additional options (see below)

Note: Previous Production is specified independently of these settings.

For additional information see: 'Gas To: Flare, Vent, Pipeline, Incinerate, Other' in the 'Data Summary' section.

Advanced Destination Control

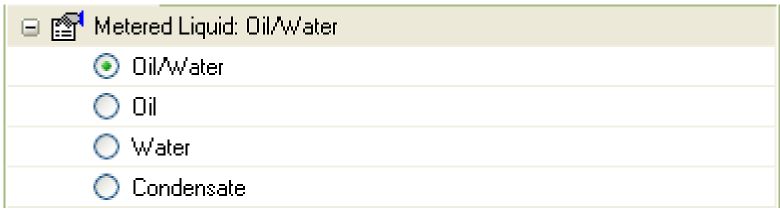
Flow Regulator



Transition Flow Rate
Destination Below
Destination Above

The 'Flow Regulator' mode allows you to divert flow based on the current flow rate. This mode is typically used when flowing into a pipeline with a fixed (maximum) capacity. To use this mode the maximum pipeline capacity is specified as the 'Rate Limit' with the 'Sink under' destination specified as 'Pipeline' and the 'Sink Over' destination specified as 'Flare' (or other…). In this case any flow at or below the rate limit will divert to the 'sink under' destination whereas the portion of flow over the rate limit diverts to the 'sink over' destination.

Liquid Meters:

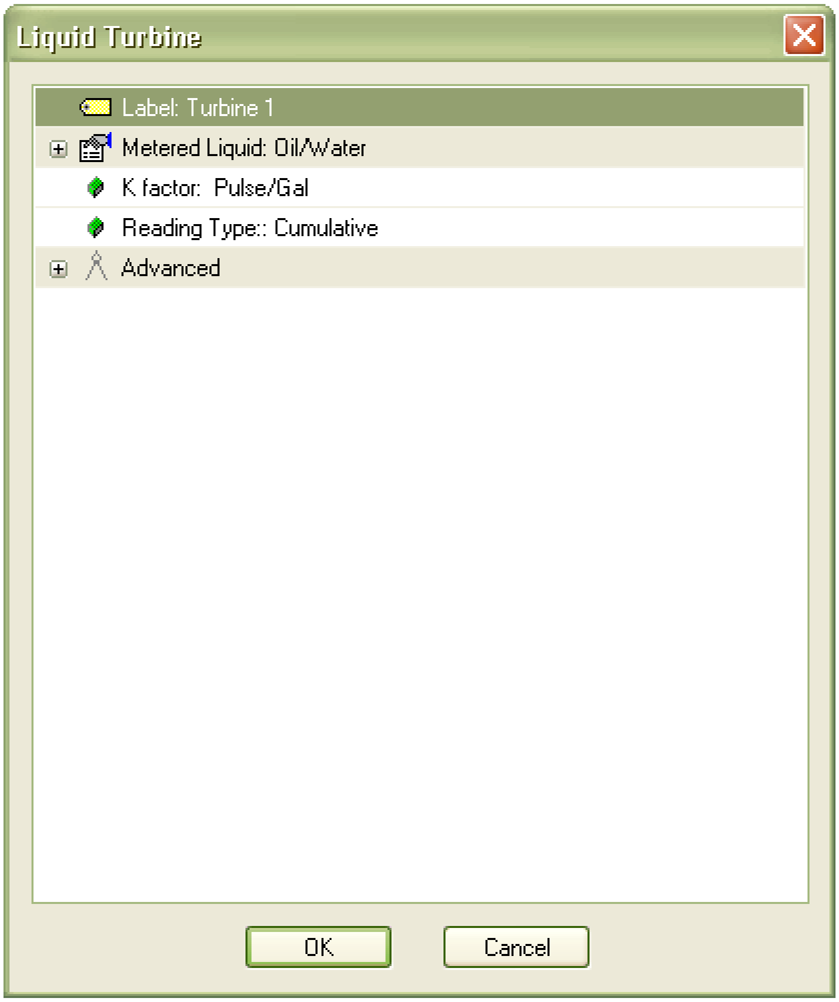


Properties common to all liquid meters

For convenience liquid meters a separated into three categories (oil, Water and Condensate) internally there is only a single fluid meter type where the type of fluid being metered can be set to Oil, Water, Condensate or an Oil/Water type (as seen above). Any liquid meter can be reconfigured to flow a different liquid type without creating a new meter.

Turbine Meter

The Liquid Turbine meter calculations are based on the AGA 7 specification. The Liquid Turbine may also be used to calculate flow rates through a Vortex meter.

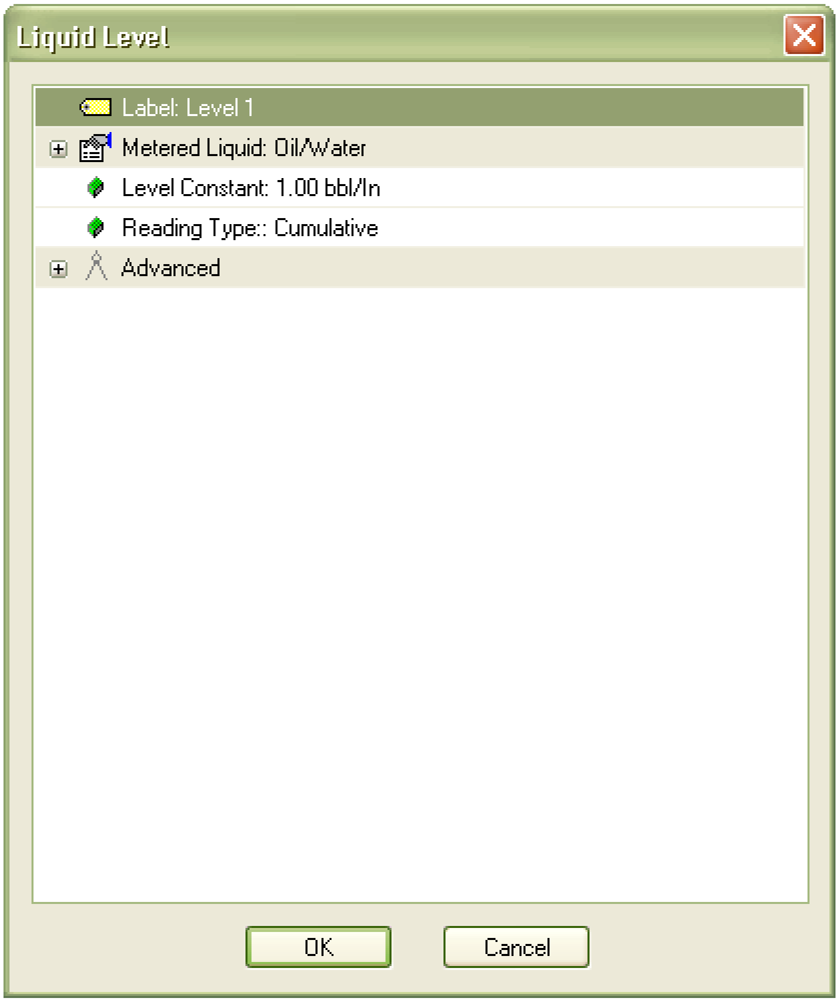


The Liquid Turbine meter contains the following configuration variables:

- K factor (specified by the manufacturer)
- Reading Type (specifies the pulse reading type and can be either cumulative input readings or incremental input readings)

Level Meter

The Liquid Level meter calculations are based on constant tank level measurements relating the tank volume to a tank depth.

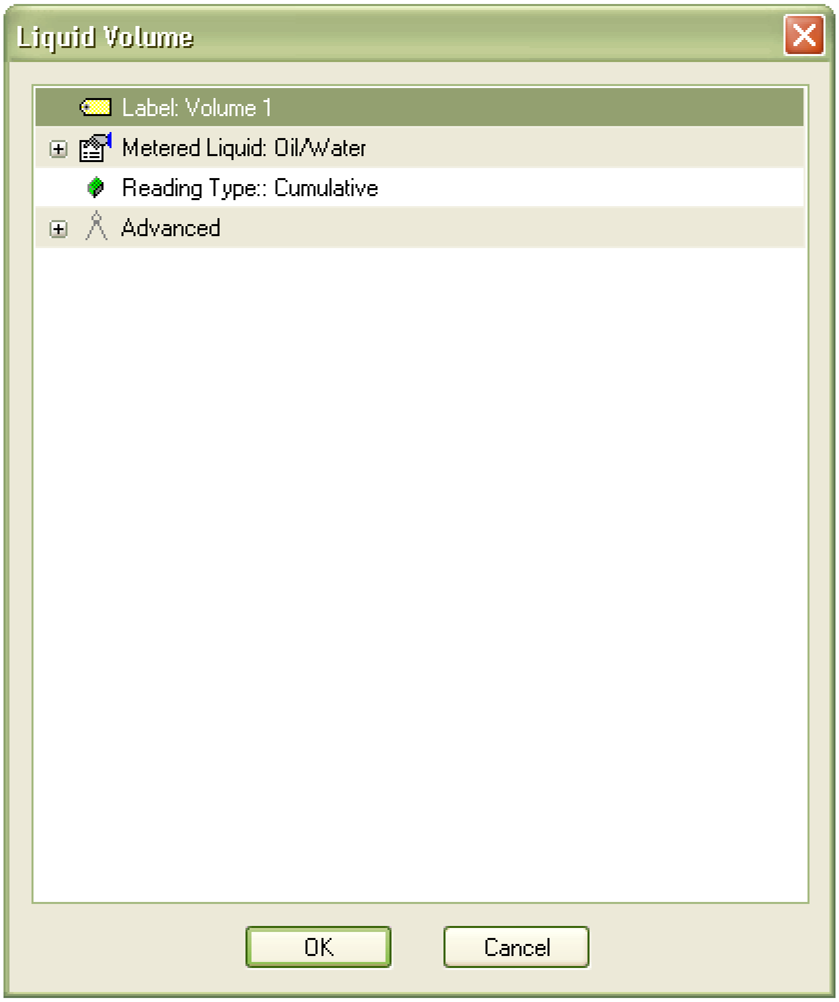


The Liquid Level meter contains the following configuration variables:

- Level Constant (constant factor relating level to volume where Volume = Level * Level Constant)
- Reading Type (specifies the pulse reading type and can be either cumulative input readings or incremental input readings) *For an oil meter, the BS&W measurement entered is always represents the BS&W percentage of the incremental liquid gain, irrespective of the cumulative or incremental setting.*

Measured Volume Meter

The Liquid Volume meter calculates a liquid rate from entered liquid volumes.

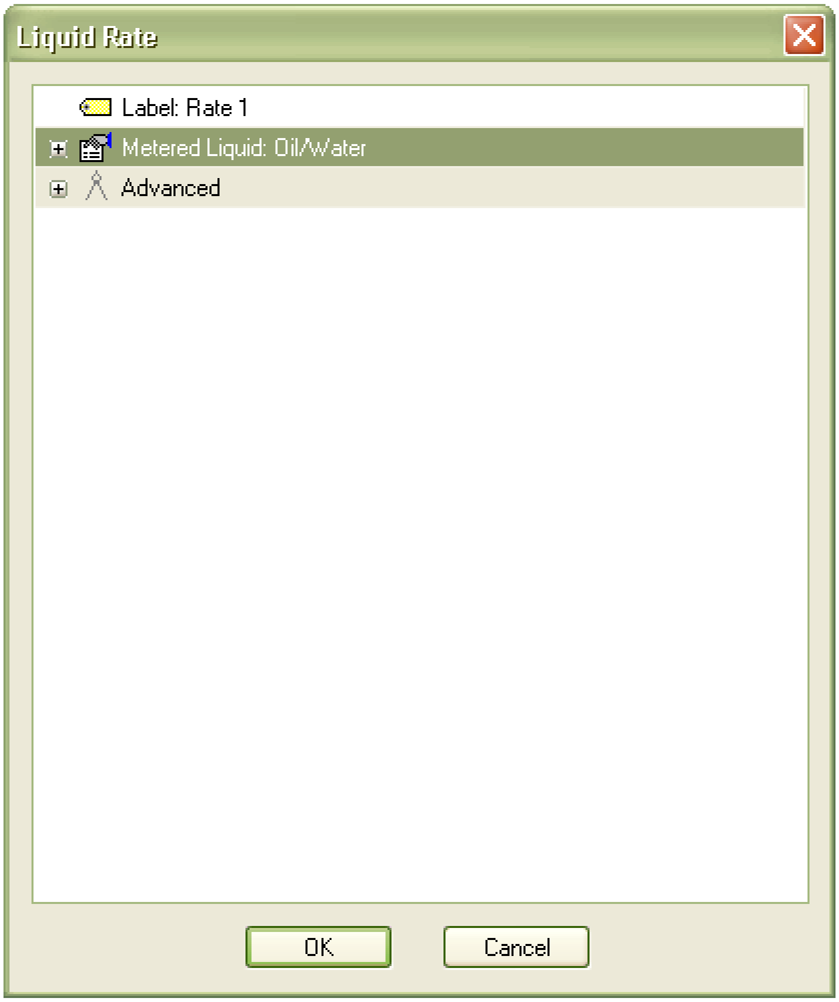


The Liquid Volume meter contains the following configuration variables:

- Reading Type (specifies the pulse reading type and can be either cumulative input readings or incremental input readings) *For an oil meter, the BS&W measurement entered is always represents the BS&W percentage of the incremental liquid gain, irrespective of the cumulative or incremental setting.*

Measured Rate Meter

The Liquid Rate meter calculates liquid volumes from entered liquid rates.

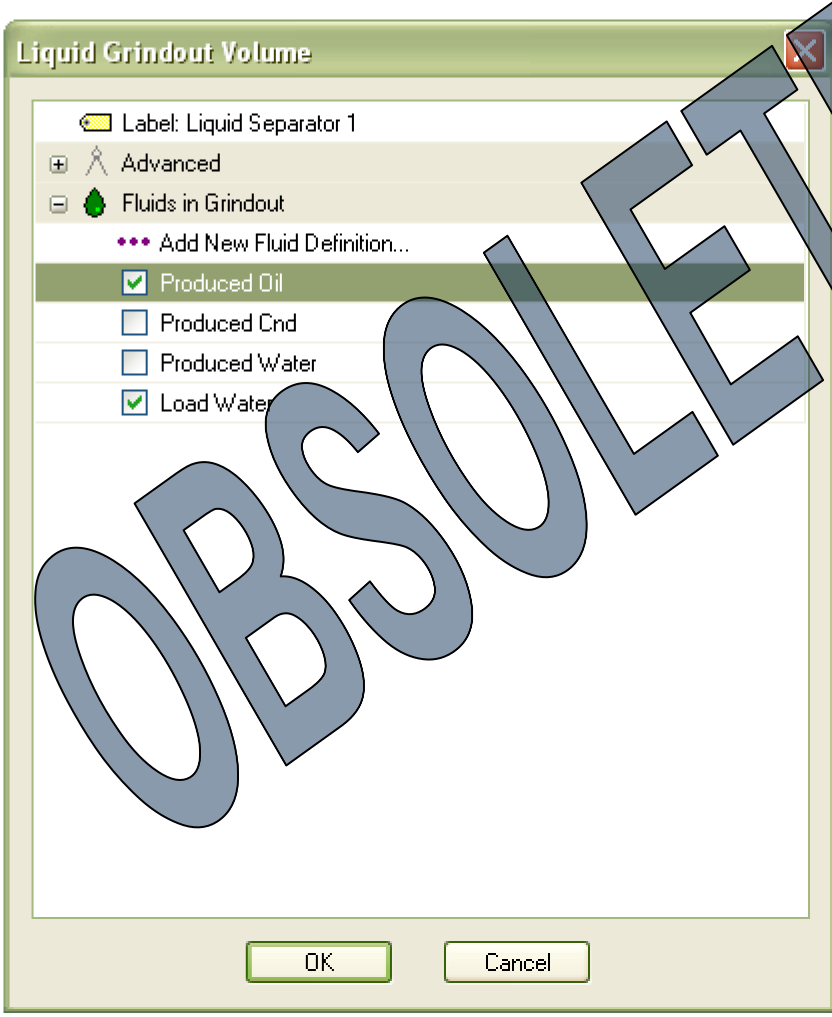


The Liquid Rate meter contains the no configuration variables.

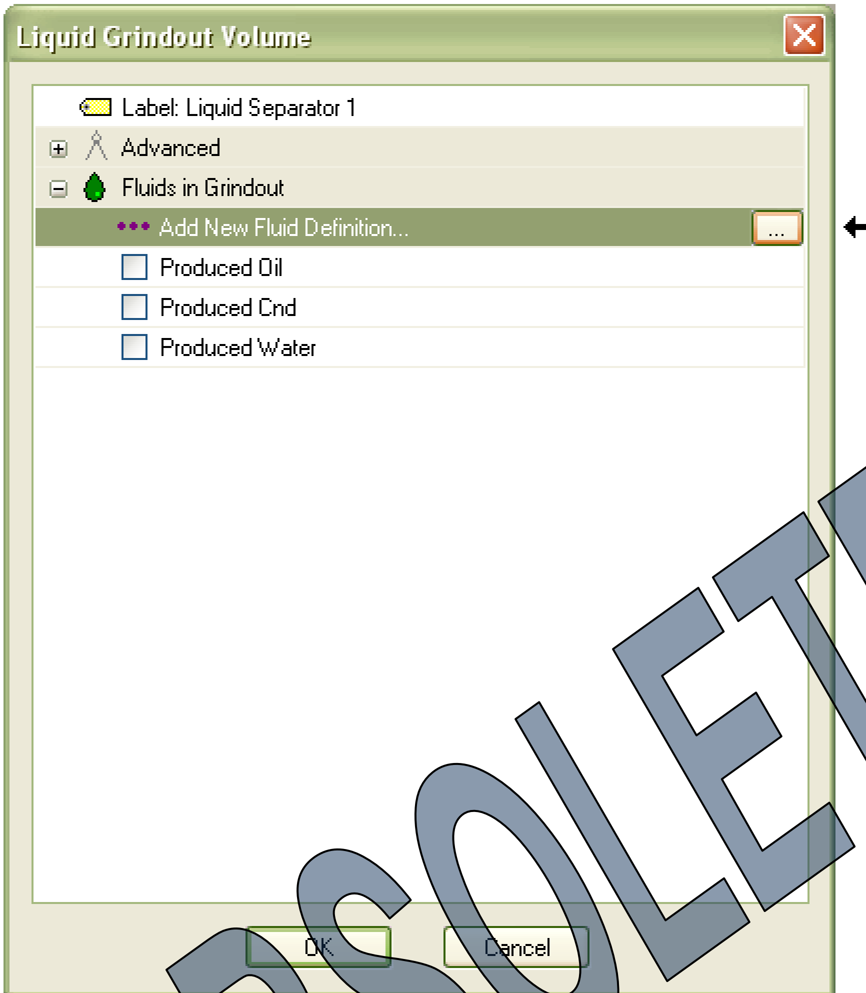
Liquid Separator Meter

The Liquid separator meter operates in a manner similar to that of the “produced volume” meter, except the BSW cut has been replaced by a special event called the “Grind-out” event.

The liquid separator can meter any liquid or solid defined in the test including; produced reservoir fluids, recovered load fluids, sands and other solids. New liquid types can be added or removed throughout the test. The grind-out event is used in conjunction with this meter to specify the actual fluids, and there relative volumes, throughout the test.



Under the “Fluids in Grind out” section all of the fluids, present in the test, are listed. The user can check the fluids that will be produced by this meter. All checked fluids will add into the data table.



New fluid types can be added at any time, throughout the test, by pressing the “Add New Fluid Definition” button (as shown above).

The "Add New Fluid Definition" allows the addition of other fluid types in addition to the predefined Oil, Water and Condensate types. Any fluid types already defined are grayed out in the dialog.

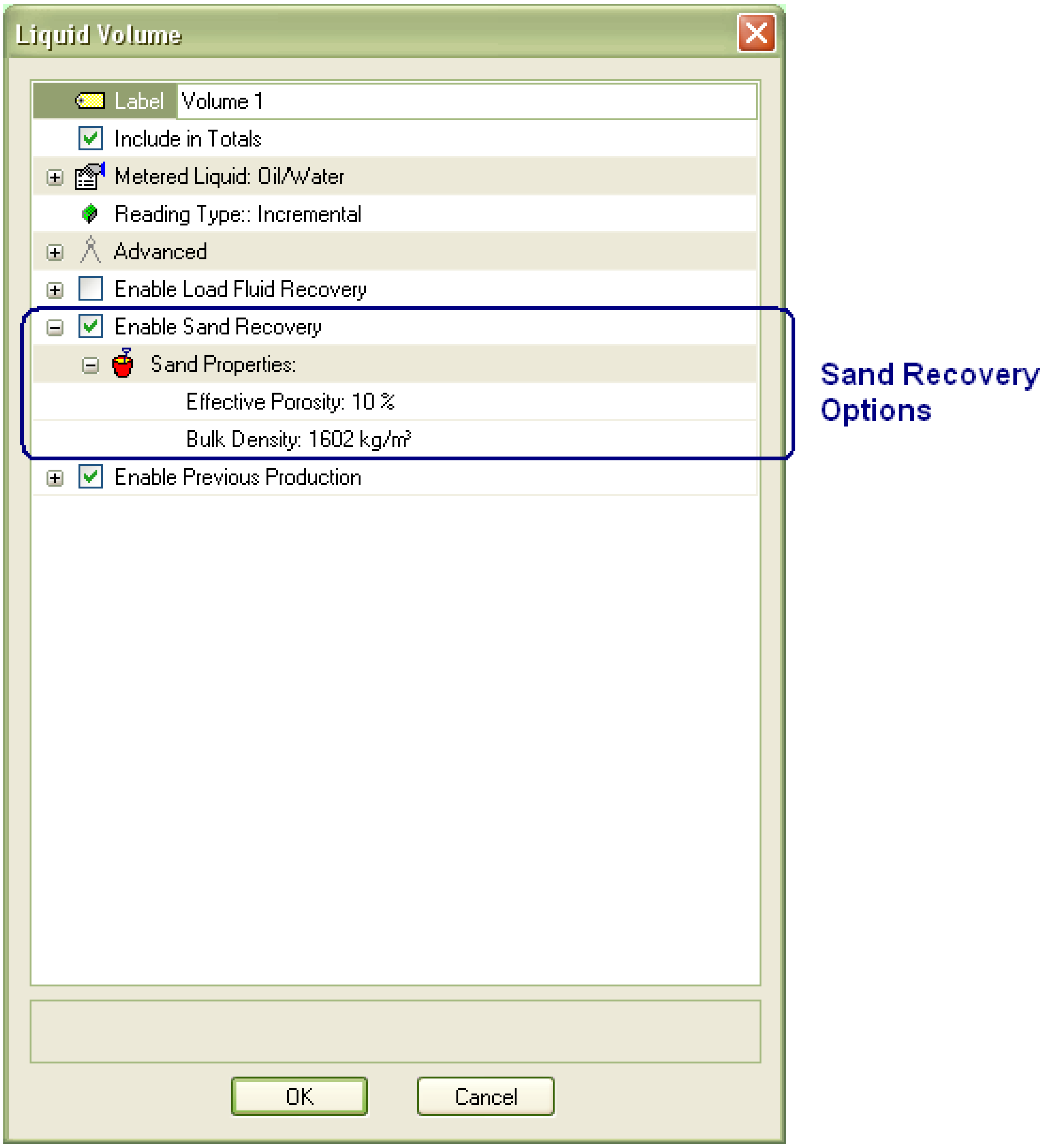
Select the new fluid to add to the Meter. The selected fluid will then be available under the "Fluids in Grind out" in the meter.

Any fluids specified as load fluid will add "LFLTR" and "RCVLF" columns in the data summary.

As noted above, the liquid separator meter works in conjunction with a grind out event (see event section for a description of the grind out event).

Sand Recovery

The sand recovery option will separate sand and water from the BS&W portion of any liquid meter producing water.



Sand Revovery Inputs:

- Effective Porosity provides a means of accounting for the extra water occupied within the pore space of the sand volume. See “Effect of Sand Porosity on recovered water volume” below.
- Bulk Density (if specified) will allow the recovered sand volumes to be reported in terms of recovered sand weight.

BSW	Oil Cum	BS&W Cum	Sand Cut	Sand Cum	Water Cum
%	m³	m³	%	m³	m³
50.0	0.000	0.000	10.0	0.000	0.000
50.0	5.000	5.000	10.0	0.500	4.500
50.0	10.000	10.000	5.0	0.750	9.250
50.0	17.500	17.500	5.0	1.125	16.375
50.0	18.500	18.500	5.0	1.175	17.325
15.0	23.600	19.400	5.0	1.220	18.180
15.0	24.450	19.550	0.0	1.220	18.330
15.0	25.300	19.700	0.0	1.220	18.480
15.0	27.000	20.000	0.0	1.220	18.780
15.0	27.850	20.150	0.0	1.220	18.930
15.0	29.550	20.450	10.0	1.250	19.200
15.0	31.250	20.750	10.0	1.280	19.470
15.0	36.350	21.650	10.0	1.370	20.280
15.0	38.900	22.100	10.0	1.415	20.685
15.0	40.600	22.400	0.0	1.415	20.985
15.0	43.150	22.850	0.0	1.415	21.435

Sand Recovery Series

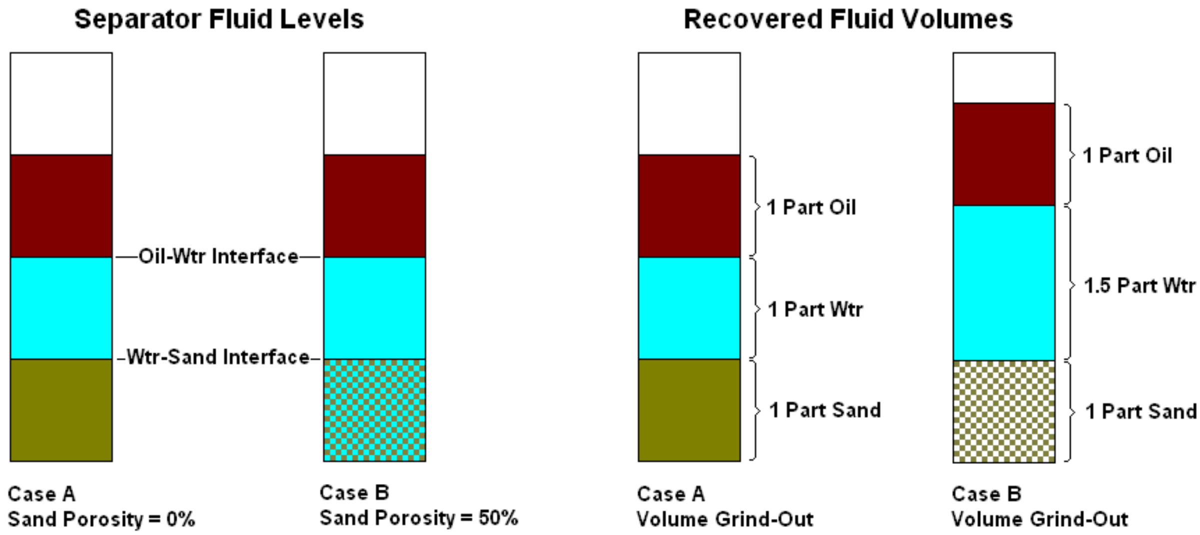
Sand Recovery Series associated with a Oil/Water meter.

The “Sand Cut” is a user entered value representing the relative portion of sand to water for the BS&W seperator fluid.

The” Sand Cut” input entered is always represents the water-sand percentage of the incremental BS&W gain, irrespective of the cumulative or incremental setting of the parent meter.

If the “Sand Recovery” option is used in conjunction with the “Load Fluid Recovery”
, and the recovered load fluid is water, then ALL metered sand is classified as a Recovered Frac Sand. As such, the sand will be classified as a load fluid in the totals and PAS report.
If “Load Fluid Recovery” is disabled or the load fluid is not water then the sand is classified as a reservoir fluid and is included as BS&W in the totals and PAS report.

Effect of Sand Porosity on recovered water volume.



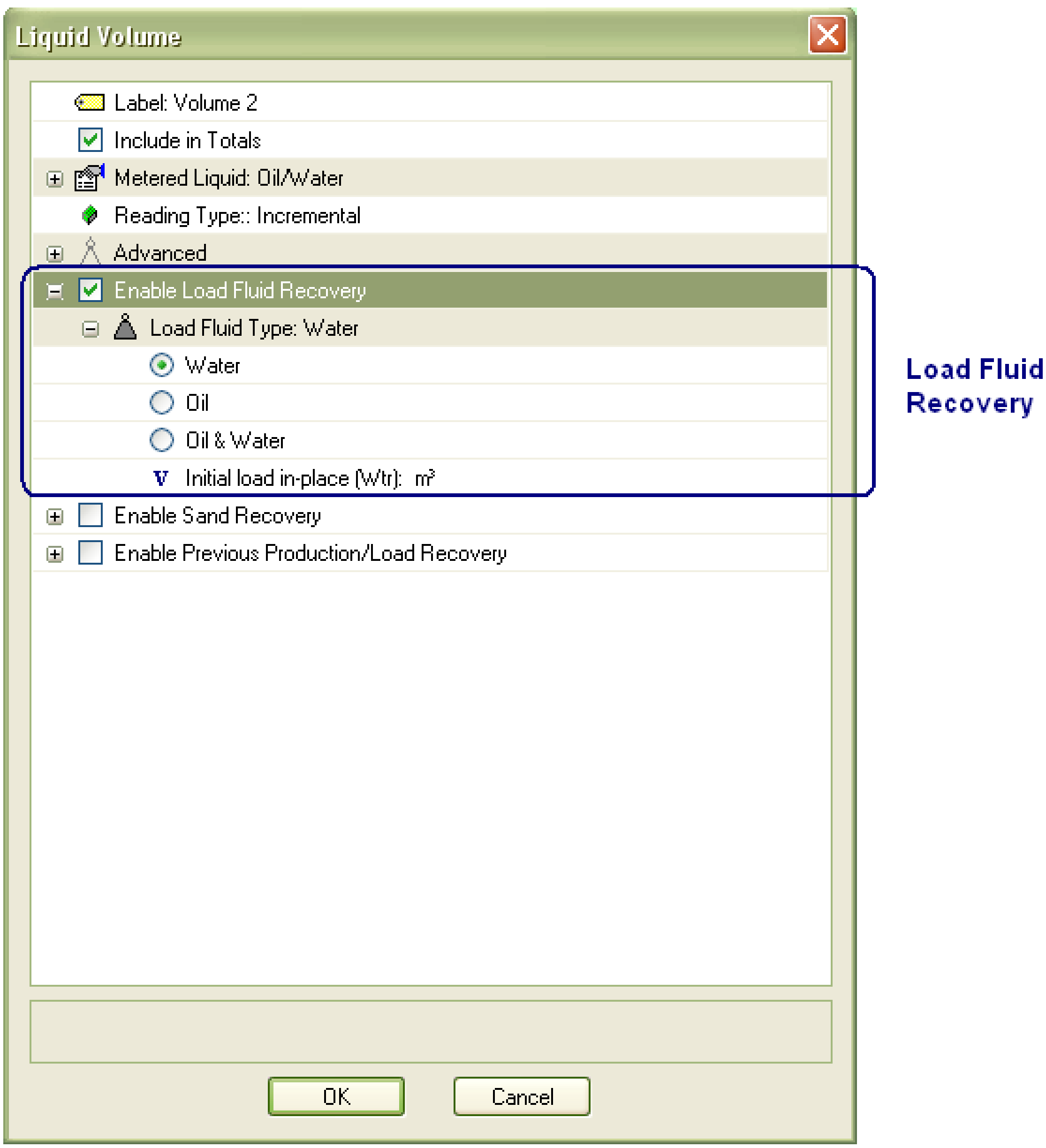
The Diagram above illustrates two cases where the separator fluid levels are identical but the recovered fluid volumes are not. Case A has a specified sand porosity of 0% as such it is assumed that no water is contained within the pore space of the sand. Case B has a specified sand porosity of 50% indicating that 50% of the sand volume contains water. As a result the recovered water volume for case B is the sum of the water contained in the sand pore space and the water above the water-sand interface.

Liquid Load Fluid Recovery

All liquid meters have an option to track recovered load fluid from produced liquids.
Features include:

- Track Load Recovered and Load Left to Recover
- Load recovery can start at any point in the test.
- Load fluid can be added at any point in the test.
- Additional load fluid can be added at any time.

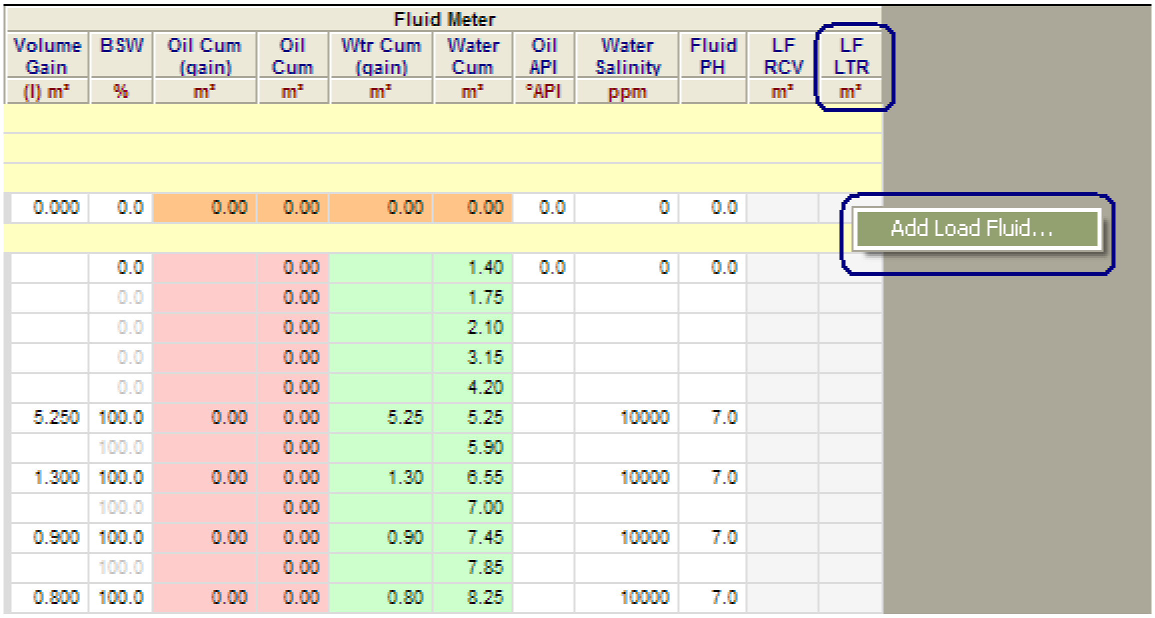
Procedure to enable load fluid recovery in liquid meters:



Enable the Load fluid recovery option in the liquid meter. And select the Load fluid type.

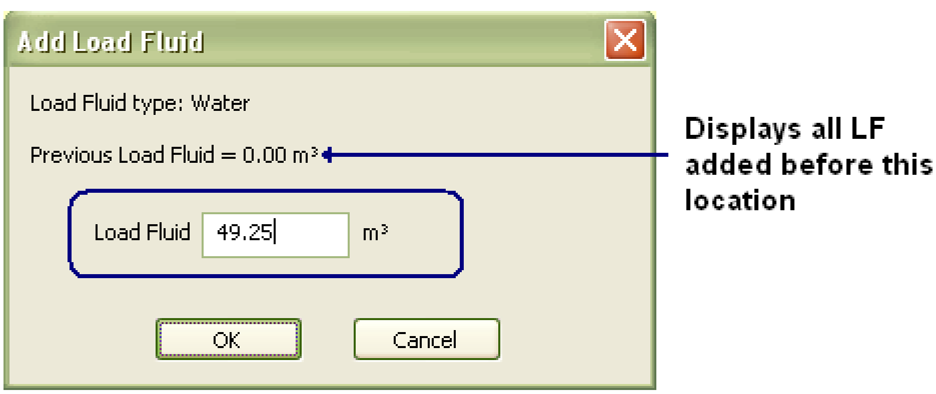
Fluid Meter										
Volume Gain (l) m³	BSW %	Oil Cum (gain) m³	Oil Cum m³	Wtr Cum (gain) m³	Water Cum m³	Oil API °API	Water Salinity ppm	Fluid PH	LF RCV m³	LF LTR m³
0.000	0.0	0.00	0.00	0.00	0.00	0.0	0	0.0		
	0.0		0.00		1.40	0.0	0	0.0		
	0.0		0.00		1.75					
	0.0		0.00		2.10					
	0.0		0.00		3.15					
	0.0		0.00		4.20					
5.250	100.0	0.00	0.00	5.25	5.25		10000	7.0		
	100.0		0.00		5.90					
1.300	100.0	0.00	0.00	1.30	6.55		10000	7.0		
	100.0		0.00		7.00					
0.900	100.0	0.00	0.00	0.90	7.45		10000	7.0		
	100.0		0.00		7.85					
0.800	100.0	0.00	0.00	0.80	8.25		10000	7.0		

The Load fluid recovery option creates two additional columns in the data table LF RCV (load fluid recovered) and LF LTR (load fluid left to recover).



Fluid Meter										
Volume Gain (l) m³	BSW %	Oil Cum (gain) m³	Oil Cum m³	Wtr Cum (gain) m³	Water Cum m³	Oil API °API	Water Salinity ppm	Fluid PH	LF RCV m³	LF LTR m³
0.000	0.0	0.00	0.00	0.00	0.00	0.0	0	0.0		
	0.0		0.00		1.40	0.0	0	0.0		
	0.0		0.00		1.75					
	0.0		0.00		2.10					
	0.0		0.00		3.15					
	0.0		0.00		4.20					
5.250	100.0	0.00	0.00	5.25	5.25		10000	7.0		
	100.0		0.00		5.90					
1.300	100.0	0.00	0.00	1.30	6.55		10000	7.0		
	100.0		0.00		7.00					
0.900	100.0	0.00	0.00	0.90	7.45		10000	7.0		
	100.0		0.00		7.85					
0.800	100.0	0.00	0.00	0.80	8.25		10000	7.0		

To set the initial load fluid to recover, 'right click' or 'double click' the LF LTR cell at the table row where you want to start recovering load fluid. (This will display the 'Add Load Fluid' dialog box below)



Enter the initial load fluid to recover and select OK.

Fluid Meter										
Volume Gain (I) m³	BSW %	Oil Cum (gain) m³	Oil Cum m³	Wtr Cum (gain) m³	Water Cum m³	Oil API °API	Water Salinity ppm	Fluid PH	LF RCV m³	LF LTR m³
0.000	0.0	0.00	0.00	0.00	0.00	0.0	0	0.0	0.00	49.25
	0.0		0.00		1.40	0.0	0	0.0	1.40	47.85
	0.0		0.00		1.75				1.75	47.50
	0.0		0.00		2.10				2.10	47.15
	0.0		0.00		3.15				3.15	46.10
	0.0		0.00		4.20				4.20	45.05
5.250	100.0	0.00	0.00	5.25	5.25		10000	7.0	5.25	44.00
	100.0		0.00		5.90				5.90	43.35
1.300	100.0	0.00	0.00	1.30	6.55		10000	7.0	6.55	42.70
	100.0		0.00		7.00				7.00	42.25
0.900	100.0	0.00	0.00	0.90	7.45		10000	7.0	7.45	41.80
	100.0		0.00		7.85				7.85	41.40
0.800	100.0	0.00	0.00	0.80	8.25		10000	7.0	8.25	41.00

The point where the load fluid is added is colored Blue. To change the initial load fluid, simply bring up the ‘Add Load Fluid’ at the blue cell.

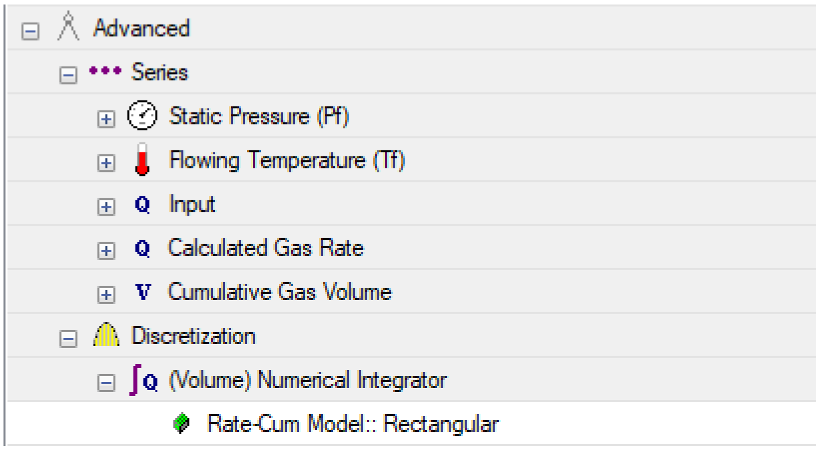
A load fluid of both oil and water can be specified for an oil meter by selecting “Oil/Water” as the load fluid type. When recovering both oil and water load, separate “LF RCV” and “LF LTR” columns will be created for each fluid type and the load is entered into each individually (oil, water).

Additional load fluid can may added at any time (as the test progresses) by simply ‘right clicking’ or ‘double clicking’ the LF LTR cell at the table row where you want to add additional load fluid.

In the example above, the initial load (of 49.25) can also be specified via the ‘Initial Load In-place’ entry in the meter properties window.

Advanced Meter Properties (common to all meters)

All meter configuration dialogs have an "Advanced" section which contains advanced of "less common" configuration variables. The following is a description of advanced properties common to all meters:

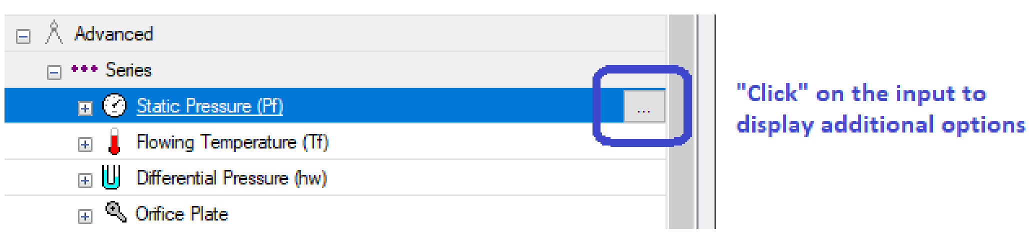


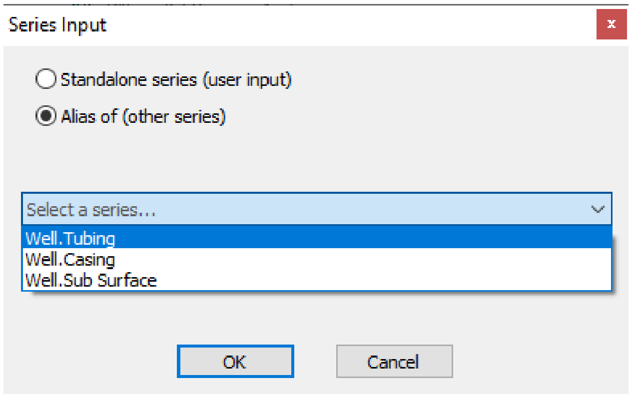
- The series section contains all the input and output series for the meter. The series can be properties can be individually set (for additional information see: Series Properties).

  Input series redirection:
  By default meter input series are set as discrete user entry columns when the meter is constructed. Meter inputs can also be redirected to use an existing series as a proxy for its input.

  <u>To redirect an input series:</u>
  1. Click on the series input to display the … button
  2. Click the … button to display the 'Series Input' window.
  3. Select 'Alias of (other series) to display a series dropdown of available inputs.
  4. Select the source series from the dropdown.

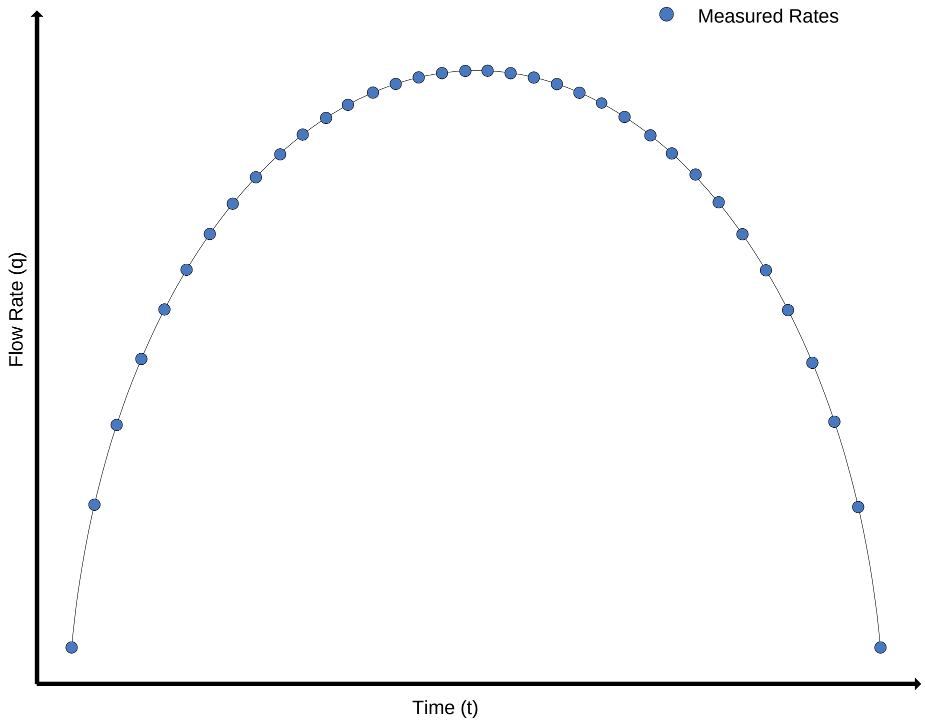
  See images below



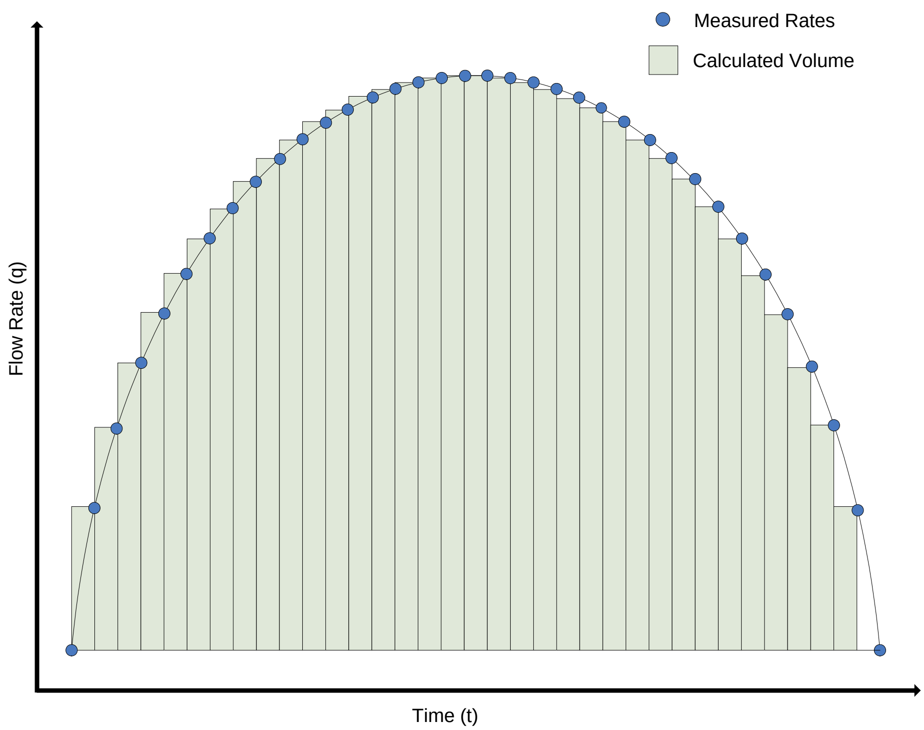


When a meter input series is redirected (or proxied) the respective input column stills appears for the meter however its appearance is grayed out (read-only) displaying the values of the source series.

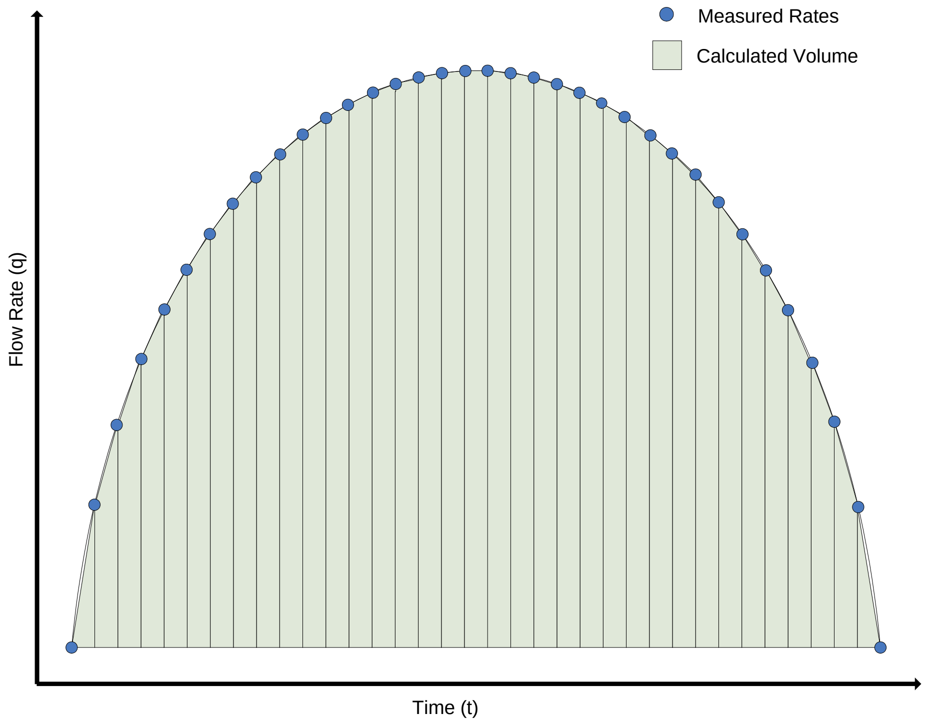
- Discretization sets the methods used to relate flow rates to cumulative volumes for the meter.
- Sampling is fixed at "End of Period" sampling where entered values represent the end of the flow period.
- (Volume) Numerical Integrator sets the method used to calculate cumulative volumes from calculated flow rates. (this option only appears in meters that directly calculate a flow rate) There are three options available; Trapezoidal, Rectangular and Trapezoidal (Detect Flow/Shut-in), as defined below.



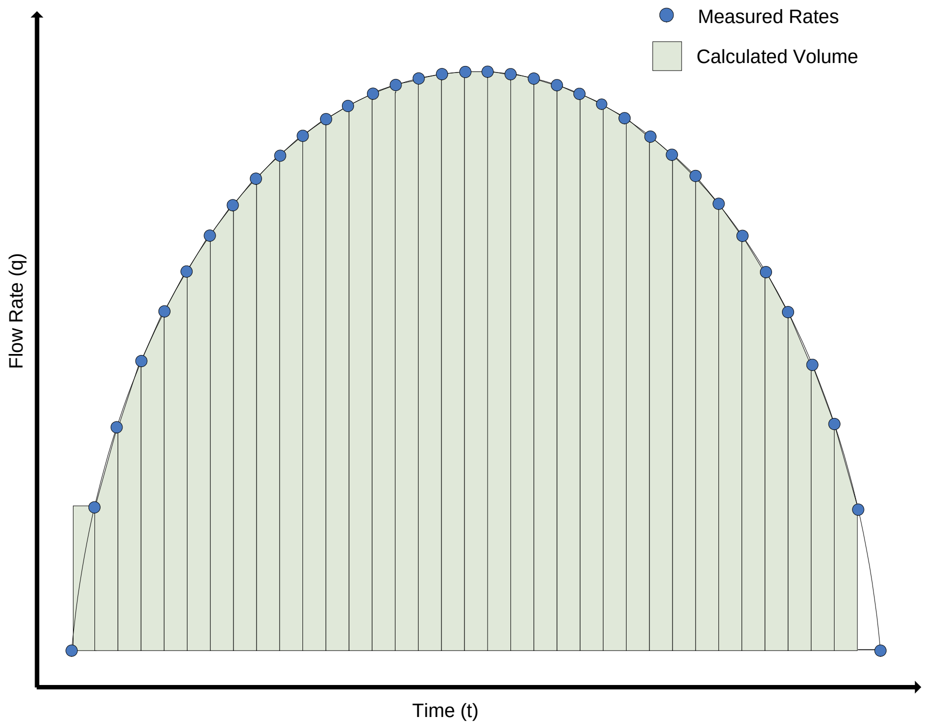
The diagram above illustrates a series of measured or calculated rates over time.



The diagram above illustrates the cumulative volume calculated by using a Rectangular volume integration method.



The diagram above illustrates the cumulative volume calculated by using a Trapezoidal volume integration method.



The diagram above illustrates the cumulative volume calculated by using a Trapezoidal (Detect Flow/Shut-in) volume integration method. This is a combination of the Trapezoidal and the Rectangular integration methods. Where the method is primarily trapezoidal with an exception for rate transitions to and from zero, where the rectangular method is used. When a meter rate calculation transitions to zero it is taken as a "flow to shut-in" condition, and is treated as an event asynchronous to the sampling process. Likewise, when a meter rate calculation transitions from zero it is taken as a "shut-in to flow" condition.

In general:

If the inputs into the meter calculation represent average values for the sample period, then the calculated flow rate is, also, representative of the average flow rate for the sample period. In this case, a" Rectangular" integration method should be used.

If the inputs into the meter calculation represent instantaneous values, then the calculated flow rate is representative of an instantaneous flow rate. In this case, a" Trapezoidal" Integration method could be used.

The Trapezoidal (Detect Flow/Shut-in) method is provided for compatibility with some pre-existing procedures used in production testing. <u>This method is not based on any accepted instrumentation practices, suffers from a lack of data portability and promotes poor sampling practice.</u> As such, this method is not endorsed by PetroClass.

An additional note:

The process of measuring and quantifying 'real world' analog quantities involves; not only obtaining a measured value, but also understanding the implied precision (or error) associated with the measured value. In the diagrams above, it may seem that trapezoidal integration fits the data more precisely than the rectangular method (and as such it should be used in the majority of cases) however there are some additional points the need be considered:

1. *As stated above, sampled data has an associated error band. As the sample rate increases the error band decreases (as does the difference between the differing methods).*
2. *If the data is random the trapezoidal and the rectangular methods are equally valid (irrespective of the sample rate). Additionally, if the data tends to trend in a single direction (i.e. a declining rate) more accurate results can be realized using a trapezoidal method.*
3. *The models described here are essentially different accounting methods used to calculate cumulative volume; any decision made here ultimately affects the material balance of the entire system. The trapezoidal method has an added consequence where; the flow rates are not representative of a normalized flow rate, required to honor material balance for all fluids. The following equation shows the relationship of the volumetric flow rates to the total mass flow rate for gas, oil, water and condensate.*

$$\mathrm{q_m} = \mathrm{q_{gas}} \cdot \rho_{\mathrm{gas}} + \mathrm{q_{oil}} \cdot \rho_{\mathrm{oil}} + \mathrm{q_{wtr}} \cdot \rho_{\mathrm{wtr}} + \mathrm{q_{cnd}} \cdot \rho_{\mathrm{cnd}}$$

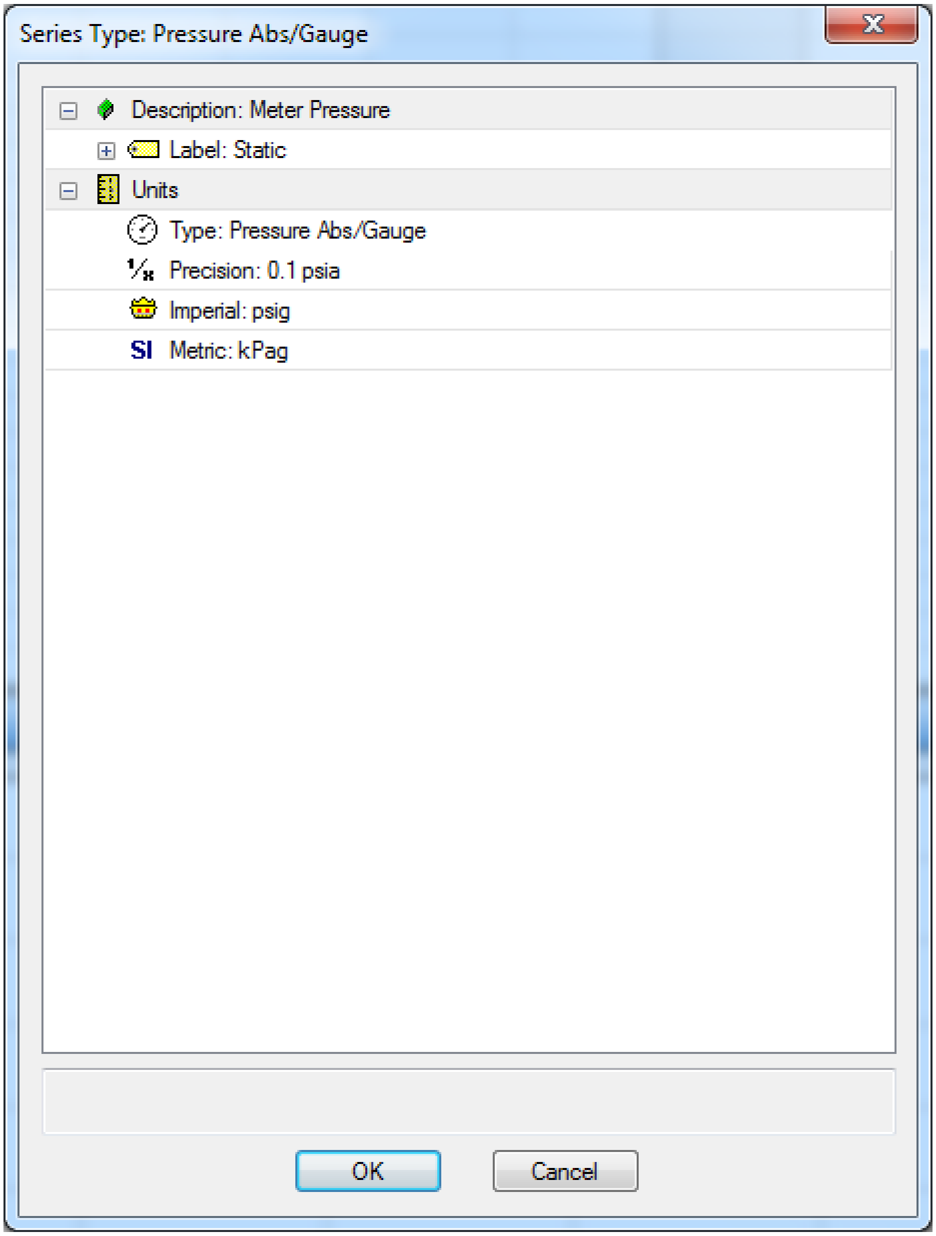
I order for this equation to hold true (honor material balance) each volumetric flow rate q_x should represent a common, normalized, flow rate such as those defined using a rectangular integration method. <u>Trapezoidal method flow rates need to be normalized for use in this equation.</u>

$\mathrm{q_{V(normal)}} = \frac{\Delta \mathrm{V}}{\Delta \mathrm{t}}$	*Normalized volumetric flow rate*
$\mathrm{q_{V(normal)}} = \frac{q_n + q_{(n-1)}}{2}$	T*rapezoidal volumetric flow rate to normalized volumetric flow rate*

<u>Flow rates and cums reported in the 'Data Summary' section of FlowTest, ensure the proper material balance across ALL phases of gas, liquid and solids, for ALL meters, irrespective of the discretization mode set at the meter level.</u>

Series Properties

The Series Properties dialog allows, the user, to edit the properties for a given series. The series dialog can be accessed by either by the 'Data Entry' Navigation bar or via the "Properties" context menu option on the table header.



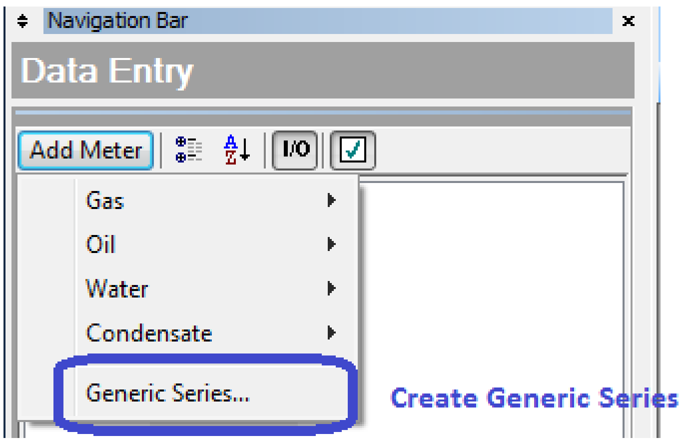
The Series Properties contains the following configuration variables.

- Label (edit the series name)
- Full Name (a non editable name displaying the parent object and series names)

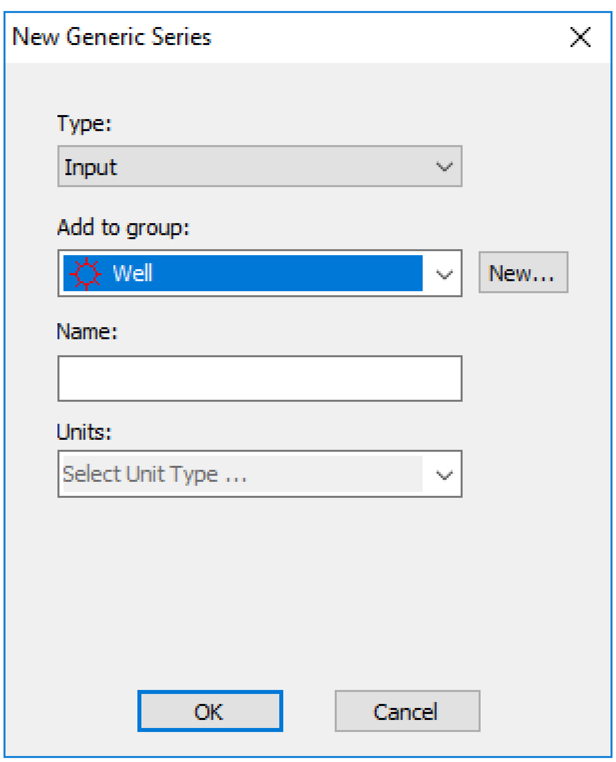
- Precision (set the precision of the series). The series precision sets the number of decimal points displayed in the tables for any given unit type. In the example above, a value of 0.1 psi will display 1 digit after the decimal point for psi unit types. A value of 0.01 psi will display 2 digits after the decimal point for psi unit types. For other unit types the appropriate number of decimal points is automatically selected based on the precision value.
- Imperial (sets the unit type for imperial unit mode)
- Metric (sets the unit type for metric unit mode)

Generic Series

All data series belong to either the well or summary group, or are created as part of a meter process with fixed roles to either input data or perform value added calculations.
There are times when the predetermined group and meter series are inadequate to record all required input data or special 'user defined' calculations are required, FlowTest provides a set of input and calculated generic series to fulfill these requirements.



Generic series are created via the 'Add Meter' button on the top of the Navigation Bar. The 'Add Meter' button provides a dropdown, from there select "Generic Series…" to display the 'New series' window shown below.



New Generic Series window to create generic series.

The ‘New Generic Series’ window allows the user to specify the type and attributes for the generic series including:

- Type — Generic series can be either a column to record data values or some other value added calculation as follows:
  - Input — Provides a means to record data readings of a given type.
  - Calculated (formula) — Allows for calculations based on a user specified formula.
  - Flow-Time — Calculates a cumulative flow-time for a user specified set of gas and liquid cums.

- Group — The group option specifies the parent group for the new series. All FlowTest series are associated with a parent grouping, these may be fixed groups like the ‘well’ or ‘summary’ groups or user created meter groupings. The ‘Add to Group’ dropdown contains all existing groups and meters, in addition, a new (user defined) group can also be created via the ‘New’ button.

- Name — The series name as it will appear in the data table header.

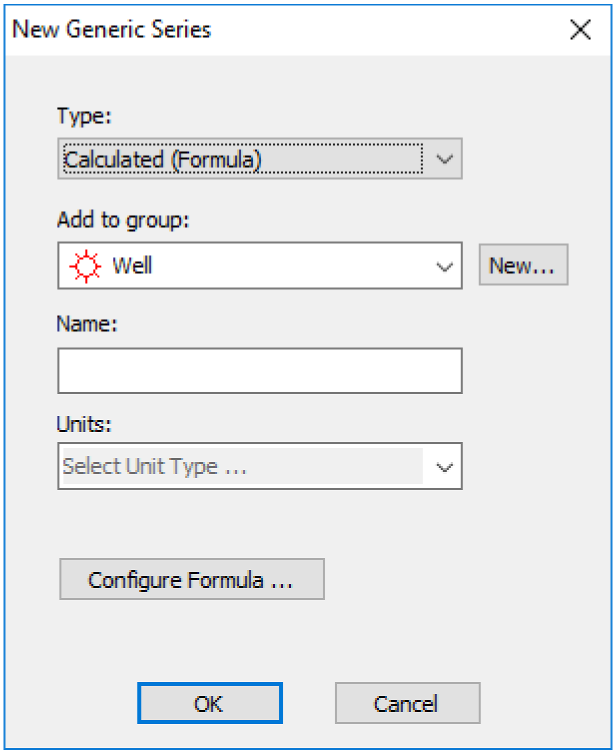
- Units — The Units drop-down defines the unit type for the series. In the case of ‘input’ or ‘formula calculated’ series, the user can select the resulting type. For flow-time the unit type if fixed to be ‘cumulative time’.

Input Generic Series

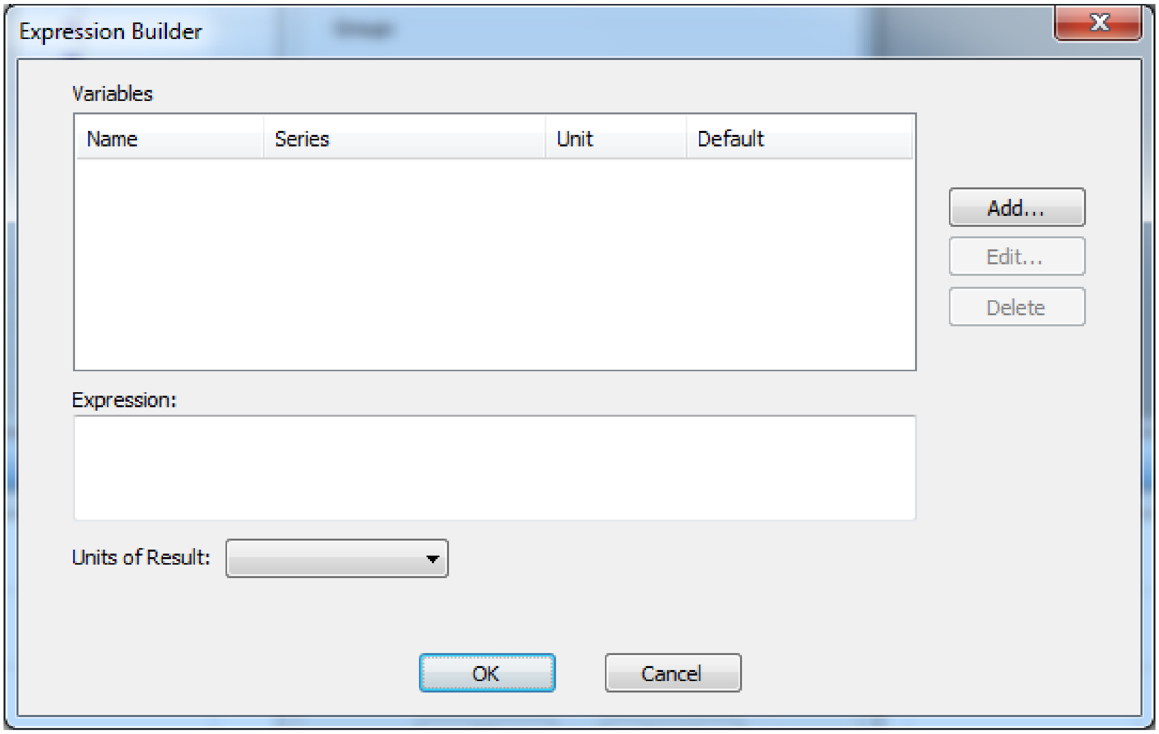
As stated above, input generic series provide a means for the user to input (and report) data that is not included through the default group or meter series. Input generic series are the simpler of the two generic series types where the user need only specify the group, series name and type then select “OK’ on the ‘New Series’ window to create the series.

Calculated (formula) Generic Series

Creating a calculated generic series is more involved than creating an input series, as it requires specifying a calculation expression, which can range from a simple series clone to an advanced mathematical formula involving several input variables.



When 'Calculated (formula)' type is selected, the 'Configure Formula ...' button is enabled allowing for the definition of the series calculation. Pressing the 'Configure Formula...' button displays the 'Expression Builder' window as follows:



Generic Series Expression Builder

The expression builder window's purpose is to define the series calculation. There are three main components to defining the series formula:

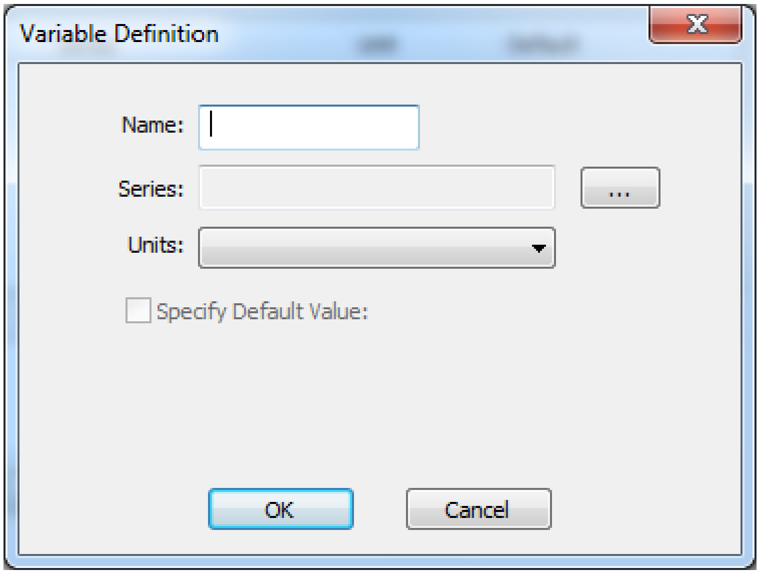
- The calculation expression:
  The calculation expression is a user defined expression, using standard mathematical notation, which defines the series calculation.
- Expression variables:
  Formula variables are references to other data series and provide input to the calculation expression engine.
- Resultant Unit/Type:
  The 'Units of Result' essentially specifies the unit of the expression result. The series 'type' (pressure, temperature…) is specified in the initial creation window and as a result, the 'Units of Result' dropdown contains the available units for the type specified.

For the 'Calculated Generic Series' the series output (or calculation) is governed by the mathematical expression entered into the 'Expression' box. The expression receives input in the form of variables; variables are the output from other data series and are defined in the 'Variables' box.

<u>The 'Expression Builder' can also be accessed from the 'Series Properties' window (of the generic series) for viewing/editing of the expression after the series is created.</u>

Defining expression variables:

The Variables box displays the variable definitions that can be used in the calculation expression. New variable are created via the ‘Add…’ button which displays the ‘Variable Definition’ window, as shown below:



Variable Definition window (data series input for calculation expression)

The ‘Variable Definition’ window contains the following inputs:

- Name specifies the variable name (this is the name that will be referenced in the calculation expression).
- Series the ‘…’ button allows the user to select the data series as the variable source.
- Units once a series is specified, the ‘Units’ dropdown will be populated with all available series units. The selected unit specifies the units returned when the variable is referenced in the expression.
- Default the ‘Specify Default Value’ when checked, allows for a default value (in the selected units) to return when the series value is empty (null).

  Variable names may contain the following characters:
  - *upper/lower case A-Z*
  - *numbers 0 -9*   *(first character cannot be a number)*
  - *underscore _*

Defining Calculation Expressions:

The 'Expression' box contains the series calculation expression and is the heart of the series makeup. The expression uses standard mathematical notation referencing the defined series variables by name.

The calculation expression represents the right-side of a mathematical equation as follows:

Calculated_Series_Output[n] = Expression[n]

Where: 'n' represents a series reading

For the expression side, all input variable are evaluated as: variable[n]

The expression may contain:

- standard mathematical operators: */+-
- parenthesis to specify precedence: ()
- defined variable (by name) to provide input
- predefined function such as: sin(), cos(), tan()…

For a complete list of supported operators and functions see:
Generic Series Expression Reference in Appendix C

When entering an expression in the 'Expression Builder' window you are entering the right-side of the equation where, the first character of the entry should be the "=" sign.
The "=" sign is optional and if omitted it is automatically added by the software.

Implementation Note:

When declaring series variables all declared variables are evaluated (value assigned per reading) prior to evaluating the expression, if the result of ANY variable evaluates to be null (after applying any specified default) the expression evaluation is skipped (for the reading) and the out value is set as null, even if the null variable is not actually used in the expression.
This behavior can be useful to prevent output on specific readings (i.e. readings with no associated time) by including a variable (i.e. cum time) without any reference in the expression.

Expression Examples:

- **Constant Value**
  Variables: none
  Expression: **= 7**
  Comment: Assigns the constant value of 7(in the result units) to all readings. Not very practical, but essentially the simplest expression possible.
- **Series Clone**
  Variables: **TubingPres** (references the Tubing Pressure Series)
  Expression: **= TubingPres**
  Comment: Essentially clones the tubing pressure series.
  This can be useful if you want to display tubing pressure in different units in the data table. <u>Note: It is important that the variable and the result units match!</u>

- **Difference Calculation**
  Variables: **TubingPres** (references the Tubing Pressure Series)
  CasingPres (references the Casing Pressure Series)
  Expression: **= TubingPres – CasingPres**
  Comment: Provides a "Tubing – Casing" calculation. Note: Tubing and Casing units must be the same and the result units would also be the same with the exception that the type should NOT be specified gauge/absolute (as the result is a relative pressure).
- **Rate Sum**
  Variables: **Q1** (reference to flow rate 1)
  Q2 (reference to flow rate 2)
  Expression: **= Q1 + Q2**
  Comment: Provides the sum of two rates. Note: as stated previously, units must match. In addition, a default value of zero should be specified for the Q1 and Q2 variables if there is a possibility of having null reading for either series.

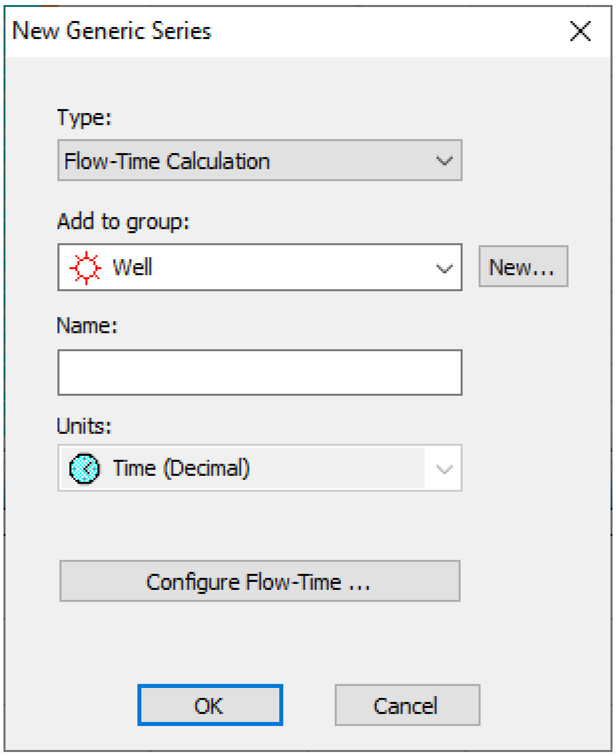
Calculation Errors:

If there is an error in the expression (be it syntax i.e. misspelled name or logical i.e. division by zero) the reading output is set to null for the affected readings. For less obvious errors the series may output the following error codes:

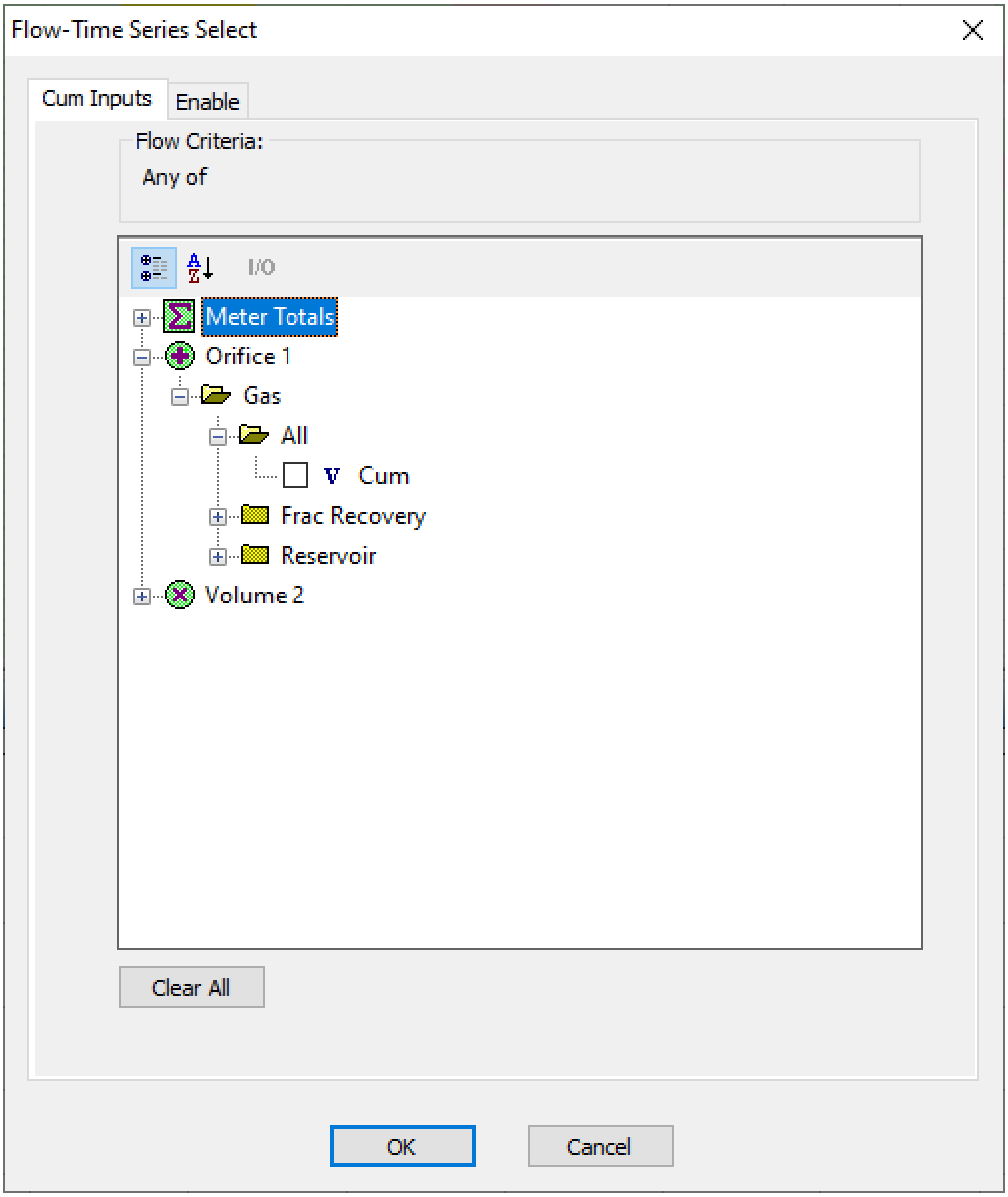
- REF! Indicates that a series variable references a deleted series.
- CREF! Indicates that the expression contains a variable with a circular reference.

Flow-Time Generic Series

The Flow-time generic series allows for customized flow time calculations based on any combination of gas or liquid flows.



When 'Flow-Time Calculation' type is selected, the 'Configure Flow-Time ...' button is enabled allowing for the definition of the series calculation. Pressing the 'Configure Flow-Time ...' button displays the 'Flow-Time Series Select' window as follows:



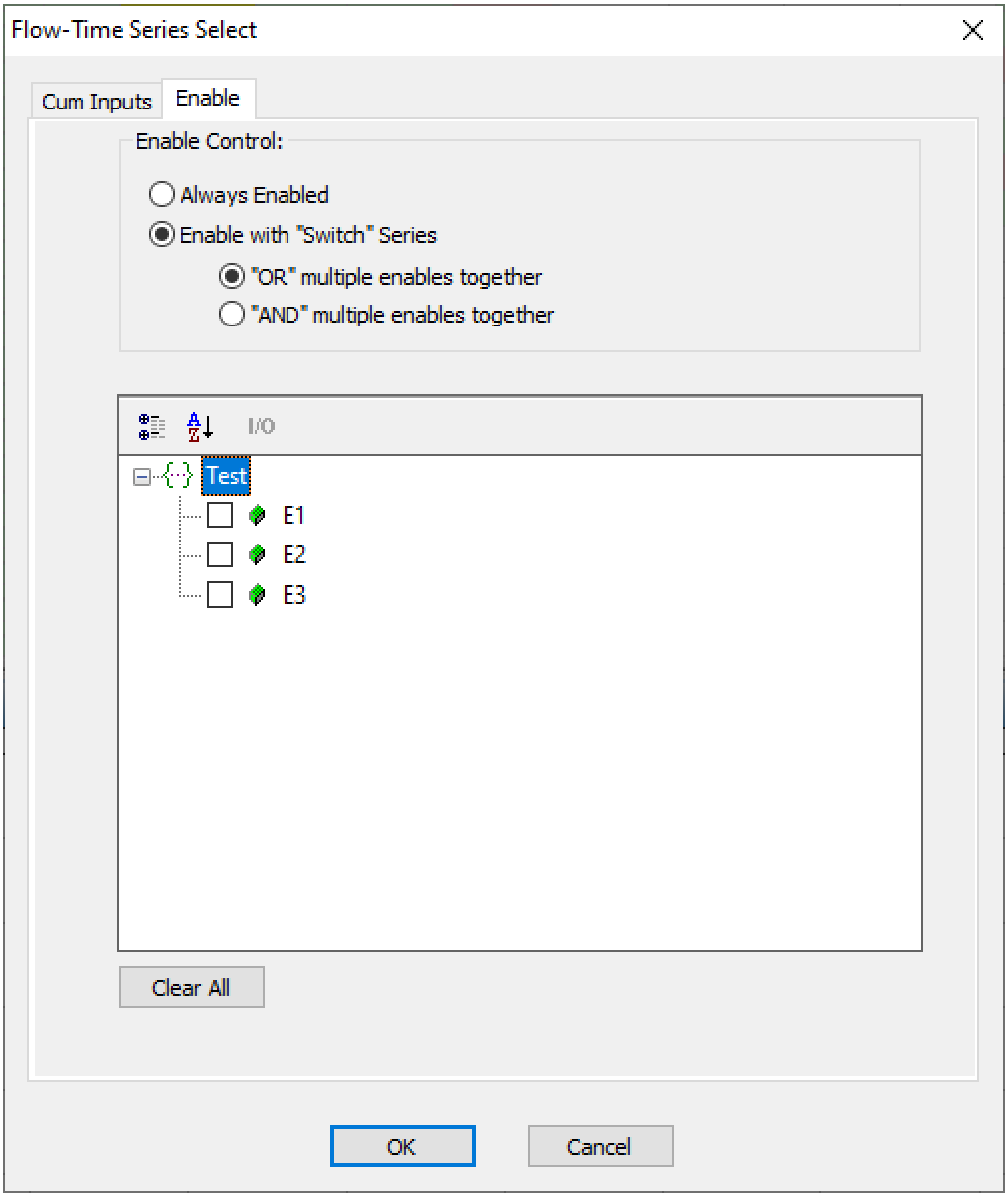
The ‘Flow-Time Series Select’ window contains two configuration tabs:

1. The ‘Cum Inputs’ tab specifies the Flow Criteria. This is currently limited to a single option of ‘Any of’ the meaning of which is:
   <u>Any of the cumulative series selected will determine flow.</u>

   All available gas and liquid cums are displayed and are available for the target flow-time calculation. Select (check off) the fluids for the calculation.

2. The ‘Enable’ tab is an optional configuration that allows you to select a switch series to enable/disable the flow-time calculation on-the-fly by connecting series switches.

A single ‘switch’ series can be selected to control when the flow-time calculation is enabled, Multiple ‘switch’ series can also be selected with ‘OR’ ‘AND’ logic applied to determine the enabled state.

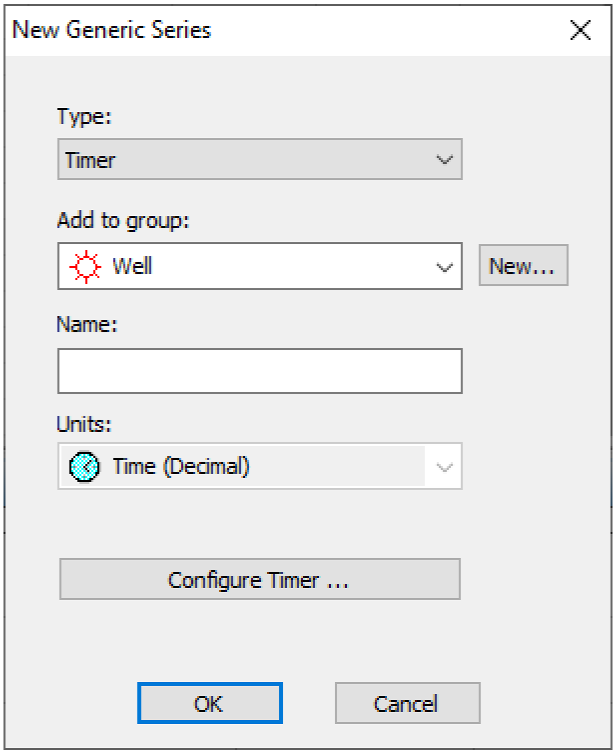


For more information on configuring ‘switch’ series, see ‘Toggle Switch Generic Series’ below.

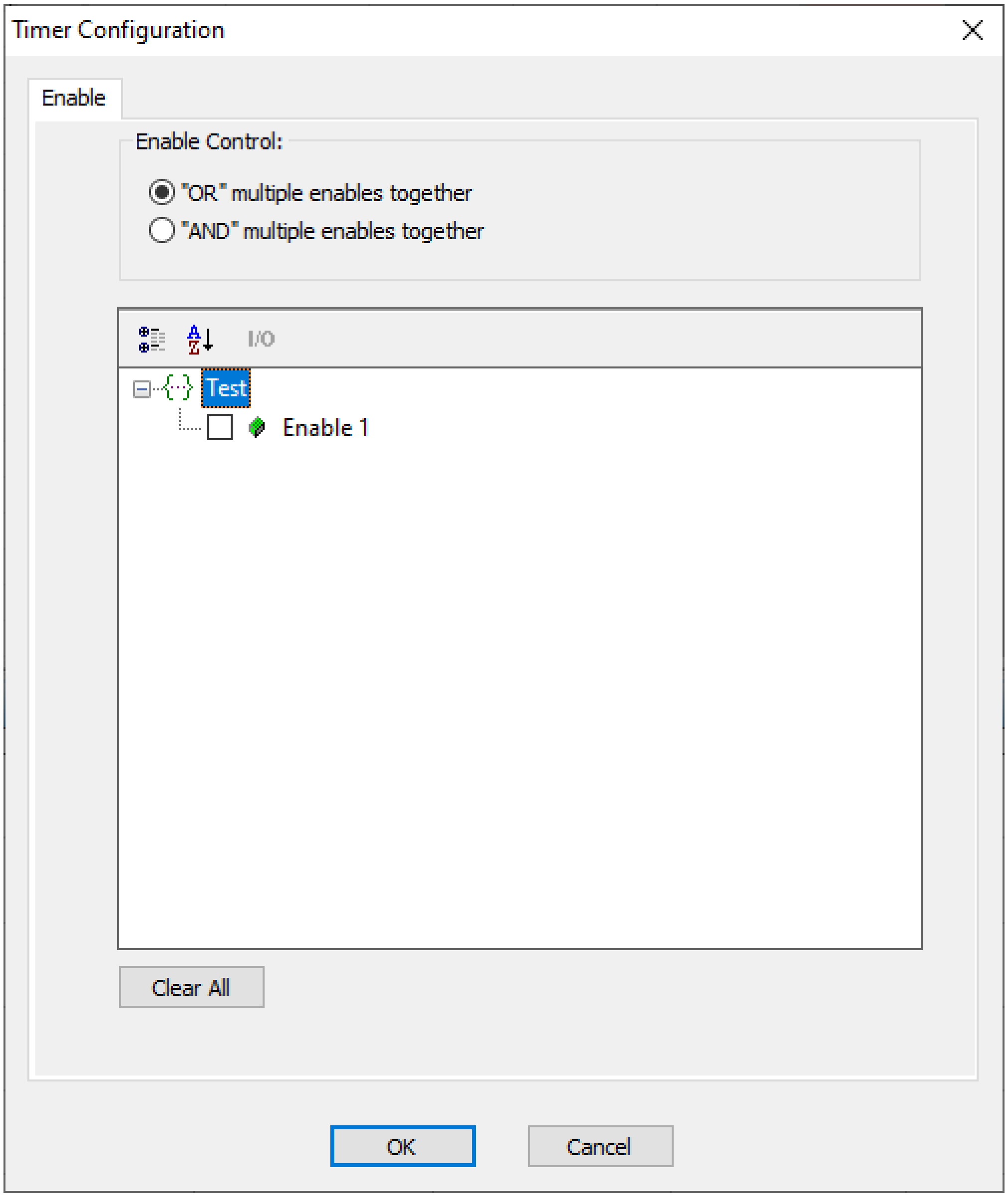
The ‘Flow-Time Series Select’ window can also be accessed from the ‘Series Properties’ window (of the generic series) for viewing/editing of the expression after the series is created.

Timer Generic Series

The Timer series can be used as a generic timer to track the elapsed time of any test operation sequence. The Timer series works in conjunction with the On/Off Toggle Switch sees to start and stop the timer.



When 'Timer' type is selected, the 'Configure Timer ...' button is enabled allowing for the selection of the control series. Pressing the 'Configure Timer ...' button displays the 'Timer Configuration' window as follows:



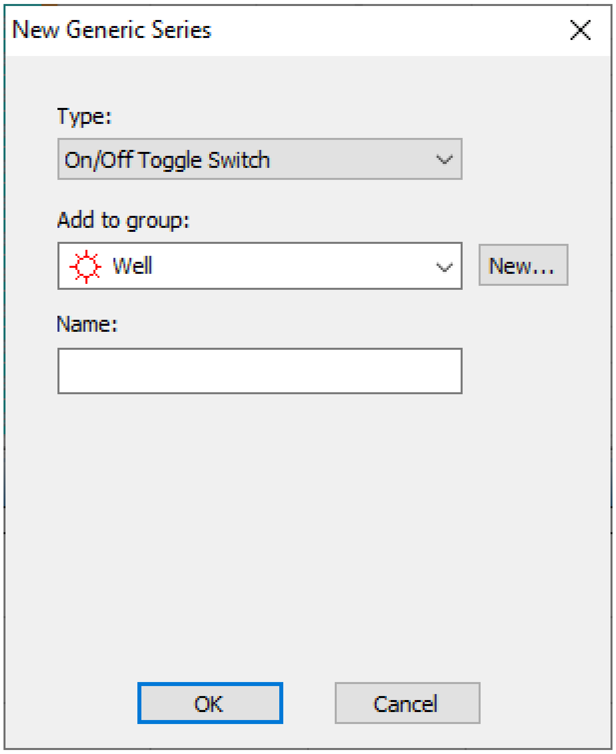
A single ‘switch’ series can be selected to control when the timer is enabled, Multiple ‘switch’ series can also be selected with ‘OR’ ‘AND’ logic applied to determine the enabled state.

For more information on configuring ‘switch’ series, see ‘Toggle Switch Generic Series’ below.

The ‘Timer Configuration’ window can also be accessed from the ‘Series Properties’ window (of the generic series) for viewing/editing of the expression after the series is created.

Toggle Switch Generic Series

The ‘Toggle Switch’ creates a series that implements a simple on/off state.

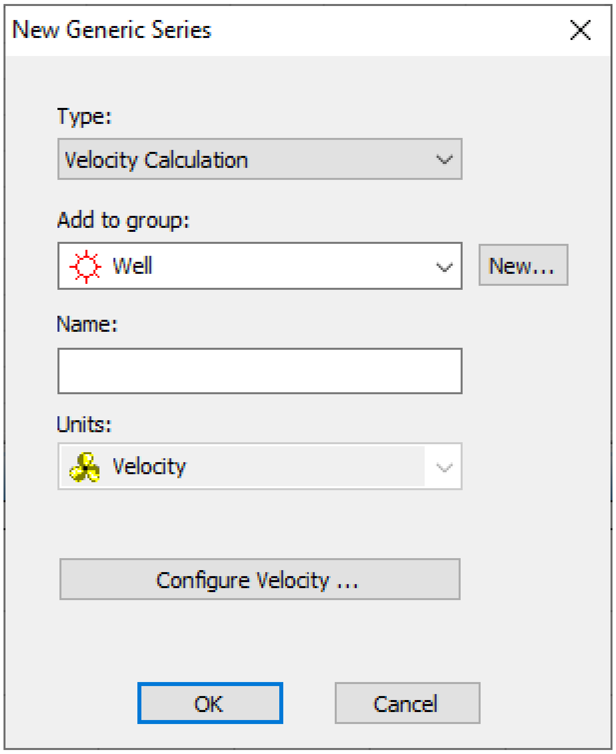


The ‘Toggle Switch’ series can be used on its own to indicate the state of on operation i.e. a pump is on or off, or can be used as an input to an enable line of another series such as a generic series flow-time calculation.

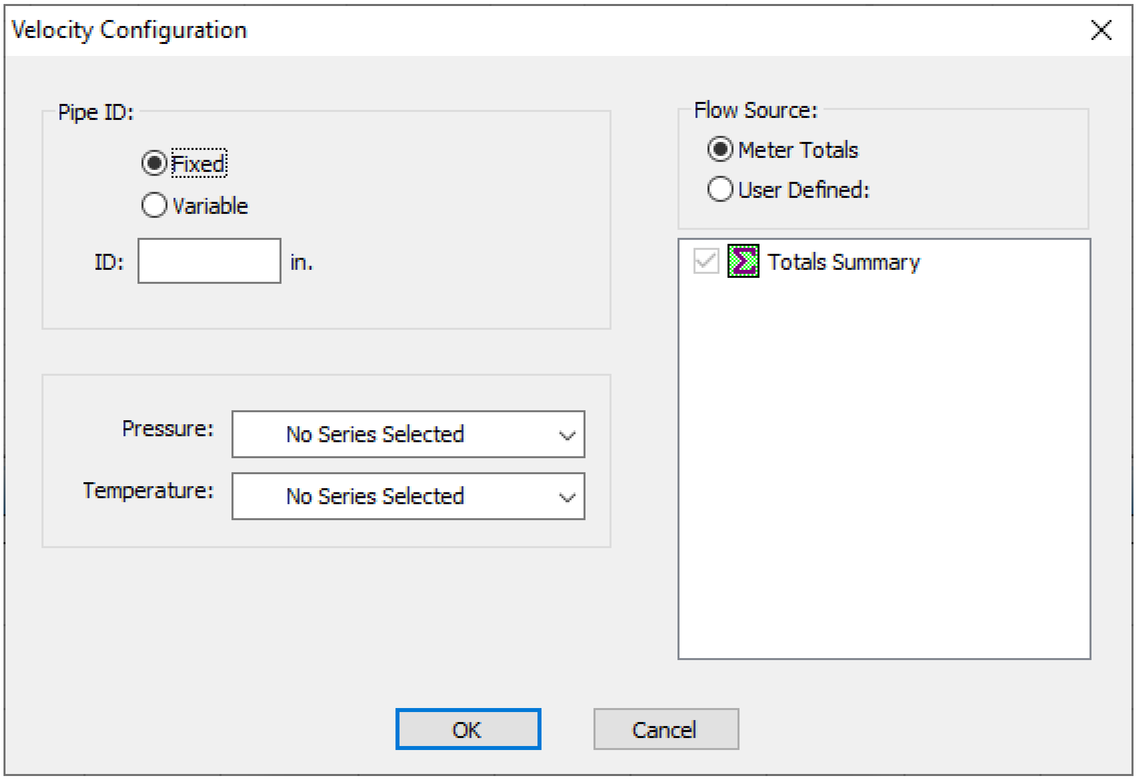
<u>Additional configuration options to specify the on/off state text and cell colors can be set in the ‘Series Properties’ window (of the generic series).</u>

Velocity Generic Series

The velocity generic series allows for customized velocity calculations based on any combination of insitu gas and liquid flows.



When ‘Velocity Calculation’ type is selected, the ‘Configure Velocity ...’ button is enabled allowing for the definition of the series calculation. Pressing the ‘Configure Velocity …’ button displays the ‘Velocity Configuration’ window as follows:



'Pipe ID' specifies the inside diameter for the flow. This can be either a fixed value or a series of values that change in time.

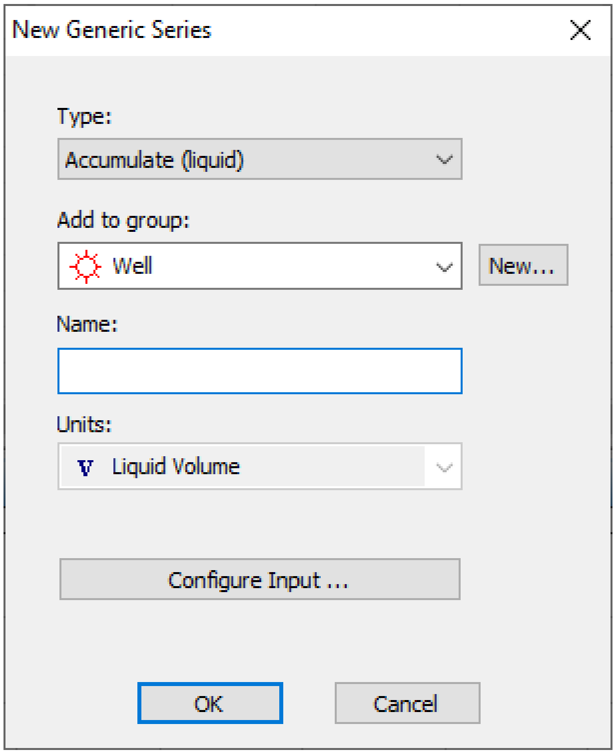
The 'Pressure' and 'Temperature' series specify the insitu pressure and temperature of the mixture at the location of the specified pipe ID.

The 'Flow Source' specified the meters that make up the mixture flow. Two options are available:

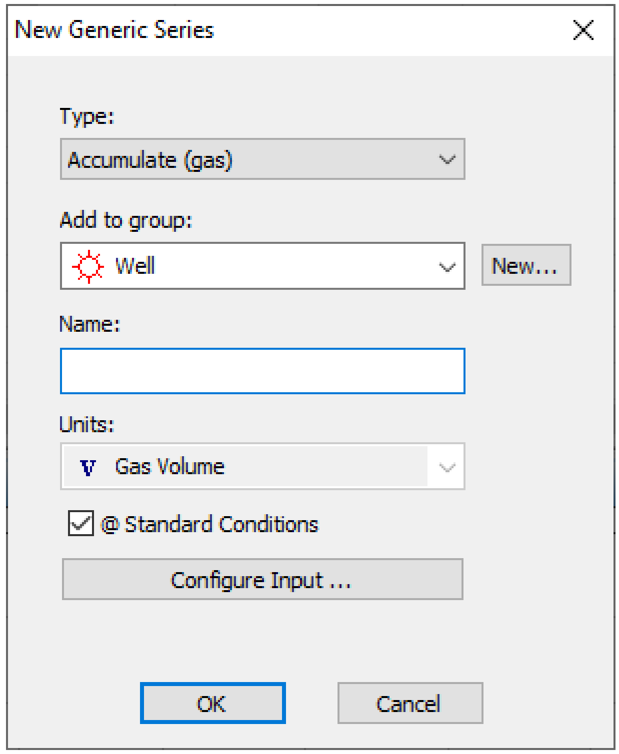
1) Meter Totals — this specifies that the mixture source will be all meters that are included in the totals.
2) User Defined — user defined mode allows the user to specify any combination of active meters to make up the mixture flow.

Flow Accumulator Generic Series

The Flow accumulator generic series calculate the cumulative volumetric flow for a gain or rate input series. The input series can be either liquid or gas with an additional “gas” option to specify the calculated gas cum is at standard conditions.



Liquid Accumulator



Gas Accumulator

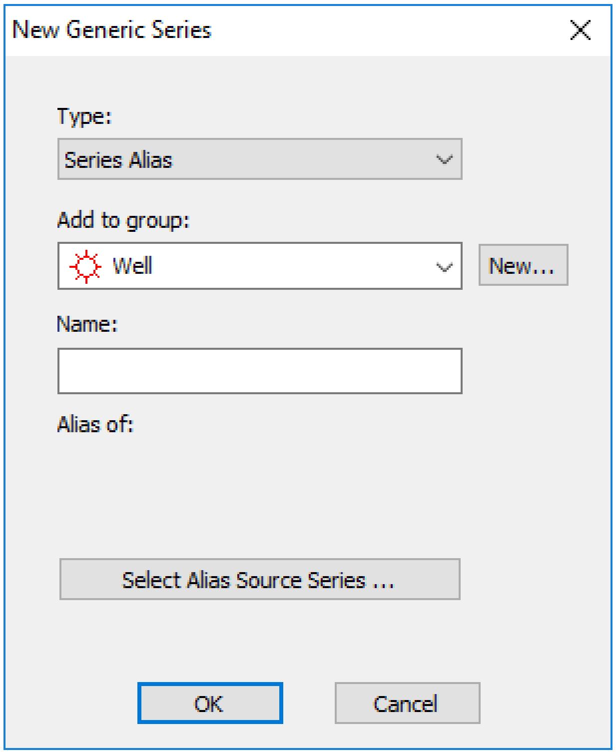
The ‘Configure Input…’ button displays a window to select the input series to accumulate.

For the gas mode selecting the ‘@ Standard Conditions’ option, creates a cumulative series that will adjust volumes according to the active pressure and temperature base conditions.

<u>Additional configuration options to previous production and change the calculation input series can be set in the ‘Series Properties’ window (of the generic series).</u>

Series Alias Generic Series

The series alias allows you to 'clone' any series. The alias (or 'cloned') series becomes a new series that is a reference to the original source series data.



To create a series alias:

- Select 'Series Alias' as the type.
- Select the group to create the new series in.
- Specify a name for the new alias series.
- Use the 'Select Alias Source Series…' button to select the alias source.

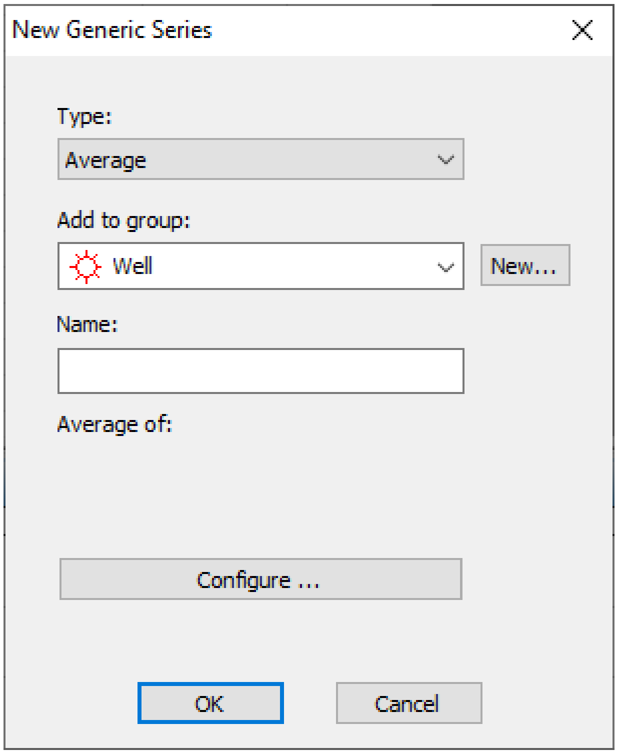
The new alias series becomes an exact copy of the source series and changes as the source data changes. The Alias is effectively a reference to the source series data.

Although the alias is a reference to the source series data, the alias series properties, such as: name and units, can be configured independently. For example you can create an alias of 'Tubing Pressure' and have 'Tubing Pressure' display in kPag and the 'Alias of Tubing Pressure' display in psig.

By default the alias series is set to read-only (it is a read-only reference to the source) however if it source is not read-only the alias can also be configured to be editable (via. the 'Read-Only' option in the series property window). When the alias is not read-only, changes to the alias will change the source and vise versa.

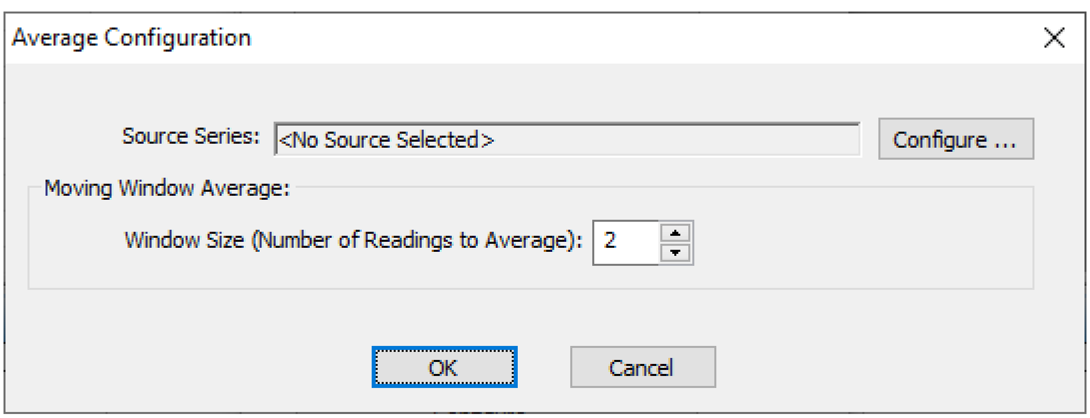
Average Generic Series

The average generic series calculates a moving average of the source series.



To create a series alias:

- Select ‘Average’ as the type.
- Use the ‘Configure …” button to display the ‘Average Configuration’ window.



In the configuration window you can specify the source series and select the size of the moving average window.

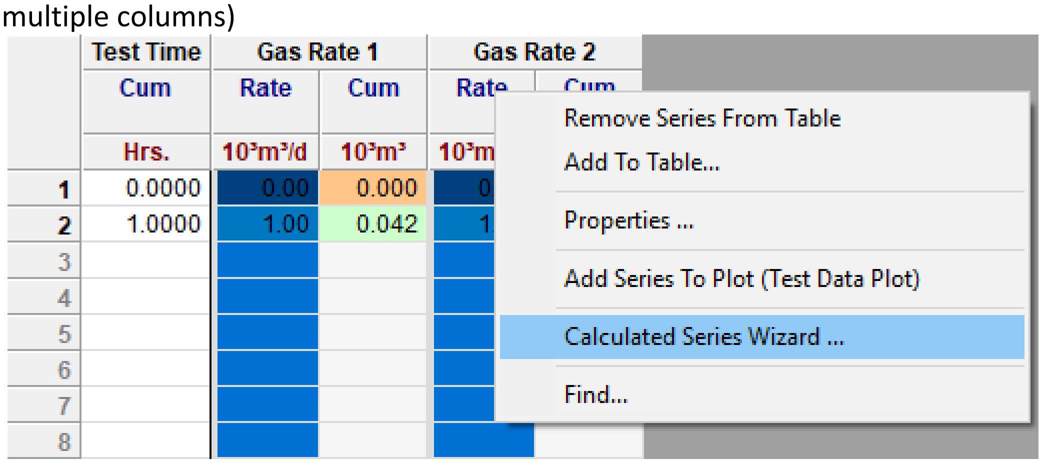
Generic Series Creation Wizard

The Generic series creation wizard can simplify the task of creating calculated generic series for some common scenarios.
The wizard is launched from the data table by first selecting the data columns (series) that will be calculation inputs then 'Right-Click' the table column header and select "Calculated Series Wizard…"

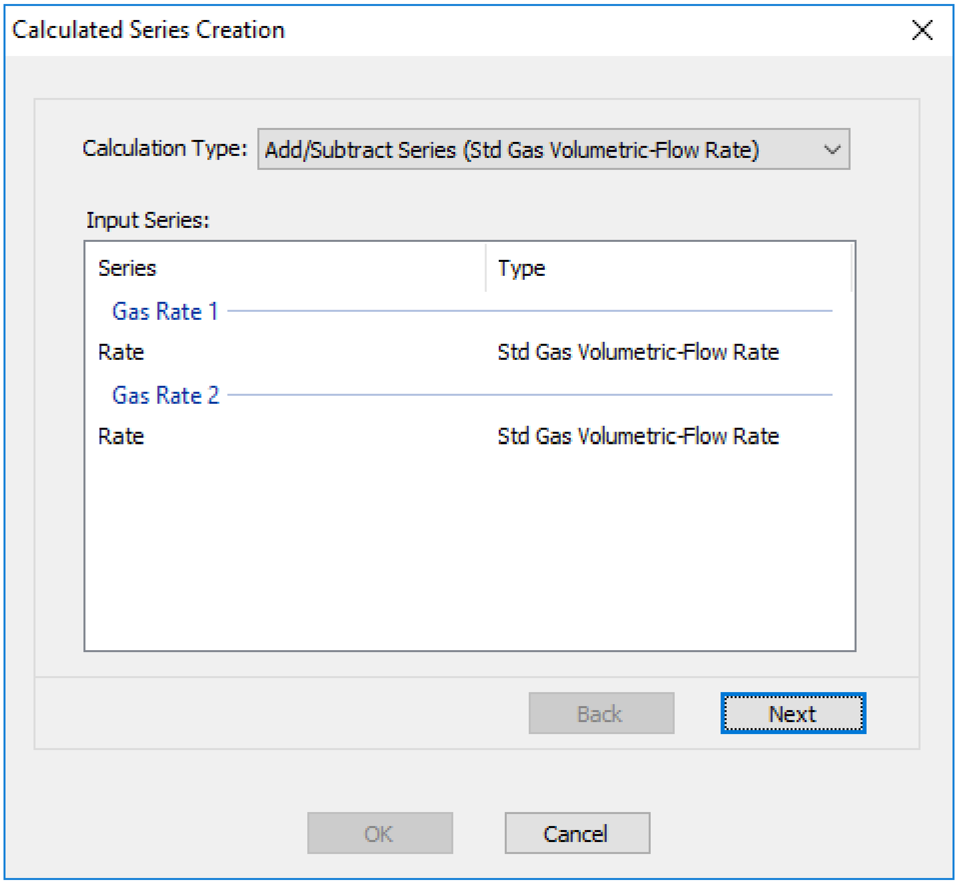
The wizard operation is best illustrated with an example.
Given the two gas meters below, we will create a calculated generic series that is the sum of the two meter gas rates.

	Test Time	Gas Rate 1		Gas Rate 2	
	Cum	Rate	Cum	Rate	Cum
	Hrs.	$10^3m^3/d$	10^3m^3	$10^3m^3/d$	10^3m^3
1	0.0000	0.00	0.000	0.00	0.000
2	1.0000	1.00	0.042	1.00	0.042
3					

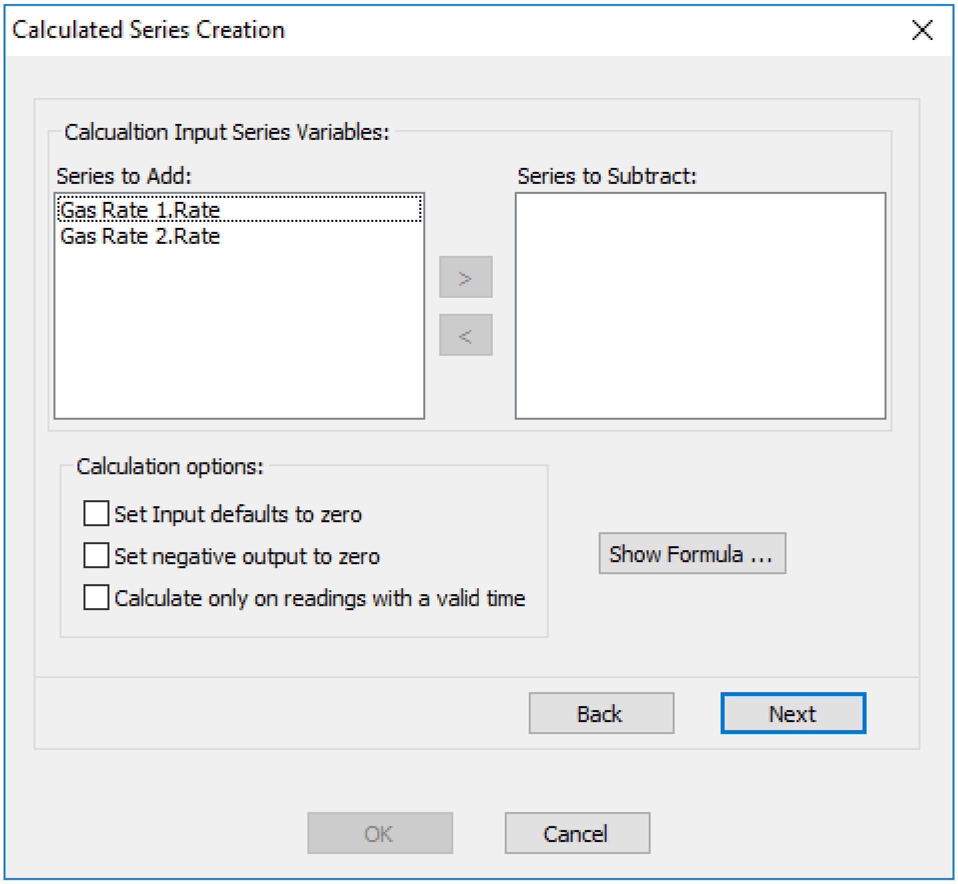
1. Select the rate column inputs (click on the column headers while holding the Ctrl key down to select multiple columns)



2. Right-Click the header and select "Calculated Series Wizard…" to start the wizard process.



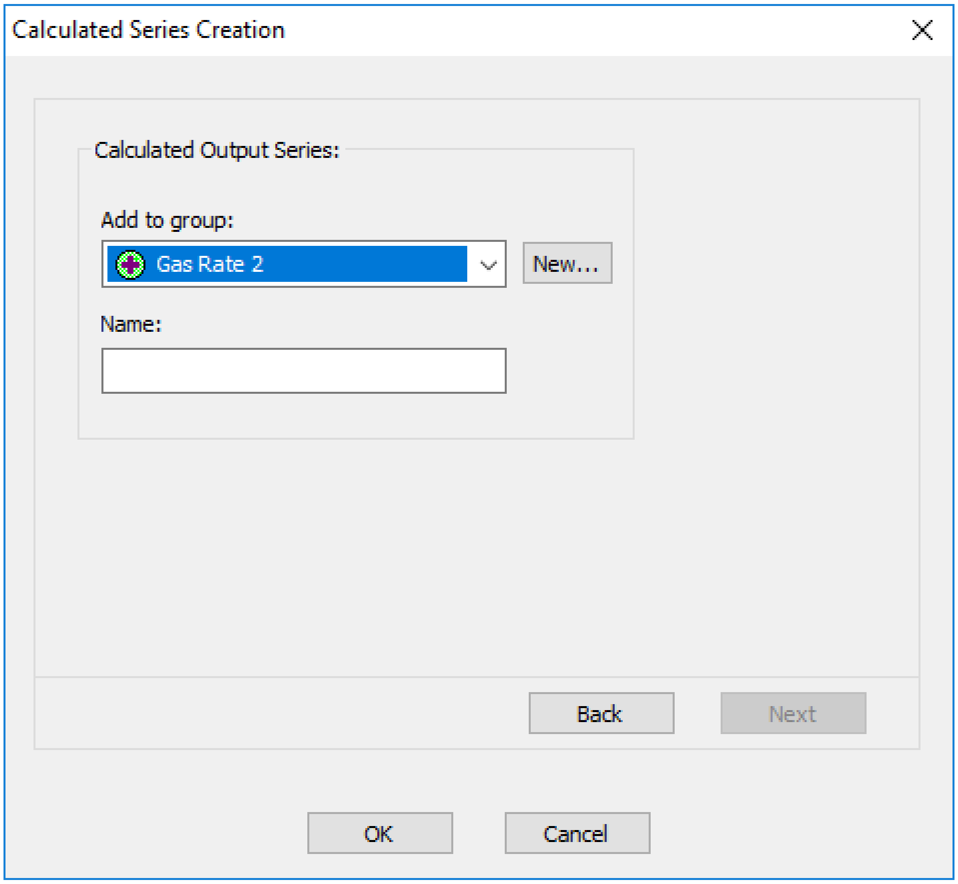
3. The initial wizard window displays the selected input series along with the "Calculation Type" drop-down selector. Select the Add/Subtract… calculation type by pressing the "Next" button.



4. From the window above…
   Use the "Series to Add" and "Series to Subtract" to specify how to apply input series for the calculation. Additionally, the Calculation options allow for the following behaviors and defaults:
   - Set Input defaults to zero
     When checked inputs with a reading of "nothing" are defaulted to zero.
   - Set negative output to zero
     When checked the calculated output is set to zero if the result is negative.
   - Calculate only on readings with a valid time
     When checked calculations only occur when the reading has a valid time stamp.

   The "Show Formula …" button can be used to display the formula that is created for the selected configuration.

   Press the "Next" button to proceed to the final step.



5. In the final step, the series name is specified along with the group where the series is to be created.

   Press the "OK" button to create the series and close the wizard.

	Test Time	Gas Rate 1		Gas Rate 2		
	Cum	Rate	Cum	Rate	Cum	Rate Sum
	Hrs.	$10^3m^3/d$	10^3m^3	$10^3m^3/d$	10^3m^3	$10^3m^3/d$
1	0.0000	0.00	0.000	0.00	0.000	0.00
2	1.0000	1.00	0.042	1.00	0.042	2.00
3						

The newly created calculated generic series.

Net Cumulative Series

Net Cumulative Series (Net Cum Series) are a special case of 'Generic Series' that allow you to zero (or net-out) cumulative values for meters and 'Data Summary' totals.

To create a net cum series for an existing cumulative series:

	Test Time					Orifice 1					
	Date	Time	Cum	Flow	Event	Static	Temp	Diff	Plate	Rate	Cum
	dd/mm/yyyy	hh:mm:ss	Hrs.	Hrs.		psig	°F	inH2O	1/64	Mcf/d	M
1	12/08/2015	09:07:24	0.0000	0.0000		150.0	70.0	200	40	424.2	
2	12/08/2015	10:07:24	1.0000	1.0000		150.0	70.0	200	40	424.2	
3	12/08/2015	11:07:24	2.0000	2.0000		150.0	70.0	200	40	424.2	
4	12/08/2015	12:07:24	3.0000	3.0000		150.0	70.0	200	40	424.2	
5	12/08/2015	13:07:24	4.0000	4.0000		150.0	70.0	200	40	424.2	
6	12/08/2015	14:07:24	5.0000	5.0000		150.0	70.0	200	40	424.2	
7	12/08/2015	15:07:24	6.0000	6.0000		150.0	70.0	0	40	0.0	
8	12/08/2015	16:07:24	7.0000	7.0000		150.0	70.0	0	40	0.0	
9	12/08/2015	17:07:24	8.0000	8.0000		150.0	70.0	200	40	424.2	106.1
10	12/08/2015	18:07:24	9.0000	9.0000		150.0	70.0	200	40	424.2	123.7
11									40		

Remove Series From Table
Add To Table...
Properties ...
Add Series To Plot (Test Data Plot)
Create Net Cum Series
Find...

'Right Click' the column header of any cum series and select "Create Net Cum Series" from the context menu.

	Test Time					Orifice 1						
	Date	Time	Cum	Flow	Event	Static	Temp	Diff	Plate	Rate	Cum	Cum (net)
	dd/mm/yyyy	hh:mm:ss	Hrs.	Hrs.		psig	°F	inH2O	1/64	Mcf/d	Mcf	Mcf
1	12/08/2015	09:07:24	0.0000	0.0000		150.0	70.0	200	40	424.2	0.0	*0.0*
2	12/08/2015	10:07:24	1.0000	1.0000		150.0	70.0	200	40	424.2	17.7	*17.7*
3	12/08/2015	11:07:24	2.0000	2.0000		150.0	70.0	200	40	424.2	35.4	*35.4*
4	12/08/2015	12:07:24	3.0000	3.0000		150.0	70.0	200	40	424.2	53.0	*53.0*
5	12/08/2015	13:07:24	4.0000	4.0000		150.0	70.0	200	40	424.2	70.7	*70.7*
6	12/08/2015	14:07:24	5.0000	5.0000		150.0	70.0	200	40	424.2	88.4	*88.4*
7	12/08/2015	15:07:24	6.0000	6.0000		150.0	70.0	0	40	0.0	88.4	*88.4*
8	12/08/2015	16:07:24	7.0000	7.0000		150.0	70.0	0	40	0.0	88.4	*88.4*
9	12/08/2015	17:07:24	8.0000	8.0000		150.0	70.0	200	40	424.2	106.1	*106.1*
10	12/08/2015	18:07:24	9.0000	9.0000		150.0	70.0	200	40	424.2	123.7	*123.7*
11									40			

Net Cum Series

A net cum series is created to the right of the selected cum series.
The net cum series displays the same values as the parent cum series with values displayed in blue italic text (by default).

The net cum series column displays the cumulative values of the parent cum series with the ability of being zeroed at any point in the data table.

To zero a net cum in the data table:

Orifice 1						
Static	Temp	Diff	Plate	Rate	Cum	Cum (net)
psig	°F	inH2O	1/64	Mcf/d	Mcf	Mcf
150.0	70.0	200	40	424.2	0.0	0.0
150.0	70.0	200	40	424.2	17.7	17.7
150.0	70.0	200	40	424.2	35.4	35.4
150.0	70.0	200	40	424.2	53.0	53.0
150.0	70.0	200	40	424.2	70.7	70.7
150.0	70.0	200	40	424.2	88.4	88.4
150.0	70.0	0	40	0.0	88.4	88.4
150.0	70.0	0	40	0.0	88.4	
150.0	70.0	200	40	424.2	106.1	
150.0	70.0	200	40	424.2	123.7	
			40			
			40			

Finalize (Zero) All Net Cums Here
Clear All Net Cums Here
This Net Cum Only

'Right Click' the net cum cell at the reading to zero and select "Finalize (Zero) All Net Cums Here".

Orifice 1						
Static	Temp	Diff	Plate	Rate	Cum	Cum (net)
psig	°F	inH2O	1/64	Mcf/d	Mcf	Mcf
150.0	70.0	200	40	424.2	0.0	0.0
150.0	70.0	200	40	424.2	17.7	17.7
150.0	70.0	200	40	424.2	35.4	35.4
150.0	70.0	200	40	424.2	53.0	53.0
150.0	70.0	200	40	424.2	70.7	70.7
150.0	70.0	200	40	424.2	88.4	88.4
150.0	70.0	0	40	0.0	88.4	88.4
150.0	70.0	0	40	0.0	88.4	0.0
150.0	70.0	200	40	424.2	106.1	17.7
150.0	70.0	200	40	424.2	123.7	35.4
			40			
			40			

Net Cum Zeroed Here

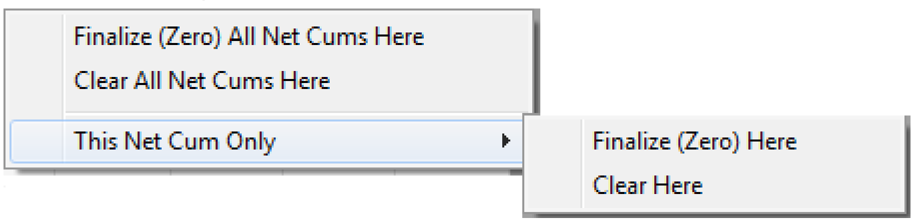
At the reading where the cum was zeroed, a finalized total is displayed as an orange cell. Subsequent readings begin accumulating from zero. Additional zero sequences can be applied at any reading by repeating these steps.

Orifice 1													
Static	Temp	Diff	Plate	Rate	Cum	Cum (net)	N2	Rcv Gas Cum	Rcv Gas Cum (net)	Rcv Gas Rate	Rcv N2 Cum	Rcv N2 Cum (net)	Rcv N2 Rate
psig	°F	inH2O	1/64	Mcf/d	Mcf	Mcf	%	Mcf	Mcf	Mcf/d	Mcf	Mcf	Mcf/d
150.0	70.0	200	40	399.2	0.0	0.0	25	0.0	0.0	299.4	0.0	0.0	99.8
150.0	70.0	200	40	399.2	16.6	16.6	25	12.5	12.5	299.4	4.2	4.2	99.8
150.0	70.0	200	40	399.2	33.3	33.3	25	25.0	25.0	299.4	8.3	8.3	99.8
150.0	70.0	200	40	399.2	49.9	49.9	25	37.4	37.4	299.4	12.5	12.5	99.8
150.0	70.0	200	40	399.2	66.5	66.5	25	49.9	49.9	299.4	16.6	16.6	99.8
150.0	70.0	200	40	399.2	83.2	83.2	25	62.4	62.4	299.4	20.8	20.8	99.8
150.0	70.0	0	40	0.0	83.2	83.2	25	62.4	62.4	0.0	20.8	20.8	0.0
150.0	70.0	0	40	0.0	83.2	0.0	25	62.4	0.0	0.0	20.8	0.0	0.0
150.0	70.0	200	40	399.2	99.8	16.6	25	74.9	12.5	299.4	25.0	4.2	99.8
150.0	70.0	200	40	399.2	116.4	33.3	25	87.3	25.0	299.4	29.1	8.3	99.8
			40				25						
			40				25						
			40				25						
			40				25						
			40				25						

Additional Net Cum Series Created

Additional net cum series can be created for other cum series simply repeat the creation process for each cum.

Net cum readings can be zeroed or cleared via the context menu.

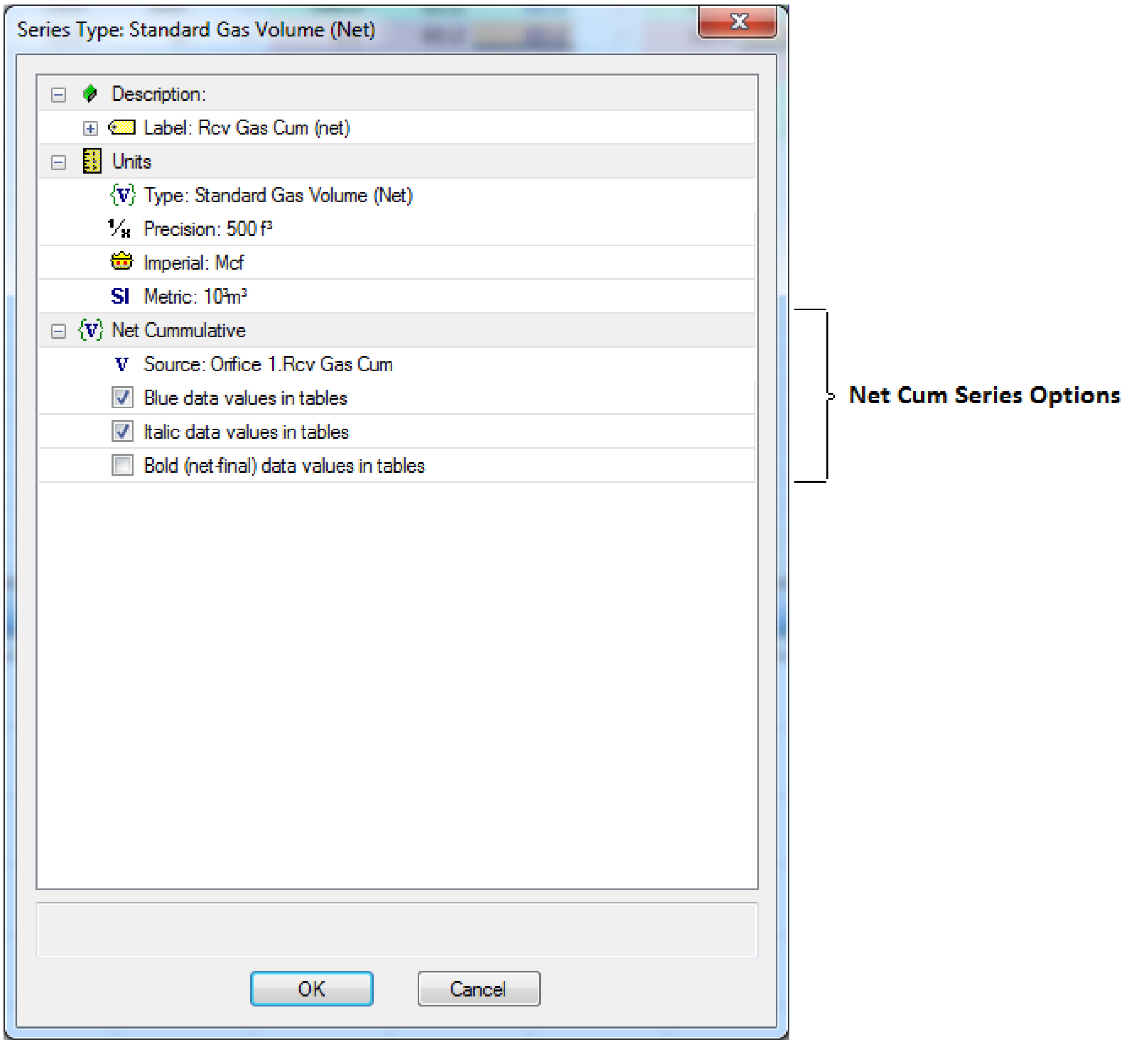


Net Cum Zero menu options:

- Finalize (Zero) All Net Cums Here
  This option will zero ALL net cum series at the given reading.
- Clear All Net Cums Here
  This option will clear ALL net cum series at the given reading.
- This Net Cum Only -> Finalize (Zero) Here
  This option zeros only the selected net cum.
- This Net Cum Only ->Clear Here
  This option clears only the selected net cum.

The various menu options give the user the ability to quickly zero or clear all net cums together or individually. Allowing for a great deal of flexibility in how the net cums can be applied for a given test.

The appearance of the net cum column, within the data table, can be customized in the series property window for the net cum series.



Net Cum Series Property Window.

Time Series Group

The time group contains a set of series representing the time track for all entered data.

	Test Time			
	Date	Time	Cum	Flow
	yyyy/mm/dd	hh:mm:ss	Hrs.	Hrs.
1	2008/01/28	00:00:00	0.0000	0.0000

The series include:

- Date (sample date part)
- Time (sample time part)
- Cum (cumulative test time relative to the first date and time sample)
- Flow (cumulative time of the well on flow)

The following outlines the behavior of the date and time series:

Date Series:

- Dates only need be entered if the current date is different from the previous date.
- If no date is entered the previous date is assumed.
- If there is no previous date, the current date is assumed.

Time Series:

- Time values can be partially entered where:
    - 12 <enter> resolves to 12:00:00
    - 1213 <enter> resolves to 12:13:00

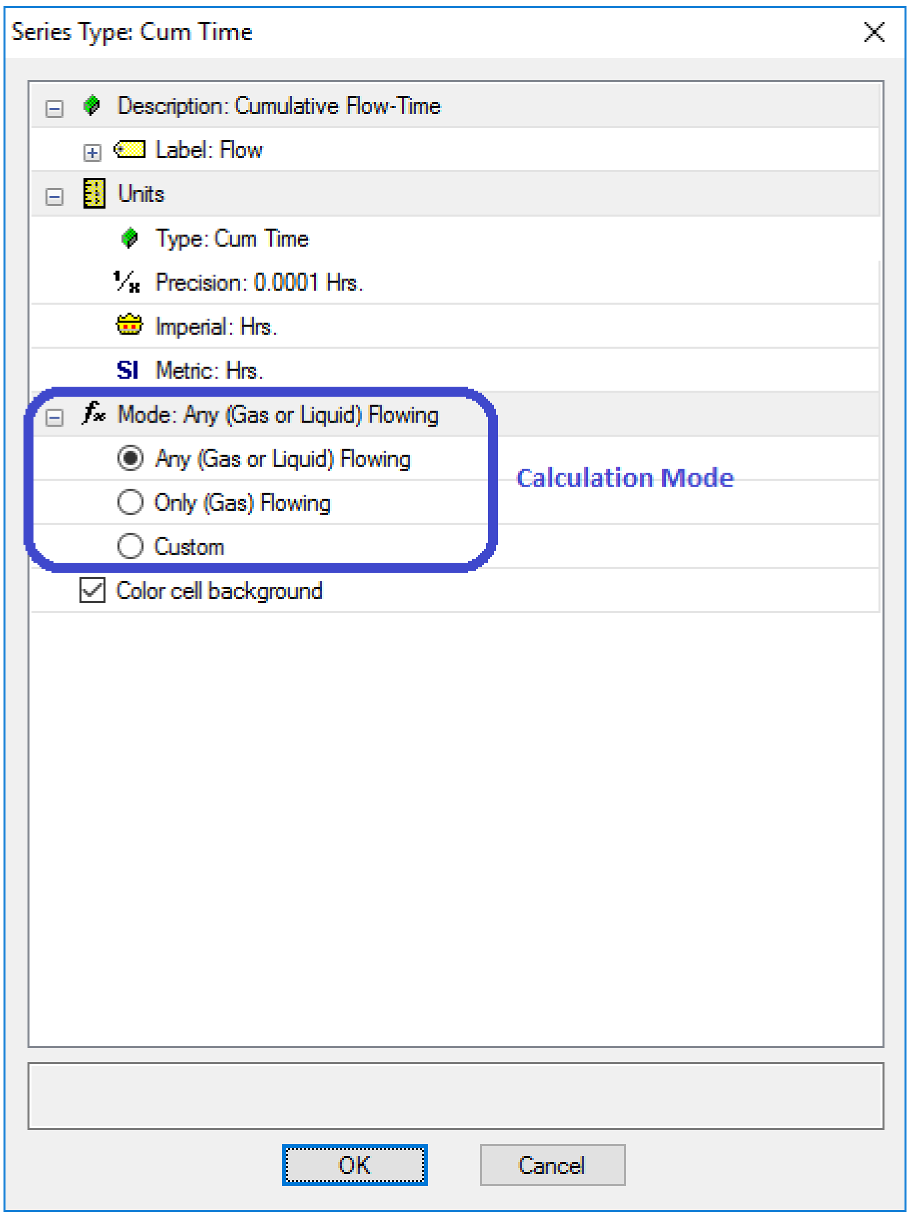
Cum Time

- The entered cum time is relative to the first date and time entry If there are no dates or times entered the current date and time is used.

Flow Time

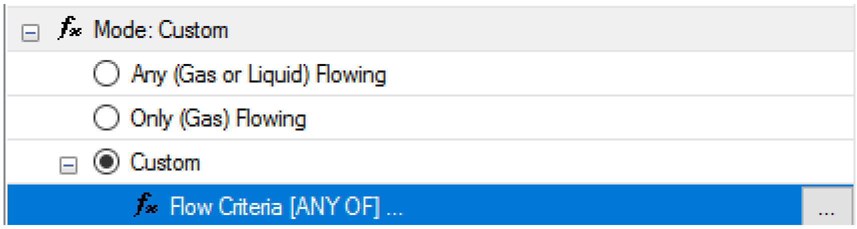
- Flow time is a calculated series and does not allow for user entry.
- Flow Time is considered active if any production meter is flowing.
- Flow Time can be configured to calculate for either of the following conditions:
    - Any gas or liquid meter flowing
    - Only gas meter(s) flowing
    - Custom (user specified criteria)

The flow time calculation mode can be configured in the 'Flow Time' series properties.



Flow Time Series properties.

Custom Mode allows for a user defined criteria to be specified for determining flow.



Define Custom Mode

The custom flow criteria operates in the same fashion as specified in the 'Flow-Time generic series' with the exception that the target series are limited to cumulative series from the 'Data Summary' group.

See: 'Flow-Time Generic Series' for details.

Time Sequence Error

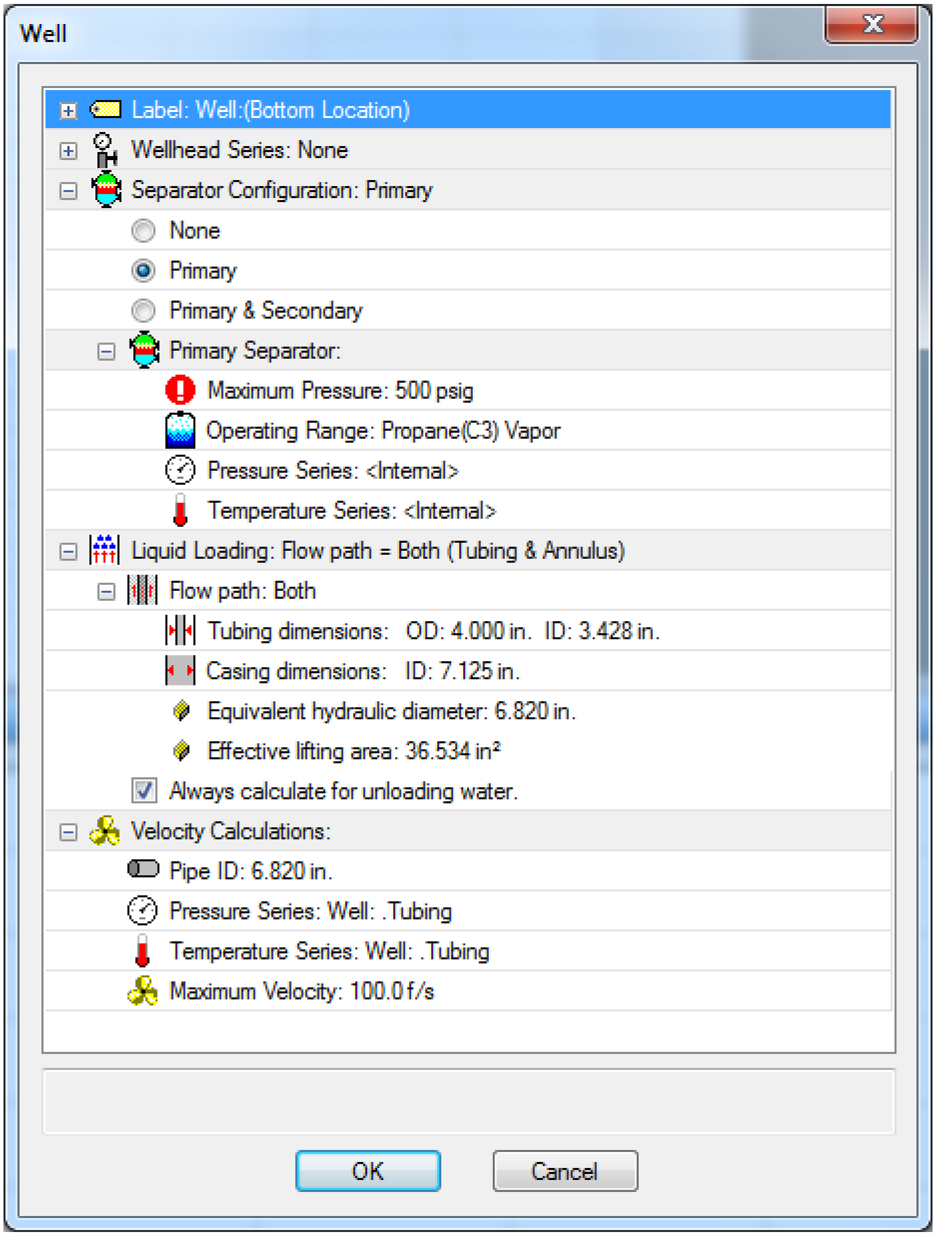
- *In the event of an error in the date time order, all times after the error are displayed in red.*
- *If a sequence error is present in the data, all calculations are suspended until the error is resolved.*

Well Series Group

The well group contains data series and items associated with wellhead measurements, choke manifold and production separators. The data table "Well" group contains the following series:

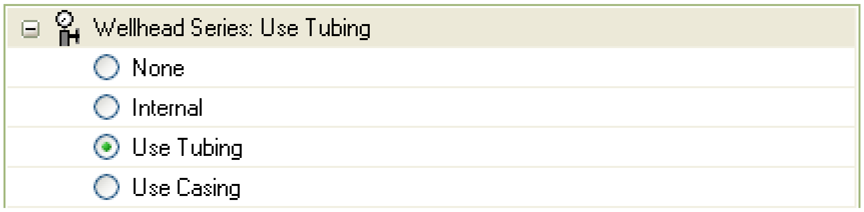
- Choke (Manifold Choke Size)
- Tubing Pressure
- Tubing Temperature
- Casing Pressure
- Casing Temperature
- Wellhead Pressure
- Wellhead Temperature
- Primary/Secondary Separator Pressure
- Primary/Secondary Separator Temperature
- % Tubing Drawdown (*Calculated*)
- % Casing Drawdown (*Calculated*)
- Minimum gas rate to unload liquids (Calculated)
- In-situ mixture velocity (Calculated)

Well series items are configured via the properties configuration dialog accessible by selecting the "Well" item node in the configuration pane of the 'Data Entry' view or by right clicking the "Well" header in the data table, and selecting properties.



Well configuration dialog contains configuration properties for wellhead series, test separators and monitors for liquid loading and in-situ mixture velocity. The options available are detailed as follows:

Wellhead Series



Wellhead series consist of both a pressure and temperature series added to the data table. Options include:

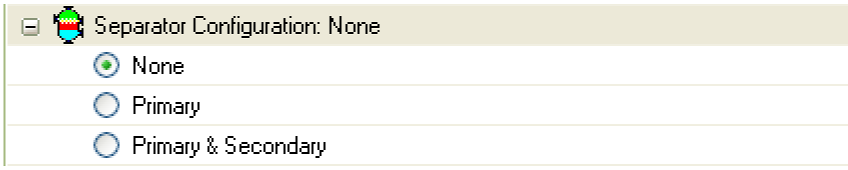
- None (no series added)
- Internal (add independent series for manual data entry)
- Use Tubing (add series and tie each to the respective tubing series)
- Use Casing (add series and tie each to the respective casing series)

Series Proxy:
The "Use Tubing" and "Use Casing" options tie the wellhead series to the respective tubing or casing series effectively creating one or more series sharing common data. In the case of "Use Tubing" the Wellhead pressure and the Tubing pressure share common data, data entered via the casing series will be reflected immediately in the wellhead series and vice versa. This tying of series is called a Series Proxy.

*** Note: as of FlowTest version 3.5.0 series proxies will be read only in the data table (preventing data changes via the proxy) if you require the data to be changed from the proxy there is a 'Read Only' option in the proxy series property window that can be cleared to restore the previous behavior. If the 'Read Only' option is grayed out, this is due to the source series being read only.*

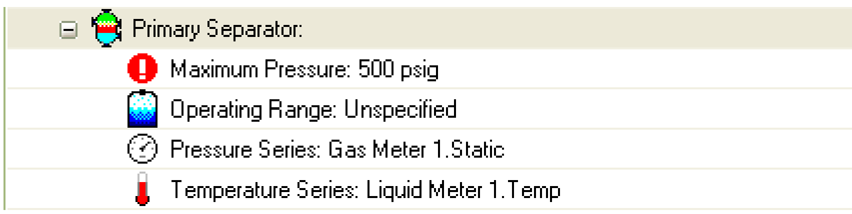
When wellhead series are specified, hydrate predictions at the wellhead will be calculated.

Separator Configuration



Primary and secondary test separators can be enabled providing (value added) alarms/warnings for monitoring over pressure and operating conditions of each test separator.
Options Include:

- None
- Primary
- Primary & Secondary



Each separator includes the following configuration options:

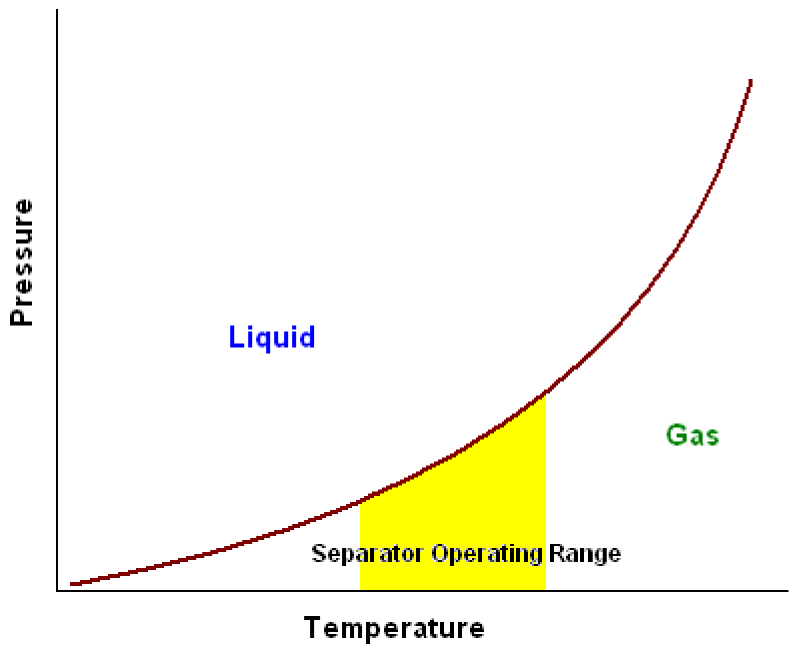
- Maximum Pressure (Enter maximum separator pressure) over-pressure Alarm
- Operating Range (The specified operating range provides an alarm alerting operator when conditions fall outside of the designated separator Pressure & Temperature range)
  The Separator operating range can be used for general production testing, but is primarily designed to be used in conjunction with propane (HD5) fracs, where you want to ensure that all the recovered propane has completely flashed to a vapor when it hits the secondary separator, as it will alert the operator that volatile liquids may be accumulating in the secondary separator.
  Selectable operating ranges include:
    - Unspecified (no operating range)
    - Vaporize Propane
    - Vaporize Butane
    - Vaporize Propane-Butane (75/25)% mix

- Pressure Series (Separator Pressure Series Selection) *see series selection below.*
- Temperature Series (Separator Temperature Series Selection) *see series selection below.*

<u>Series selection:</u>

Separator pressure and temperature series can be either an independent series or a proxy of an existing series (see Series Proxy above). The series selector dropdown contains an independent series option (as specified by the <Internal> entry as well as available proxies of the appropriate type.
For example: If a gas meter is being used to meter (Gas Meter 1) the gas phase of the primary separator and a liquid meter (Liquid Meter 1) is metering the separator liquid level then it may be convenient to specify the pressure series as Gas Meter 1.Static and the temperature series as Liquid Meter 1.Temp

Note: only existing meter pressure and temperature series will appear in the series selectors i.e. Meters must be created prior to separator configuration.

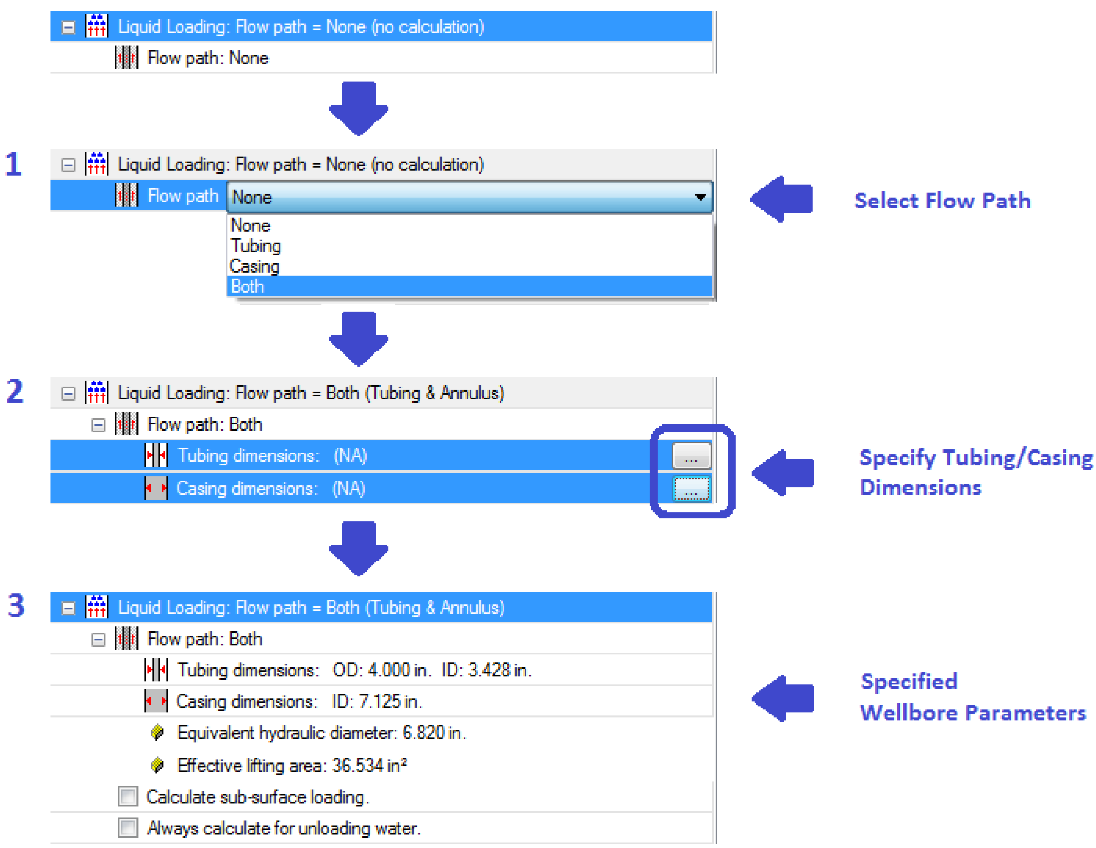


Pressure temperature diagram illustrating the separator operating range.

Liquid Loading

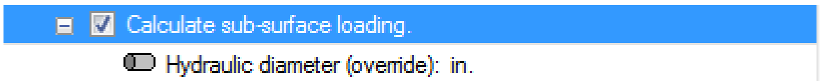
The liquid loading option allows for the monitoring, and alerting, of conditions where the gas velocity may be insufficient to remove liquids from the well. A calculated series that displays the minimum gas rate to unload liquids is available to monitor potential loading conditions along with a ‘liquid loading’ alarm when loading conditions are present.

In order to enable the liquid loading calculations, the well flow path and pipe dimensions need to be specified as follows:



Once the well flow path and pipe dimensions have been entered, two calculated entries (Equivalent hydraulic diameter and Effective lifting area) will be displayed along with the following options:

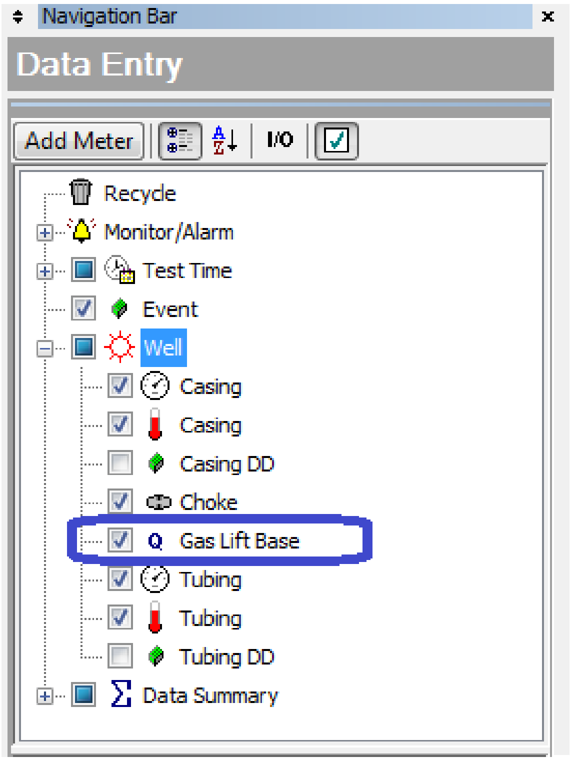
- Calculate sub-surface loading:
  In addition to surface loading calculations, loading calculations can also be computed for sub-surface conditions. Enabling the sub-surface option provides additional options to define the sub-surface conditions:



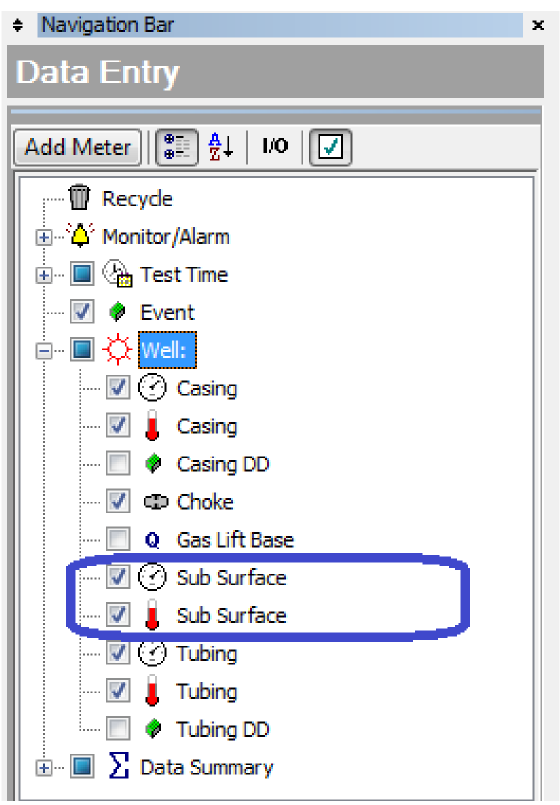
  - Hydraulic diameter override: Use this option to specify an effective hydraulic diameter (overriding the effective surface hydraulic diameter). When the down hole tubular are of different dimensions than at surface (generally this is the tubing landed depth). *Leave this entry blank if the dimensions are the same as specified at surface.*

- Always calculate for unloading water: Forces the liquid loading calculation to always calculate for water loading.

Data table series related to the liquid loading calculations:



Minimum gas rate to unload liquids (Water or Condensate)



Additional pressure temperature inputs for sub-surface conditions.

Once the liquid loading calculation has been enabled (by specifying well flow path and pipe dimensions) a new series will be available under the 'Well' group showing the minimum rate required to unload liquids. *When the total gas rate is below the minimum lift, the minimum lift rate will be marked in red in the data table (this option can be cleared in the series property window).*

Surface loading calculations require wellhead pressure and temperature inputs, the values are taken from the data table and can be any of the: Tubing, Casing or Wellhead P&T columns depending upon the selected flow path. The software will automatically select the appropriate P&T inputs for the calculation. The gas rate for determining a loading condition is the sum of all gas meters (included in the totals) as indicated by the 'Total gas rate' series in the 'Data Summary' group.

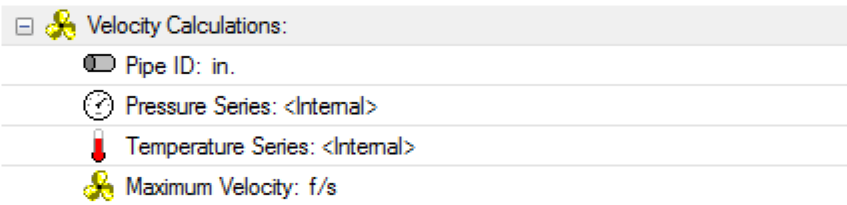
Sub-surface loading calculations require bottom-hole pressure and temperature inputs that are added to the data table when this option is selected.

When both surface and sub-surface calculations are enabled, the effective minimum gas rate is determined by the greater of the two calculations.

*The liquid loading calculation will calculate for either lifting water or condensate depending on the fluids present. If only condensate is present (and no water) the calculation will be for condensate otherwise the calculation will be for water. ** Note: The 'Always calculate for unloading water' option overrides this behavior.*

Mixture Velocity

The mixture velocity is a calculation of all well flow (combined: gas, oil, water, condensate and sand) at a specified (in-situ) flowing pressure and temperature. The mixture velocity is calculated and displayed in the data table to monitor velocity changes and optionally alert the operator when liquid or sand conveying mixtures are exceeding an acceptable erosional threshold (upon which an ‘Erosional velocity’ alarm is issued).

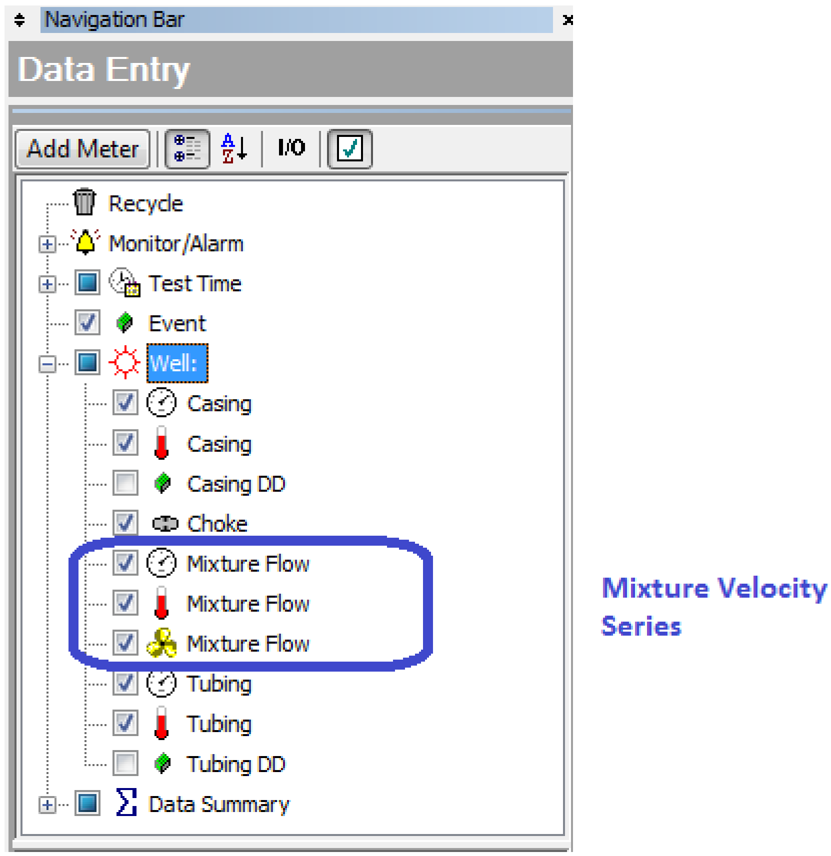


The following options are available to configure the velocity calculation:

- Pipe ID: the inside diameter that the mixture is flowing through. This is a required entry and effectively enabled the velocity calculation. (Leaving this entry blank disables the calculation).
- Pressure Series: the data series to provide the in-situ pressure for the velocity calculation (*see series selection below).*
- Temperature Series: the data series to provide the in-situ temperature for the velocity calculation (*see series selection below).*
- Maximum Velocity: the maxim (erosional) velocity allowed. This entry specifies the ‘Velocity’ alarm threshold, leaving this entry blank will disable the alarm.

Series selection:

Mixture pressure and temperature series can be either an independent series or a proxy of an existing series (see Series Proxy under the wellhead series above). The series selector dropdown contains an independent series option (as specified by the <Internal> entry as well as available proxies of the appropriate type.



Once the mixture velocity calculation has been enabled (by specifying a pipe ID) new series will be available under the 'Well' group including:

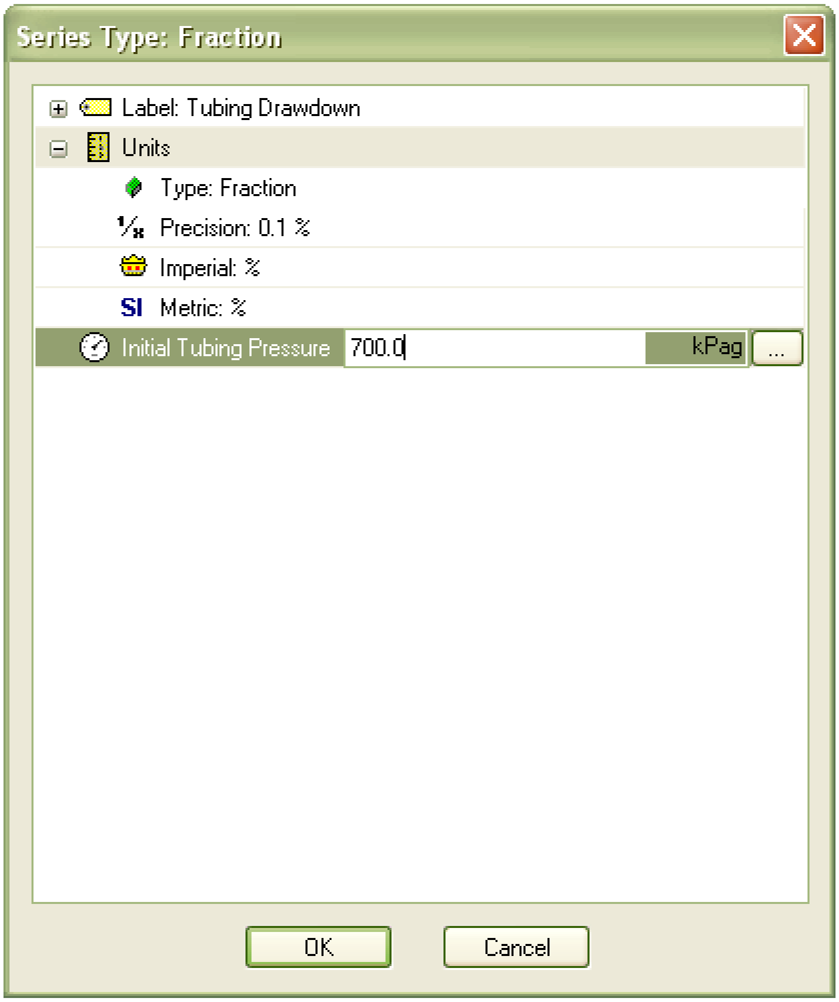
- Mixture Flow (Pressure) an input to enter the in-situ pressure.
- Mixture Flow (Temperature) an input to enter the in-situ temperature.
- Mixture Flow (Velocity) the calculated mixture velocity. *The mixture velocity is comprised of the sum of all meters (included in the totals) including all: gas, liquids and sand. Velocities above the maximum velocity will be marked in red in the data table (this option can be cleared in the series property window).*

*** Note: depending on how the pressure and temperature series are configured they not be required if they are proxies of existing series.*

Often it may be desirable to use the tubing/casing dimensions entered in the liquid loading, if this is desired you can simply enter the 'Equivalent hydraulic diameter' from the liquid loading as the Pipe ID.

Tubing/Casing Drawdown

The tubing and casing drawdown series will calculate a percent drawdown (of the respective pressure series) for a specified initial pressure.



The tubing and casing drawdown series require an initial pressure. The initial pressure is entered in the series property dialog, for each drawdown series.

Data Summary

The Data Summary is a group of series displaying the total fluids (gas and liquids) metered during the test and includes only the meters with the 'Include in Totals' checkbox checked (see Common Meter Options section). The Data Summary defines three basic totals for each test fluid, and is qualified by the following names:

- Produced (produced reservoir fluid of type; gas, oil, water or condensate)
- Load (recovered load fluid of type; gas or liquid)
- Total (total fluid = Produced + Load of type; gas, oil, water or condensate)

If load fluid does not exist for a given fluid type, produced and total will be the same.

Each test fluid type (Produced, Load and Total) contains the following three series:

- Volume (cumulative volume)
- Rate (fluid rate)
- Gain (volume gain from previous reading)

Test fluids of type "Load" may have and additional series of type:

- LTR (Load Left to Recover)

Load fluids are grouped into two broad categories in the Data Summary; 'Load Gas' and 'Load Liquid' where load liquid contains the sum of all loads of type Oil, water or condensate.

Data Summary					
Produced Gas	Produced Oil	Produced Water	Load Gas	Load Liquid	Load Liquid (LTR)
10^3m^3	m^3	m^3	10^3m^3	m^3	m^3

Table view of Data Summary series (cumulative volumes) for a test producing gas, oil and water. Load liquid in this case is the sum of all water or oil loads with a LTR series indicating the initial load is known.

It is important to note that data summary maintains a consistent and fixed relationship between time, rate and volume for all fluid types irrespective of the discretization mode (see advanced meter properties) selected for any given meter. The rate displayed for any fluid type in the data summary is an average rate back calculated from the respective time and volume series as a result the rate displayed in the data summary may not match meters with a non-rectangular discretization mode.

The data summary rate series represents a normalized average rate, applied consistently for all fluid types, as a results the individual fluid rates are comparable (on a volumetric basis) thus honoring material balance.

Gas To: Flare, Vent, Pipeline, Incinerate, Other

Data Summary also provides a provision to define the destination of the produced gas and the cumulative volumes produced (as defined in EUB PAS PRD V4.0). The additional gas destination series are displayed below.

Data Summary															
Gas To	Total Gas Flared	Total Gas Vented	Total Gas Incinerated	Total Gas Pipeline	Total Gas Other	Produced Gas Flared	Produced Gas Vented	Produced Gas Incinerated	Produced Gas Pipeline	Produced Gas Other	Load Gas Flared	Load Gas Vented	Load Gas Incinerated	Load Gas Pipeline	Load Gas Other
	10^3m^3	10^3m^3	10^3m^3	10^3m^3	10^3m^3	10^3m^3	10^3m^3	10^3m^3	10^3m^3	10^3m^3	10^3m^3	10^3m^3	10^3m^3	10^3m^3	10^3m^3

Total Gas (Produced + Recovered Load) Produced Gas (Produced Only) Load Gas (Load Only)

"Gas To" (Control Series)

The diagrams below illustrate the Data Summary with "gas to" calculations. The "Gas To" column allows the user to specify the destination of the produced gas.
For simplicity, only the "Total Gas" associated columns are shown identical column sets exist for Produced and load gas as well.

Data Summary						
Gas To	Total Gas	Total Gas Flared	Total Gas Vented	Total Gas Incinerated	Total Gas Pipeline	Total Gas Other
	10^3m^3	10^3m^3	10^3m^3	10^3m^3	10^3m^3	10^3m^3
Other	0.00	0.00	0.00	0.00	0.00	0.00
Other	0.47	0.00	0.00	0.00	0.00	0.47
Other	0.94	0.00	0.00	0.00	0.00	0.94
Other	1.41	0.00	0.00	0.00	0.00	1.41
Other	1.88	0.00	0.00	0.00	0.00	1.88
Other	2.35	0.00	0.00	0.00	0.00	2.35
Other	2.82	0.00	0.00	0.00	0.00	2.82
Other	3.28	0.00	0.00	0.00	0.00	3.28
Other	3.75	0.00	0.00	0.00	0.00	3.75
Other	4.22	0.00	0.00	0.00	0.00	4.22
Other	4.69	0.00	0.00	0.00	0.00	4.69
Other	5.16	0.00	0.00	0.00	0.00	5.16
Other	5.63	0.00	0.00	0.00	0.00	5.63
Other	6.10	0.00	0.00	0.00	0.00	6.10
Other	6.57	0.00	0.00	0.00	0.00	6.57
Other	7.04	0.00	0.00	0.00	0.00	7.04

The "Gas To" column is a user defined input which controls the destination (or sink) of the gas volume produced from the meters with the "Include in totals" option set.
The "Total Gas" column displays all gas. The "Total Gas Flared, Vented, Incinerated, Pipeline and Other" columns display respective gas volume cums as directed by the "Gas To" column.
In the diagram above, all gas is directed to the "Other" sink.

To define a gas destination, “Click” the green arrow (or “Right Click” the cell) in the “Gas To” column to display the destination menu then select the destination.

Gas To	Total Gas	Total Gas Flared	Total Gas Vented	Total Gas Incinerated	Total Gas Pipeline	Total Gas Other
	10^3m^3	10^3m^3	10^3m^3	10^3m^3	10^3m^3	10^3m^3
[illegible]	[illegible]	0.00	0.00	0.00	0.00	0.00
[illegible]	[illegible]	0.00	0.00	0.00	0.00	0.47
[illegible]	[illegible]	0.00	0.00	0.00	0.00	0.94
[illegible]	[illegible]	0.00	0.00	0.00	0.00	1.41
[illegible]	[illegible]	0.00	0.00	0.00	0.00	1.88
[illegible]	[illegible]	0.00	0.00	0.00	0.00	2.35
Other	2.82	0.00	0.00	0.00	0.00	2.82
Other	3.28	0.00	0.00	0.00	0.00	3.28
Other	3.75	0.00	0.00	0.00	0.00	3.75
Other	4.22	0.00	0.00	0.00	0.00	4.22
Other	4.69	0.00	0.00	0.00	0.00	4.69
Other	5.16	0.00	0.00	0.00	0.00	5.16
Other	5.63	0.00	0.00	0.00	0.00	5.63
Other	6.10	0.00	0.00	0.00	0.00	6.10
Other	6.57	0.00	0.00	0.00	0.00	6.57
Other	7.04	0.00	0.00	0.00	0.00	7.04

✔ Other
Pipeline
Flare
Vent
Incinerate

Gas To	Total Gas	Total Gas Flared	Total Gas Vented	Total Gas Incinerated	Total Gas Pipeline	Total Gas Other
	10^3m^3	10^3m^3	10^3m^3	10^3m^3	10^3m^3	10^3m^3
Flare	0.00	0.00	0.00	0.00	0.00	0.00
Flare	0.47	0.47	0.00	0.00	0.00	0.00
Flare	0.94	0.94	0.00	0.00	0.00	0.00
Flare	1.41	1.41	0.00	0.00	0.00	0.00
Flare	1.88	1.88	0.00	0.00	0.00	0.00
Flare	2.35	2.35	0.00	0.00	0.00	0.00
Flare	2.82	2.82	0.00	0.00	0.00	0.00
Flare	3.28	3.28	0.00	0.00	0.00	0.00
Flare	3.75	3.75	0.00	0.00	0.00	0.00
Flare	4.22	4.22	0.00	0.00	0.00	0.00
Flare	4.69	4.69	0.00	0.00	0.00	0.00
Flare	5.16	5.16	0.00	0.00	0.00	0.00
Flare	5.63	5.63	0.00	0.00	0.00	0.00
Flare	6.10	6.10	0.00	0.00	0.00	0.00
Flare	6.57	6.57	0.00	0.00	0.00	0.00
Flare	7.04	7.04	0.00	0.00	0.00	0.00

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Changing the “Gas To” designation from “Other” to “Flare”

The gas destination can be changed at any time by configuring the appropriate “Gas To” cell (as shown below).

Gas To	Total Gas	Total Gas Flared	Total Gas Vented	Total Gas Incinerated	Total Gas Pipeline	Total Gas Other
	10^3m^3	10^3m^3	10^3m^3	10^3m^3	10^3m^3	10^3m^3
Flare	0.00	0.00	0.00	0.00	0.00	0.00
Flare	0.47	0.47	0.00	0.00	0.00	0.00
Flare	0.94	0.94	0.00	0.00	0.00	0.00
Flare	1.41	1.41	0.00	0.00	0.00	0.00
Flare	1.88	1.88	0.00	0.00	0.00	0.00
Flare	2.35	2.35	0.00	0.00	0.00	0.00
Flare	2.82	2.82	0.00	0.00	0.00	0.00
Flare	3.28	3.28	0.00	0.00	0.00	0.00
Flare		3.75	0.00	0.00	0.00	0.00
Flare		4.22	0.00	0.00	0.00	0.00
Flare		4.69	0.00	0.00	0.00	0.00
Flare		5.16	0.00	0.00	0.00	0.00
Flare		5.63	0.00	0.00	0.00	0.00
Flare		6.10	0.00	0.00	0.00	0.00
Flare	6.57	6.57	0.00	0.00	0.00	0.00
Flare	7.04	7.04	0.00	0.00	0.00	0.00

Other
Pipeline
✔ Flare
Vent
Incinerate

Gas To	Total Gas	Total Gas Flared	Total Gas Vented	Total Gas Incinerated	Total Gas Pipeline	Total Gas Other
	10^3m^3	10^3m^3	10^3m^3	10^3m^3	10^3m^3	10^3m^3
Flare	0.00	0.00	0.00	0.00	0.00	0.00
Flare	0.47	0.47	0.00	0.00	0.00	0.00
Flare	0.94	0.94	0.00	0.00	0.00	0.00
Flare	1.41	1.41	0.00	0.00	0.00	0.00
Flare	1.88	1.88	0.00	0.00	0.00	0.00
Flare	2.35	2.35	0.00	0.00	0.00	0.00
Flare	2.82	2.82	0.00	0.00	0.00	0.00
Flare	3.28	3.28	0.00	0.00	0.00	0.00
Pipe	3.75	3.28	0.00	0.00	0.47	0.00
Pipe	4.22	3.28	0.00	0.00	0.94	0.00
Pipe	4.69	3.28	0.00	0.00	1.41	0.00
Pipe	5.16	3.28	0.00	0.00	1.88	0.00
Pipe	5.63	3.28	0.00	0.00	2.35	0.00
Pipe	6.10	3.28	0.00	0.00	2.82	0.00
Pipe	6.57	3.28	0.00	0.00	3.28	0.00
Pipe	7.04	3.28	0.00	0.00	3.75	0.00

Gas to “Flare” for 8 readings then to “Pipeline”

The gas destination behavior can be overridden for any meter as specified at the meter level (meter properties window). For additional information see: the ‘Gas to: Flare, Vent, Pipeline, Incinerate, Other’ section of the ‘Gas Meter’.

When opening older FlowTest data files the “Gas To” column defaults to the “Other” sink. The “Other” sink is a general purpose sink and useful if you do not know (or do not need to track) the gas destination.

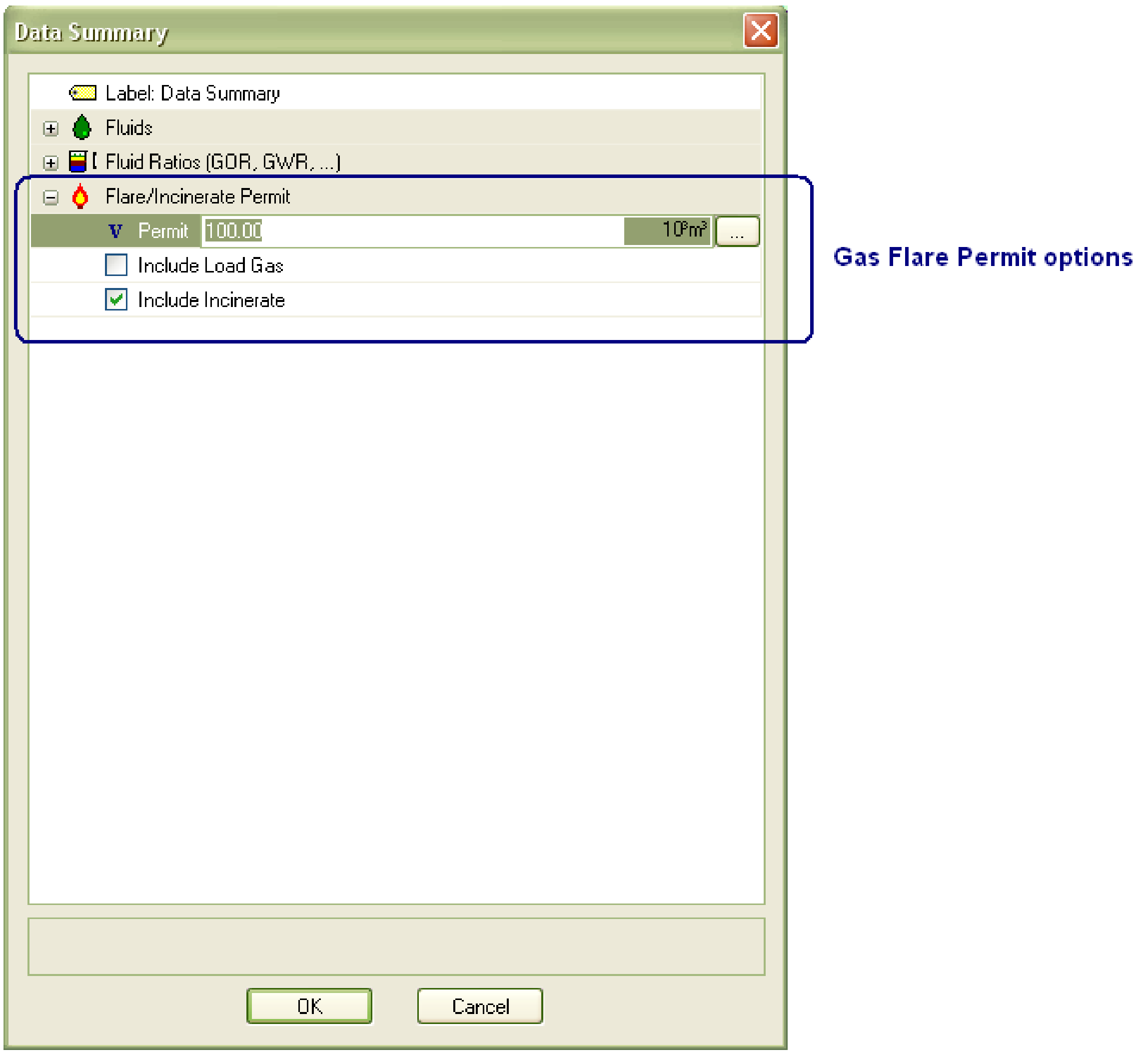
Liquid To: Tank, Pipeline, Other

FlowTest provides destination controls for the test liquids via ‘Oil to’ and ‘Water to’ control columns. The ‘Liquid to’ control columns operate in a similar fashion as ‘Gas to’ destination control described above.

The destinations for liquids are: Tank, Pipeline and Other (where ‘Other’ is the default when the controls are inactive).

Gas Flare Permit

The gas flare permit works in conjunction with the "Gas to:" series (described above) to provide a running tally of the flare permit volume remaining.



Data Summary properties window

The flare permit options are accessed via the "Data Summary" properties window, with the following options:

- Permit specifies the gas volume of the flare permit.
- Include Load Gas (if checked) includes the recovered load gas as flared.
- Include Incinerate (if unchecked) only gas designated as "flared" is reported in the flare permit, (if checked) the sum of both the flared and incinerated gas is reported.

Gas To	Total Gas	Total Gas Flared	Total Gas Vented	Total Gas Incinerated	Total Gas Pipeline	Total Gas Other	Flare Permit Remaining
	10^3m^3	10^3m^3	10^3m^3	10^3m^3	10^3m^3	10^3m^3	10^3m^3
Flare	0.00	0.00	0.00	0.00	0.00	0.00	10.00
Flare	0.47	0.47	0.00	0.00	0.00	0.00	9.53
Flare	0.94	0.94	0.00	0.00	0.00	0.00	9.06
Flare	1.41	1.41	0.00	0.00	0.00	0.00	8.59
Flare	1.88	1.88	0.00	0.00	0.00	0.00	8.12
Flare	2.35	2.35	0.00	0.00	0.00	0.00	7.65
Flare	2.82	2.82	0.00	0.00	0.00	0.00	7.18
Flare	3.28	3.28	0.00	0.00	0.00	0.00	6.72
Pipe	3.75	3.28	0.00	0.00	0.47	0.00	6.72
Pipe	4.22	3.28	0.00	0.00	0.94	0.00	6.72
Pipe	4.69	3.28	0.00	0.00	1.41	0.00	6.72
Pipe	5.16	3.28	0.00	0.00	1.88	0.00	6.72
Flare	5.63	3.75	0.00	0.00	1.88	0.00	6.25
Flare	6.10	4.22	0.00	0.00	1.88	0.00	5.78
Flare	6.57	4.69	0.00	0.00	1.88	0.00	5.31
Flare	7.04	5.16	0.00	0.00	1.88	0.00	4.84

Flare Permit Remaining (Flare Permit 10 10^3m^3)

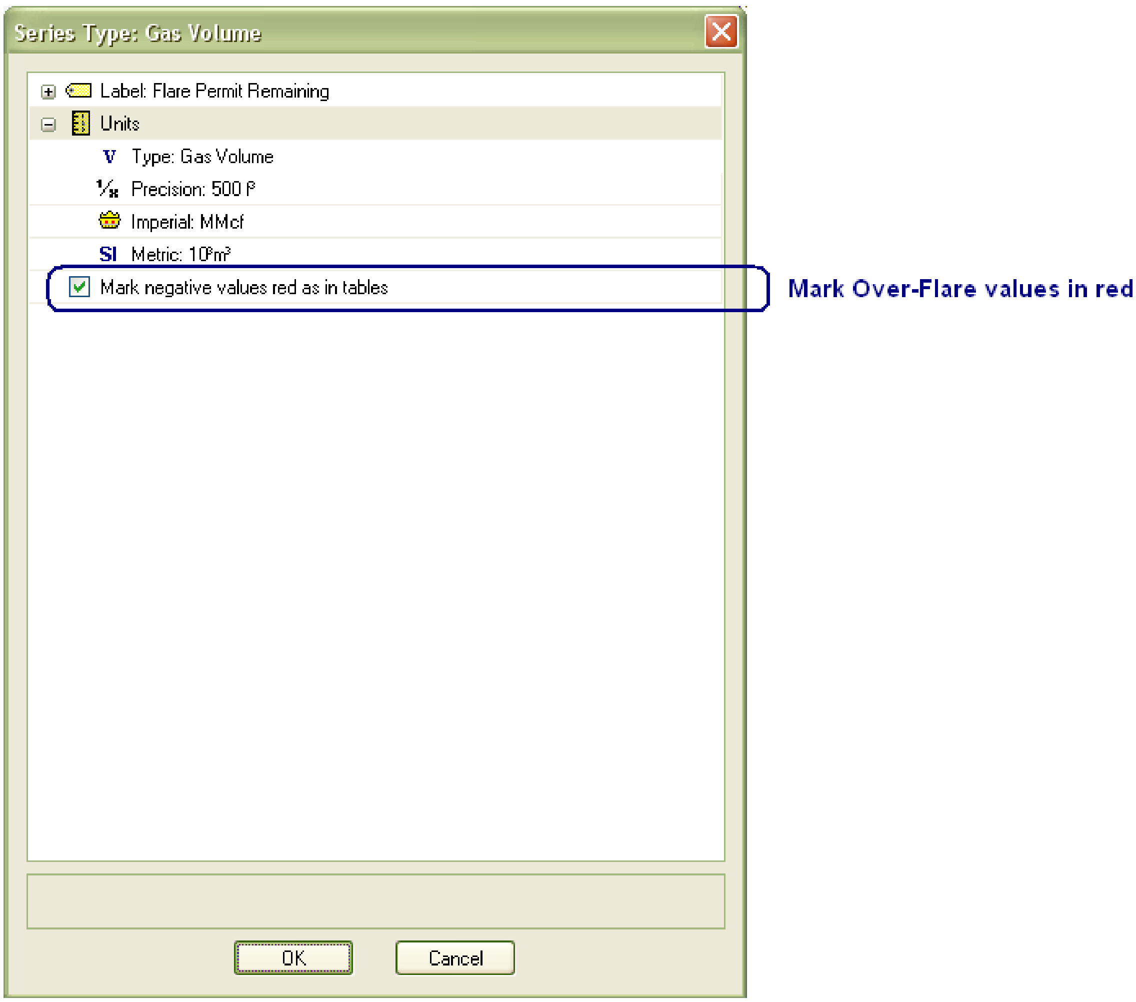
Flare permit example with “Gas To” sinks.

The “Flare Permit Remaining” column will (by default) display over-flare volume cums in red; this action can be set or cleared via the series properties window.

Gas To	Total Gas	Total Gas Flared	Total Gas Vented	Total Gas Incinerated	Total Gas Pipeline	Total Gas Other	Flare Permit Remaining
	10^3m^3	10^3m^3	10^3m^3	10^3m^3	10^3m^3	10^3m^3	10^3m^3
Pipe	3.75	3.28	0.00	0.00	0.47	0.00	0.72
Pipe	4.22	3.28	0.00	0.00	0.94	0.00	0.72
Pipe	4.69	3.28	0.00	0.00	1.41	0.00	0.72
Pipe	5.16	3.28	0.00	0.00	1.88	0.00	0.72
Flare	5.63	3.75	0.00	0.00	1.88	0.00	0.25
Flare	6.10	4.22	0.00	0.00	1.88	0.00	-0.22
Flare	6.57	4.69	0.00	0.00	1.88	0.00	-0.69
Flare	7.04	5.16	0.00	0.00	1.88	0.00	-1.16

Over-Flare values in red

"Right-Click" the "Flare Permit Remaining" column header to display the "Series Properties" window



"Flare Permit Remaining" series property window

The Data Summary contains the following calculated (ratio) series for produced fluids;

- GOR (Gas Oil Ratio)
- GOR Cum (Cumulative Gas Oil Ratio)
- GWR (Gas Water Ratio)
- GWR Cum (Cumulative Gas Water Ratio)
- WOR (Water Oil Ratio)
- WOR Cum (Cumulative Water Oil Ratio)
- CGR (Condensate Gas Ratio)
- GOR Cum (Cumulative Condensate Gas Ratio)

Alarms

FlowTest displays alarm indicators in the leftmost column of the data table. The alarm indicators alert the user to various warning and error conditions that may arise in the meter calculations.

	Test Time		
	Date	Time	Cum
	dd/mm/yyyy	hh:mm:ss	Hrs.
22	09/07/2006	17:20:00	9.3333
23	09/07/2006	17:30:00	9.5000
24	09/07/2006	17:45:00	9.7500
25	09/07/2006	18:00:00	10.0000

Alarm Indicator

Data Table with Alarm indication.

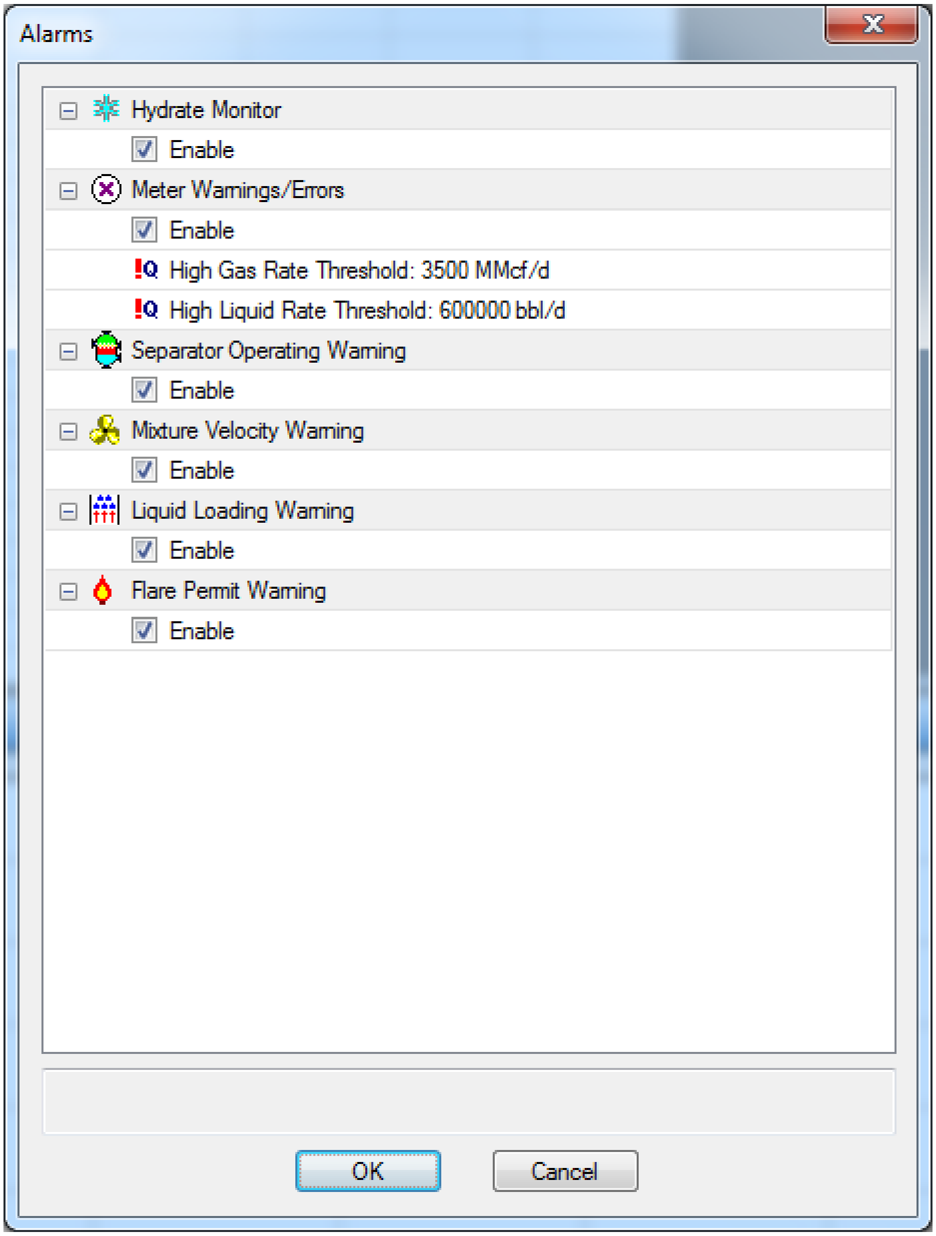
The following list describes the available alarm types:

- Multiple Alarms
- Sub-Critical Flow Warning
- Beta-ratio Warning
- Pressure-ratio Warning
- Hydrate Warning
- Separator Operating Range Warning
- Erosional Velocity Warning
- Liquid Loading Warning
- Flare Permit Warning
- Critical Alarm
- High Flow Rate Warning

- The multiple alarm indicator is displayed when more than one alarm condition exists at a given time.
- A sub-critical flow alarm indicates that a critical-flow meter (chokes and critical flow prover) is operating below the critical pressure.
- A beta ratio warning is issued by an orifice meter when the ratio of the plate to tube diameters is outside the meter calculation limits.
- A pressure ratio error is issued by an orifice meter when the ratio of the down-stream to up-stream pressures is outside the meter calculation limits.
- The hydrate warning is an indicator of the potential for hydrate formation. Hydrate warnings can be issued for the wellhead or by any gas meter type. This is not a definitive indication of hydrate formation, but is an indication that conditions are favorable for the formation of hydrates.

- A separator operating range alarm indicates a separator pressure and temperature outside the specified operating range.
- An erosional velocity alarm is an indicator that the in situ mixture velocity is greater than the erosional limit.
- A liquid loading alarm is an indicator that the gas velocity may be insufficient to remove liquids from the well.
- A flare permit alarm is issued when the flared gas volume exceeds the permitted flare volume.
- The critical alarm is displayed for any condition that requires immediate operator attention. A separator pressure in excess of the specified maximum is a critical alarm.
- The high flow rate alarm is displayed when a meter (gas or liquid) exceeds the preset maximum rate. Rate presets can be configured in the 'Alarm Monitor' dialog (described below).

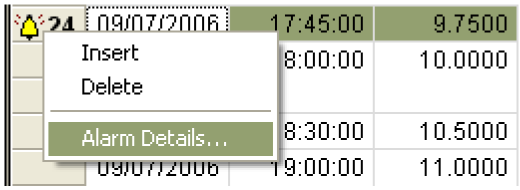
Alarms can be configured (enabled or disabled) in the Alarm monitor dialog. To display the Alarm monitor select the Alarm Monitor toolbar button. 

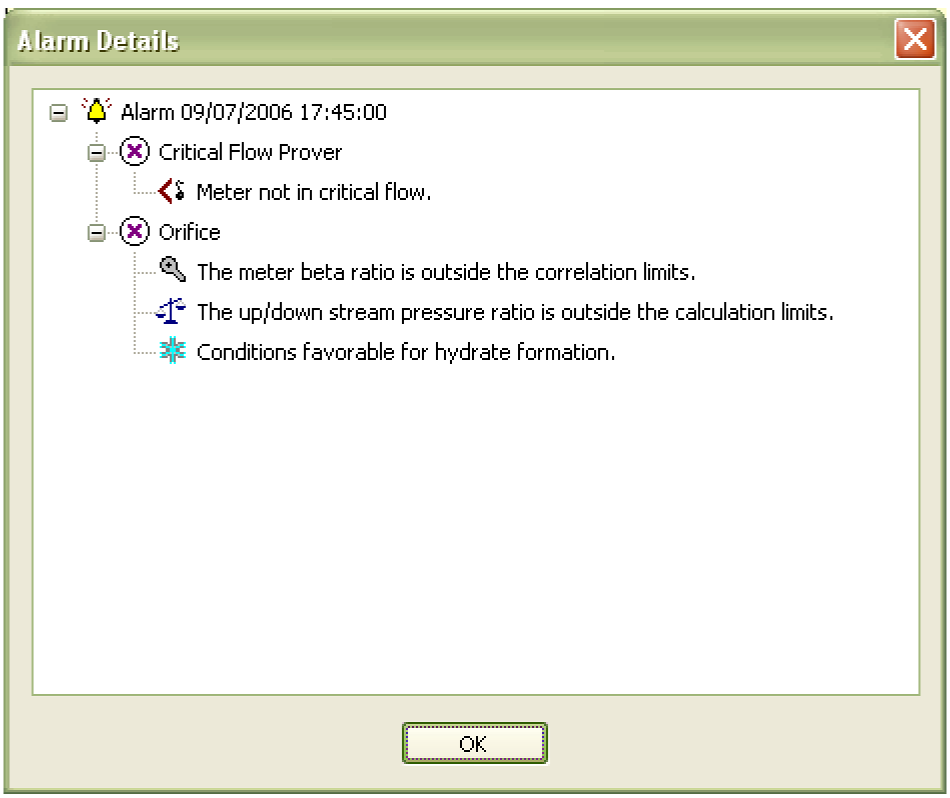


The 'Enable' checkbox under each alarm type, enables or disables the alarm.

The 'High Rate' thresholds for gas and liquid meters specify the maximum allowable flow rate before triggering an alarm. Clearing the high rate threshold value (or setting the value to zero) will disable the high rate alarm warning.

To get details on an alarm condition (including the alarm types and meters issuing the alarms) “right-click” the alarm indicator and select Alarm Details.





The Alarm Details dialog displays the alarm description, type and the meters issuing the alarm for the specified time index.

Smart Tags

Smart Tags provide the user with the ability to easily incorporate table calculations into the comments for daily summaries and other calculated sub reports. The smart tag engine is an enhancement of the Inline Summary and Section Summary events (see event section). If you create comments in the data table that look like the following:

Summary:
Total Produced:
Gas = 3.28 $10^3 m^3$
Oil = 11.50 m^3
Water = 1.50 m^3

Last 8 Hours:
Gas = 2.29 $10^3 m^3$
Oil = 9.50 m^3
Water = 1.50 m^3

(Then smart tags can make you life easier)

General Smart Tag Syntax:
All smart tag definitions state with a < character and end with a > character and include a moniker that defines the tag source followed by an optional set of moniker specific arguments (or modifiers) and an optional formatting directives.

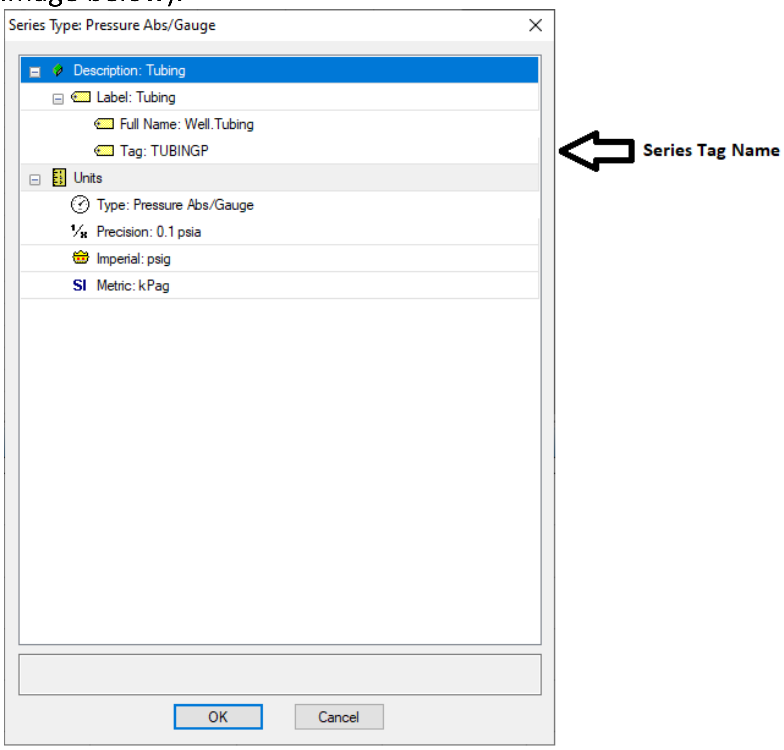
<MONIKER MODIFIER(S) FORMATTING>

MONIKER: can be any moniker listed in the 'Table Smart Tag Reference' below or test information monikers Smart Tag Reference in appendix B.

Common Smart Tag Examples

The examples below cover the “How To” with respect to some common Smart Tag requests.

1) Accessing the current value of a series column.
   Any series value can be accessed as a smart tag by using the “SERIES” command with a tag reference. Each series contains a unique user defined “Tag” name that is specified in the series properties (see image below).

   Series property window

   Given the tag name “TUBINGP” the smart tag to access the current value is as follows:
   <SERIES[TUBINGP]>

2) Cumulative Flow-Time and daily hours flowed.
   For Cumulative Flow-Time the Flow-Time series is accessed via the series command as follows:
   <SERIES[FLOWTIME]>
   For Daily hours flowed simply add a “GAIN 24” to the tag as follows:
   <SERIES[FLOWTIME] GAIN 24>
3) Cumulative gas flow-time to pipeline and daily gas hours to pipeline.
   This is similar to the Cumulative Flow-Time example above with the addition that you need to create a generic Flow-Time series on the “gas to pipe” cum series, and then you tag the Generic Flow-Time series.

Table Smart Tag Reference

Moniker	Description
Test Time General:	
DATETIME	Date/Time
Predefined Well series:	
CASINGP	Casing Pressure
CASINGT	Casing Temperature
CASINGDD	Casing Draw Down
CHOKE	Choke Size
TUBINGP	Tubing Pressure
TUBINGT	Tubing Temperature
TUBINGDD	Tubing Draw Down
Predefined Data Summary Series:	
GAS_PRO	Produced Gas
GAS_PRO_VENT	Produced Gas (vented)
GAS_PRO_FLARE	Produced Gas (flared)
GAS_PRO_INCIN	Produced Gas (incinerated)
GAS_PRO_PIPE	Produced Gas (to pipeline)
GAS_PRO_OTH	Produced Gas (to other)
GAS_LOAD	Recovered Load Gas
GAS_LOAD_INJ	Total Load Gas Injected
GAS_LOAD_LTR	Load Gas Left To Recover
GAS_LOAD_VENT	Load Gas (vented)
GAS_LOAD_FLARE	Load Gas (flared)
GAS_LOAD _INCIN	Load Gas (incinerated)
GAS_LOAD _PIPE	Load Gas (to pipeline)
GAS_LOAD _OTH	Load Gas (to other)
GAS_ALL	Total Gas (produced + load)
GAS_ALL_VENT	Total Gas (produced + load) (vented)
GAS_ALL_FLARE	Total Gas (produced + load) (flared)
GAS_ALL _INCIN	Total Gas (produced + load) (incinerated)
GAS_ALL _PIPE	Total Gas (produced + load) (to pipeline)
GAS_ALL _OTH	Total Gas (produced + load) (to other)
WTR_PRO	Produced Water
WTR_PRO_PIPE	Produced Water (to pipeline)
WTR_PRO_TANK	Produced Water (to tank)
WTR_PRO_OTH	Produced Water (to other)
WTR_ALL	Total Water (produced + load)
WTR_ALL_PIPE	Total Water (produced + load) (to pipeline)
WTR_ALL_TANK	Total Water (produced + load) (to tank)
WTR_ALL_OTH	Total Water (produced + load) (to other)

OBSOLETE
"Use SERIES Tag"

OIL_PRO	Produced Oil
OIL_PRO_PIPE	Produced Oil (to pipeline)
OIL_PRO_TANK	Produced Oil (to tank)
OIL_PRO_OTH	Produced Oil (to other)
OIL_ALL	Total Oil (produced + load)
OIL_ALL_PIPE	Total Oil (produced + load) (to pipeline)
OIL_ALL_TANK	Total Oil (produced + load) (to tank)
OIL_ALL_OTH	Total Oil (produced + load) (to other)
CND_PRO	Produced Condensate
CND_PRO_PIPE	Produced Condensate (to pipeline)
CND_PRO_TANK	Produced Condensate (to tank)
CND_PRO_OTH	Produced Condensate (to other)
CND_ALL	Total Condensate (produced + load)
CND_ALL_PIPE	Total Condensate (produced + load) (to pipeline)
CND_ALL_TANK	Total Condensate (produced + load) (to tank)
CND_ALL_OTH	Total Condensate (produced + load) (to other)
LIQ_PRO	Produced Liquids
LIQ_ALL	Total Liquids (produced + load)
LIQ_LOAD	Recovered Load Liquid
LIQ_LOAD_LTR	Load Liquid Left To Recover
LIQ_LOAD_INJ	Total Load Liquid Injected
LIQ_LOAD_PCT	% Recovered Load Liquid
FLARE_REMAIN	Flare permit remaining
Series Tag:	
SERIES[TAG]	Any series where “TAG” is the series tag name

For series representing a volume, under the ‘Data Summary’ heading in the table above, an additional syntax is supported allowing the user to specify the fluid gain over a specified time interval as indicated below:

MODIFIER(S):

Various modifiers can be included within the moniker tag, after the moniker name. The modifiers define value-added functionality, for certain monikers, as defined below:

- GAIN modifier
  Format:
  <MONIKER GAIN ##.##>

  - MONIKER specifies the data summary volume series (by predefined name)
  - GAIN keyword specifies that the moniker represents a gain rather than the cumulative volume.
  - ###.## a number (in hours) representing the time interval the gain is calculated for.

  Example:
  <OIL_PRO GAIN 8> Reports the oil produced over the last 8 hours

  The SERIES[TAG] will also support the "GAIN" modifier in the following cases:
  - If the series represented by the "TAG" is a calculated cumulative volume.
  - If the series represented by the "TAG" is a calculated flow-time.

  Example:
  <SERIES[TAG] Gain 8> Reports the gain over the last 8 hours

  Note: if the series represented by the "TAG" does not support the "GAIN" modifier the tag will report a "NOGAIN !" error.

- OFFSET modifier
  Format:
  <MONIKER OFFSET ##.##>

  - MONIKER specifies the date-time series (by name: DATETIME)
  - OFFSET keyword specifies that the moniker represents an offset from the current date-time.
  - ###.## a number (in hours) representing the offset.

  Example:
  <DATETIME OFFSET 8> Resolves to a [DATE + 8 hours]

- RANGE modifier
  Format:
  <MONIKER RANGE ##.##>

  - MONIKER specifies the date-time series (by name: DATETIME)

- RANGE keyword specifies that the moniker represents a from-to date rather than a single date.
- ###.## a number (in hours) representing the time interval the range is calculated for.

Example:
<DATETIME RANGE 8> Resolves to a [DATE – 8 hours] – [DATE]

FORMATTING:
For smart tags representing a numeric value, control over the display precision, units and other visual attributes can customized via a 'number format' definition.
The number format definition contains format specifiers to control display output and a series of optional directives to control units and other attributes.

A number format definition is contained within a matching set of {} characters and must be the final tag item before the closing > character of the smart tag.

Number Format: {'Format Specifiers', Directive, Directive, …}

Format specifiers are specified within a matching set of '' characters. Valid specifiers are as follows:

Formatting specifiers:
V outputs the numerical value of the resulting tag
U outputs the abbreviated unit
% the '%' character is used with the 'V' character to control the precision of the numeric tag value.

The default numeric formatting (when no formatting is specified) is equivalent to:
{'V U'} resulting in the numeric value followed by the unit.

Tags can be configured to display only the numeric value by omitting the 'U' specifier, in addition omitting the 'V' specifier displays the units only (without the associated value).

When a smart tag represents a data series, the default precision for the 'V' specifier and the unit type is the same as that specified for the series (precision and units follow the series).

The display precision 'V' specifier can be overridden by preceding % specifier to explicitly specify the numeric precision as shown below:
%0.nV where: n specifies the number of digits following the decimal.

‘V’ format examples:

%V	outputs the value in maximum precision.
%0.2V	outputs the value formatted to 2 decimal points
%0.4V	outputs the value formatted to 4 decimal points

Format directives can be applied to the number formatting to change both the reported units and base conditions using the directive commands as follows:

Directives:

IN(UNIT) overrides the display units for the tag (affects the ‘V’ and ‘U’ output) “UNIT” can be any valid unit tag for the value (for a list of unit tags see ‘Unit Tag Reference’ in appendix A). “UNIT” can also be one of the following key words:

ACTIVE Use the current active units, this is the default when no IN directive is specified.

METRIC Use the active metric units.

IMPERIAL Use the active imperial units.

AT(CON) overrides the pressure and temperature base of the displayed ‘V’ value (where applicable) “CON” can be one of the following condition key words:

ACTIVE Use the current active conditions, this is the default when no AT directive is specified.

METRIC Use the active metric base conditions.

IMPERIAL Use the active imperial base conditions.

STD Use the default imperial standard conditions of: 14.73 psia and 60 °F

PAS Use the default metric standard conditions of: 101.325 kPaa and 15 °C

Time Shifting:

Smart tags in the data table typically represent a summary of the test data at the point where they are placed in the data table (i.e. the reference is the current data row), however tags can also be created that use a reference point other than the current position.

To change the SmartTag reference point a single positive value is placed between the opening tag and the tag name. This value represents the number of hours to shift the reference back.

Format:

<# MONIKER > where # represents the time shift in hours.

Example:

<8 SERIES[TAG]> Reports the series value 8 hours previous.

Table Comments may also include test information smart tags, for more information see Smart Tag Reference in appendix B.

Creating a data table comment with Smart Tags

The following demonstrates how to use smart tags in the data tables.

	Test Time			Data Summary					
	Date	Time	Event	Produced Oil	Produced Water	Load Liquid	Load Liquid (LTR)	Produced Gas	Load Gas
	dd/mm/yyyy	hh:mm:ss		m^3	m^3	m^3	m^3	10^3m^3	10^3m^3
1	06/04/2009	16:10:34		0.00	0.00	0.00	10.00	0.00	0.00
2	06/04/2009	17:10:34		0.50	0.00	0.50	9.50	0.33	0.08
3	06/04/2009	18:10:34		1.50	0.00	1.50	8.50	0.66	0.16
4	06/04/2009	19:10:34		2.00	0.00	2.00	8.00	0.98	0.25
5	06/04/2009	20:10:34		3.00	0.00	3.00	7.00	1.31	0.33
6	06/04/2009	21:10:34		5.50	0.00	5.50	4.50	1.64	0.41
7	06/04/2009	22:10:34		8.00	0.00	8.00	2.00	1.97	0.49
8	06/04/2009	23:10:34		9.50	0.00	9.50	0.50	2.29	0.57
9	07/04/2009	00:10:34		10.00	0.00	10.00	0.00	2.62	0.66
10	07/04/2009	01:10:34		10.50	0.50	10.00	0.00	2.95	0.74
11	07/04/2009	02:10:34		11.00	1.00	10.00	0.00	3.28	0.82
12	07/04/2009	03:10:34		11.50	1.50	10.00	0.00	3.28	0.82
13									
14									
15									

Example production with produced gas, oil, water and load fluids.

	Test Time			Data Summary					
	Date	Time	Event	Produced Oil	Produced Water	Load Liquid	Load Liquid (LTR)	Produced Gas	Load Gas
	dd/mm/yyyy	hh:mm:ss		m^3	m^3	m^3	m^3	10^3m^3	10^3m^3
1	06/04/2009	16:10:34		0.00	0.00	0.00	10.00	0.00	0.00
2	06/04/2009	17:10:34		0.50	0.00	0.50	9.50	0.33	0.08
3	06/04/2009	18:10:34		1.50	0.00	1.50	8.50	0.66	0.16
4	06/04/2009	19:10:34		2.00	0.00	2.00	8.00	0.98	0.25
5	06/04/2009	20:10:34		3.00	0.00	3.00	7.00	1.31	0.33
6	06/04/2009	21:10:34		5.50	0.00	5.50	4.50	1.64	0.41
7	06/04/2009	22:10:34		8.00	0.00	8.00	2.00	1.97	0.49
8	06/04/2009	23:10:34		9.50	0.00	9.50	0.50	2.29	0.57
9	07/04/2009	00:10:34		10.00	0.00	10.00	0.00	2.62	0.66
10	07/04/2009	01:10:34		10.50	0.50	10.00	0.00	2.95	0.74
11	07/04/2009	02:10:34		11.00	1.00	10.00	0.00	3.28	0.82
12	07/04/2009	03:10:34		11.50	1.50	10.00	0.00	3.28	0.82
13			Produced Gas = <GAS_PRO>						
14									
15									

Add a comment with the produced gas smart tag

	Test Time			Data Summary					
	Date	Time	Event	Produced Oil	Produced Water	Load Liquid	Load Liquid (LTR)	Produced Gas	Load Gas
	dd/mm/yyyy	hh:mm:ss		m^3	m^3	m^3	m^3	10^3m^3	10^3m^3
1	06/04/2009	16:10:34		0.00	0.00	0.00	10.00	0.00	0.00
2	06/04/2009	17:10:34		0.50	0.00	0.50	9.50	0.33	0.08
3	06/04/2009	18:10:34		1.50	0.00	1.50	8.50	0.66	0.16
4	06/04/2009	19:10:34		2.00	0.00	2.00	8.00	0.98	0.25
5	06/04/2009	20:10:34		3.00	0.00	3.00	7.00	1.31	0.33
6	06/04/2009	21:10:34		5.50	0.00	5.50	4.50	1.64	0.41
7	06/04/2009	22:10:34		8.00	0.00	8.00	2.00	1.97	0.49
8	06/04/2009	23:10:34		9.50	0.00	9.50	0.50	2.29	0.57
9	07/04/2009	00:10:34		10.00	0.00	10.00	0.00	2.62	0.66
10	07/04/2009	01:10:34		10.50	0.50	10.00	0.00	2.95	0.74
11	07/04/2009	02:10:34		11.00	1.00	10.00	0.00	3.28	0.82
12	07/04/2009	03:10:34		11.50	1.50	10.00	0.00	3.28	0.82
13			Produced Gas = 3.28 10^3m^3						
14									
15									

The smart tag is calculated when the user clicks away from the comment line

	Test Time			Data Summary					
	Date	Time	Event	Produced Oil	Produced Water	Load Liquid	Load Liquid (LTR)	Produced Gas	Load Gas
	dd/mm/yyyy	hh:mm:ss		m^3	m^3	m^3	m^3	10^3m^3	10^3m^3
4	06/04/2009	19:10:34		2.00	0.00	2.00	8.00	0.98	0.25
5	06/04/2009	20:10:34		3.00	0.00	3.00	7.00	1.31	0.33
6	06/04/2009	21:10:34		5.50	0.00	5.50	4.50	1.64	0.41
7	06/04/2009	22:10:34		8.00	0.00	8.00	2.00	1.97	0.49
8	06/04/2009	23:10:34		9.50	0.00	9.50	0.50	2.29	0.57
9	07/04/2009	00:10:34		10.00	0.00	10.00	0.00	2.62	0.66
10	07/04/2009	01:10:34		10.50	0.50	10.00	0.00	2.95	0.74
11	07/04/2009	02:10:34		11.00	1.00	10.00	0.00	3.28	0.82
12	07/04/2009	03:10:34		11.50	1.50	10.00	0.00	3.28	0.82
13			Summary: Total Produced: Gas = <GAS_PRO> Oil = <OIL_PRO> Water = <WTR_PRO> Last 8 Hours: Gas = <GAS_PRO GAIN 8> Oil = <OIL_PRO GAIN 8> Water = <WTR_PRO GAIN 8>						
14									
15									

An example of using smart tags to create multi-line comments with test totals and daily summaries.

	Test Time			Data Summary					
	Date	Time	Event	Produced Oil	Produced Water	Load Liquid	Load Liquid (LTR)	Produced Gas	Load Gas
	dd/mm/yyyy	hh:mm:ss		m^3	m^3	m^3	m^3	10^3m^3	10^3m^3
4	06/04/2009	19:10:34		2.00	0.00	2.00	8.00	0.98	0.25
5	06/04/2009	20:10:34		3.00	0.00	3.00	7.00	1.31	0.33
6	06/04/2009	21:10:34		5.50	0.00	5.50	4.50	1.64	0.41
7	06/04/2009	22:10:34		8.00	0.00	8.00	2.00	1.97	0.49
8	06/04/2009	23:10:34		9.50	0.00	9.50	0.50	2.29	0.57
9	07/04/2009	00:10:34		10.00	0.00	10.00	0.00	2.62	0.66
10	07/04/2009	01:10:34		10.50	0.50	10.00	0.00	2.95	0.74
11	07/04/2009	02:10:34		11.00	1.00	10.00	0.00	3.28	0.82
12	07/04/2009	03:10:34		11.50	1.50	10.00	0.00	3.28	0.82
13			Summary: Total Produced: Gas = 3.28 10^3m^3 Oil = 11.50 m^3 Water = 1.50 m^3 Last 8 Hours: Gas = 2.29 10^3m^3 Oil = 9.50 m^3 Water = 1.50 m^3						
14									
15									

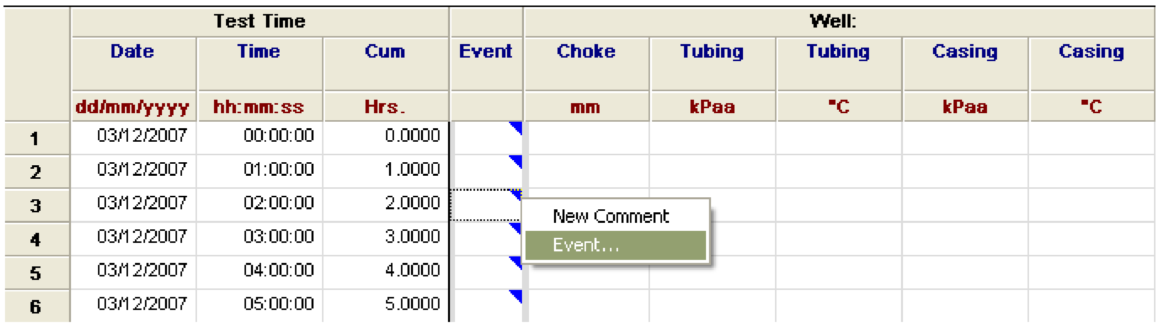
Resulting calculated smart tag.

Using Smart Tags in the table comments provides the following advantages over hard entered values and fluid volumes:

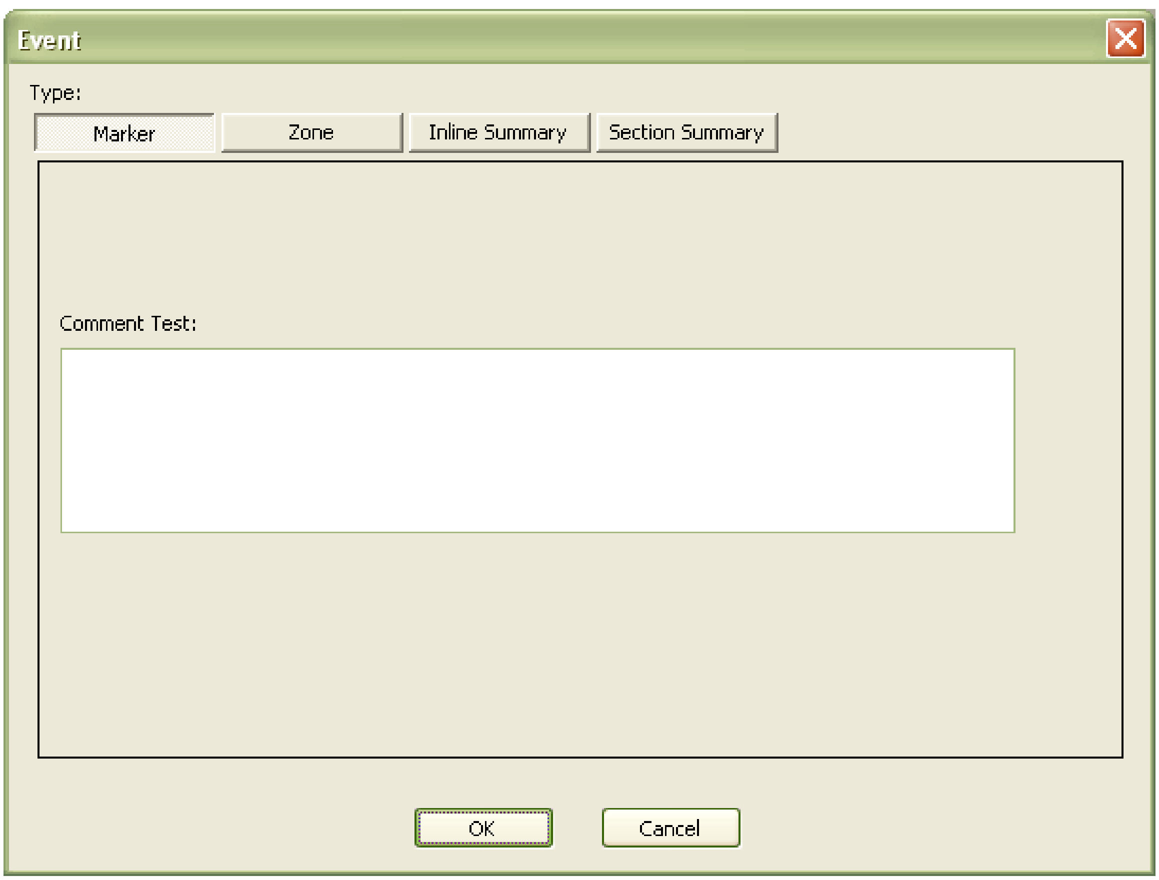
1. Eliminates the need to manually calculate fluid gains for daily totals.
2. Smart tags are automatically recalculated when the table data is modified.
3. Changing units will also change the smart tag values and units.
4. Gas volume smart tags will update automatically when gas properties are updated from the gas analysis results.

Events

FlowTest includes a number of events to indicate specific actions during the test. Events are created in the data table by clicking the blue triangle in the event column, and selecting the “Event…” menu option.



The “Event…” option will display the main event dialog.



The buttons across the top of the event dialog specify the event to be added as described below:

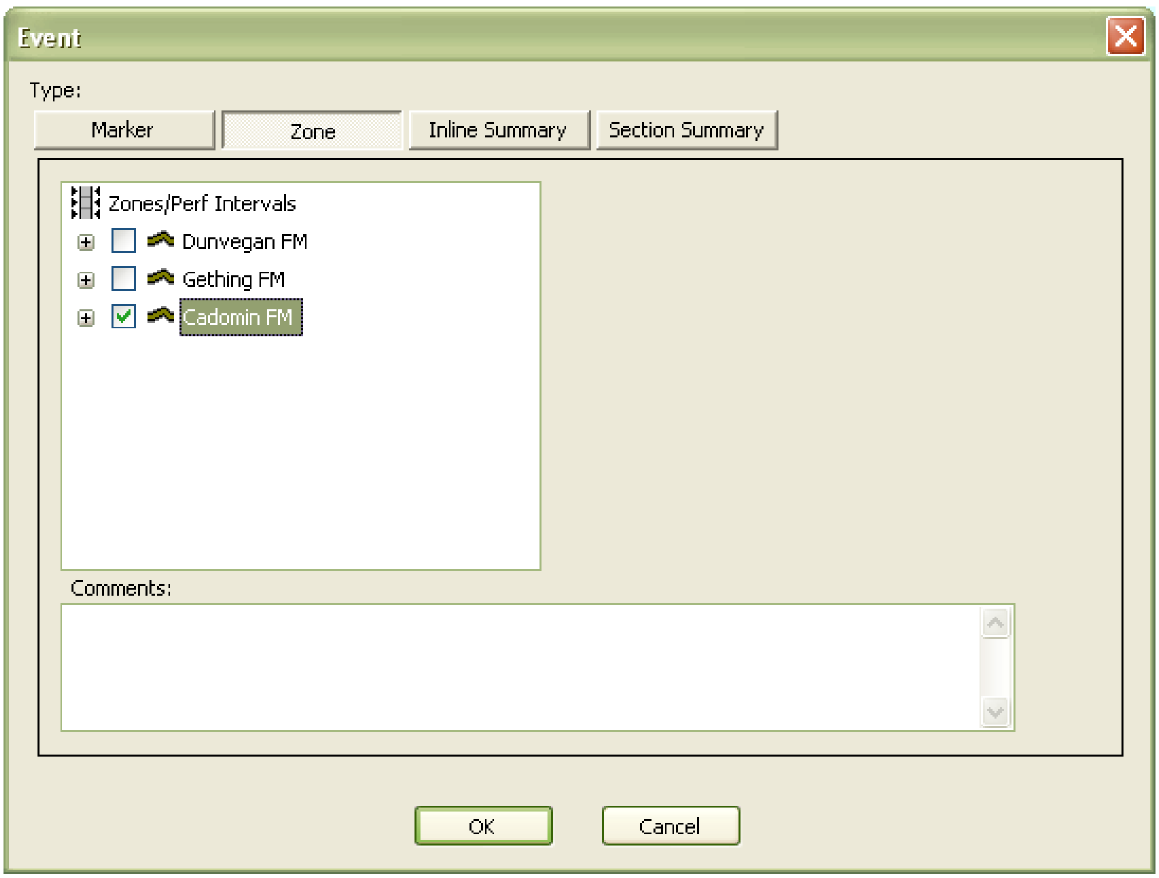
Marker Event:

The Marker event is similar to a data comment with the exception that other events can be referenced to the marker event. The contents of the Comment Text will be displayed in the data table.

Zone Event:

Zone events allow the user to specify the zones(s) currently under test. The zone event can be any single zone or a commingling of zones specified in the intervals of the “Test Information” dialog.

A Zone event is created by selection the “Zone” on the add Event dialog.



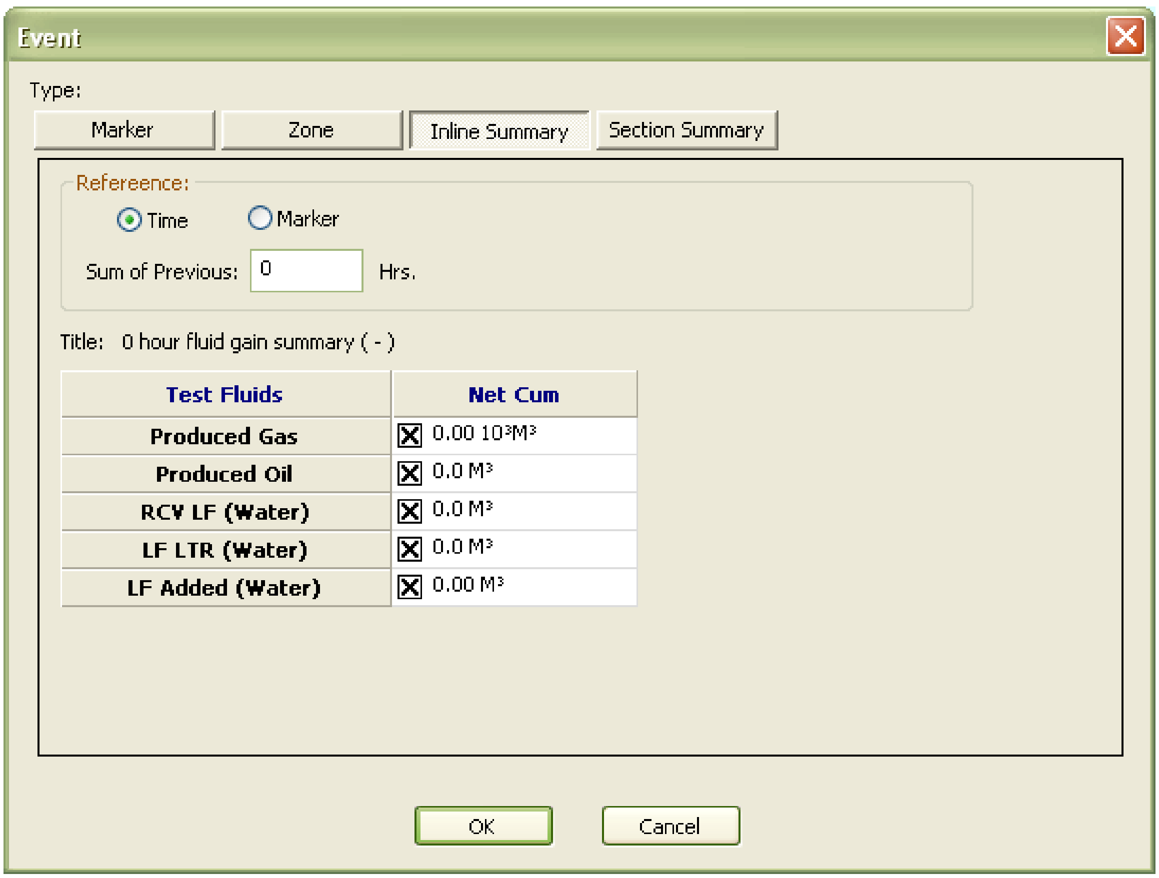
Select the zone or commingled zones under test via. Check the box beside the respective zone to specify the current zone(s) under test. Additional comment text can be entered under “Comments”, for display in the data table.

Inline Summary Event:

An Inline Summary event provides the ability to add test summaries, based on the previous (n hours) of production, to the data table

28	04/12/2007	00:00:00	24.0000	**12 hour fluid gain summary (03/12/2007 12:00:00 - 04/12/2007 00:00:00)** **Produced Gas 7.11 10^3M^3** **Produced Oil 5.4 M^3** **RCV LF (Water) 2.2 M^3** **LF LTR (Water) 4.8 M^3** **LF Added (Water) 0.00 M^3**
29	04/12/2007	00:00:00	24.0000	**24 hour fluid gain summary (03/12/2007 00:00:00 - 04/12/2007 00:00:00)** **Produced Gas 13.34 10^3M^3** **Produced Oil 17.4 M^3** **RCV LF (Water) 10.2 M^3** **LF LTR (Water) 4.8 M^3** **LF Added (Water) 15.00 M^3**

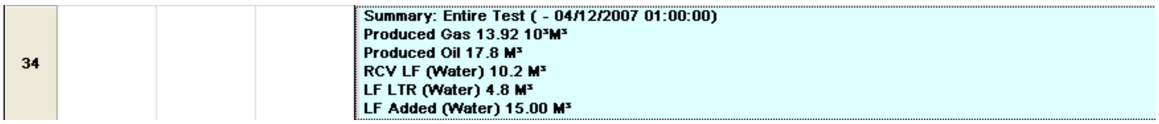
An Inline Summary event is created by selection the “Inline Summary” on the add Event dialog.



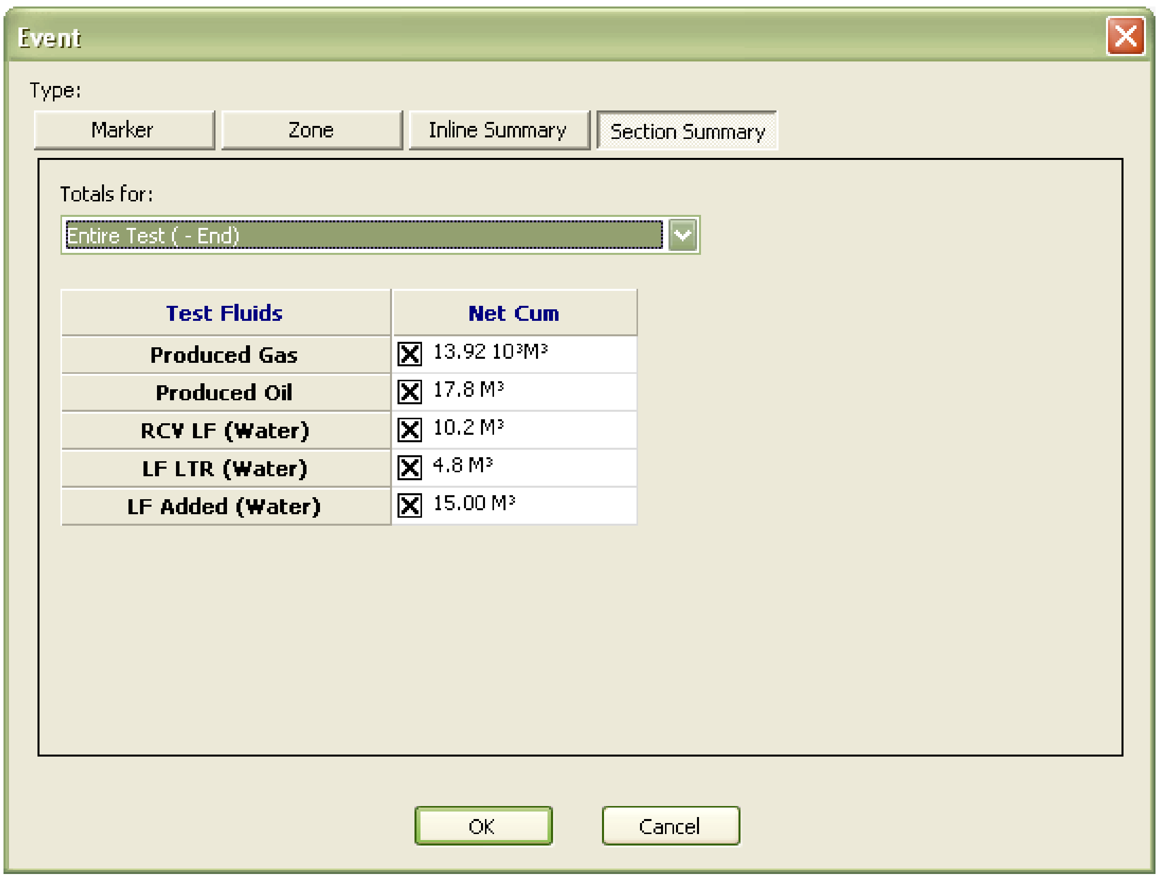
The “Reference” for the summary can be either a fixed time (i.e. the last 8 hours) or a previous “marker” type event.
All fluids, currently defined in the test, are listed in the “Test Fluids” table. The check boxes beside each fluid (when checked) will be included in the summary.

Section Summary Event:

The Section summary event operates in a manner similar to that of the Inline Summary with the exception that the summary is reported on a specified test section rather than the previous (n hours) of production. Valid test section include; the entire test and any Zone event.



A Section Summary event is created by selection the “Section Summary” on the add Event dialog.



The “Totals for” option specifies the section for the summary, options will include “Entire Test” and all zone events.
All fluids, currently defined in the test, are listed in the “Test Fluids” table. The check boxes beside each fluid (when checked) will be included in the summary.

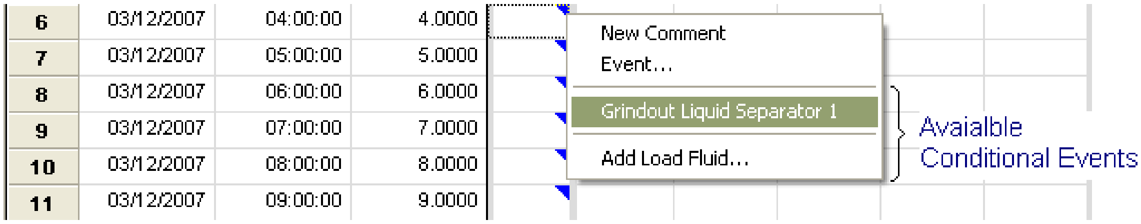
The Section Summary events are stateless (they do not require an event time in the data table) as such Section Summaries can be placed anywhere in the data table, even before the actual, referenced, section event.

	Test Time				Well:				
	Date	Time	Cum	Event	Choke	Tubing	Tubing	Casing	Casing
	dd/mm/yyyy	hh:mm:ss	Hrs.		mm	kPaa	°C	kPaa	°C
34				Summary: Entire Test (- 04/12/2007 01:00:00) Produced Gas 13.92 10^3M^3 Produced Oil 17.8 M^3 RCV LF (Water) 10.2 M^3 LF LTR (Water) 4.8 M^3 LF Added (Water) 15.00 M^3					

$\underbrace{\hspace{6cm}}_{\text{Date/Time Optional}}$

Conditional Events

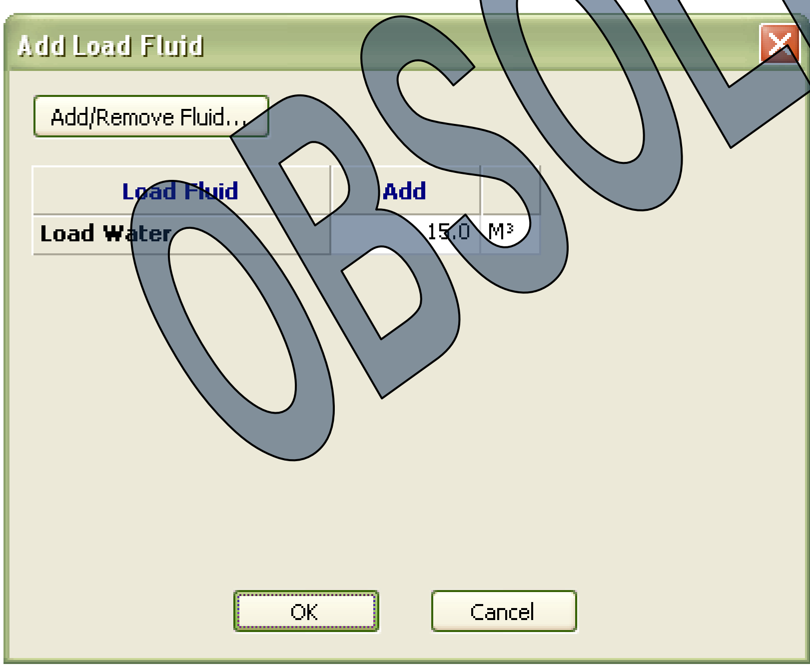
Conditional events are not accessible though the “Add Event” dialog, these events are available only if certain criteria are met. Conditional events are accessed through the event column of the data table.



The following events are conditional events:

Add Load Fluid Event:

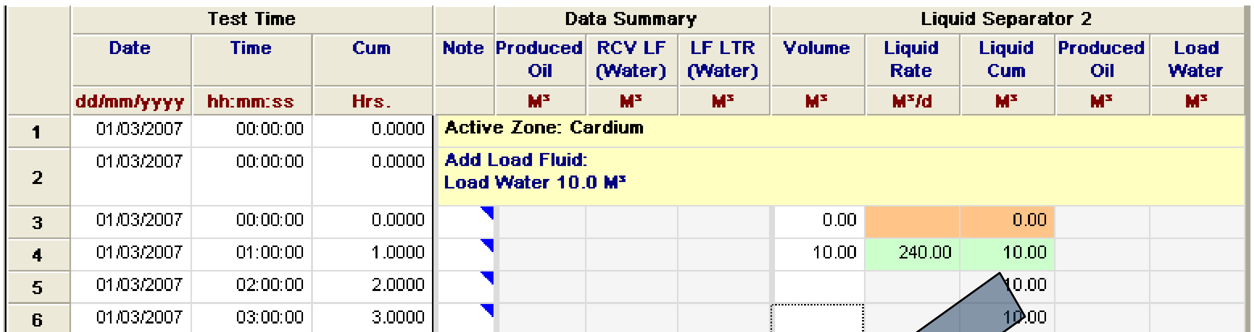
The Add Load Fluid event provides a mechanism to add load fluid to the system and is available only if load fluid is specified for the test (see Liquid Separator Meter).
The Add Load Fluid event(s) in conjunction with the load fluid recovered, by the liquid meters, form the basis of the LF LTR (load fluid left to recover) calculation. An Add Load Fluid event would typically follow a Zone event; however load fluid can be added at any point during the test.



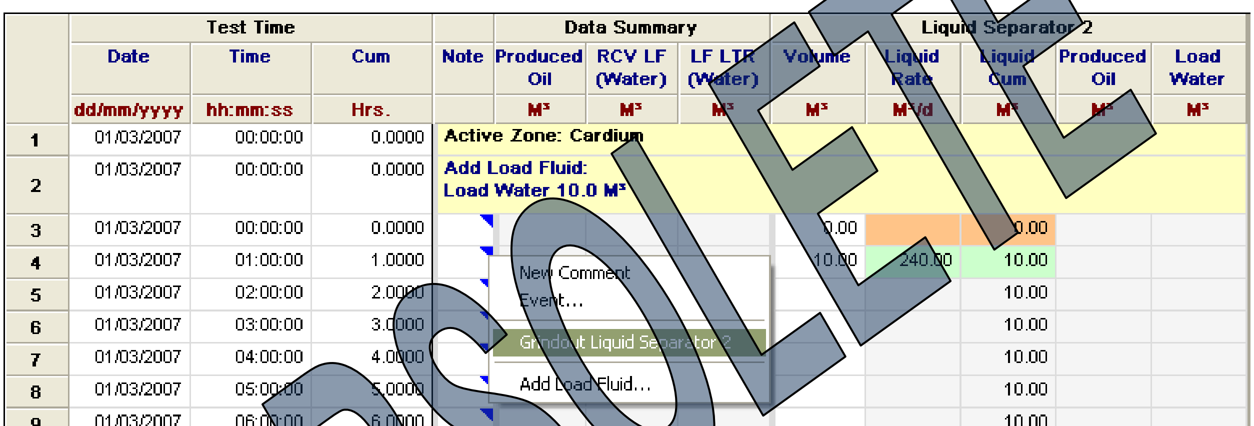
The Add Load Fluid dialog lists all fluid types defined as load fluid. The entered volume specifies the fluid addition for the event.

Liquid Meter Grind-out Event

In order for the liquid meter to calculate the proportions of separator fluids, a "Grind-out" Event must be applied at a **valid** meter reading. The Grind-out event is available only for Liquid Separator meter types and only on valid meter readings.

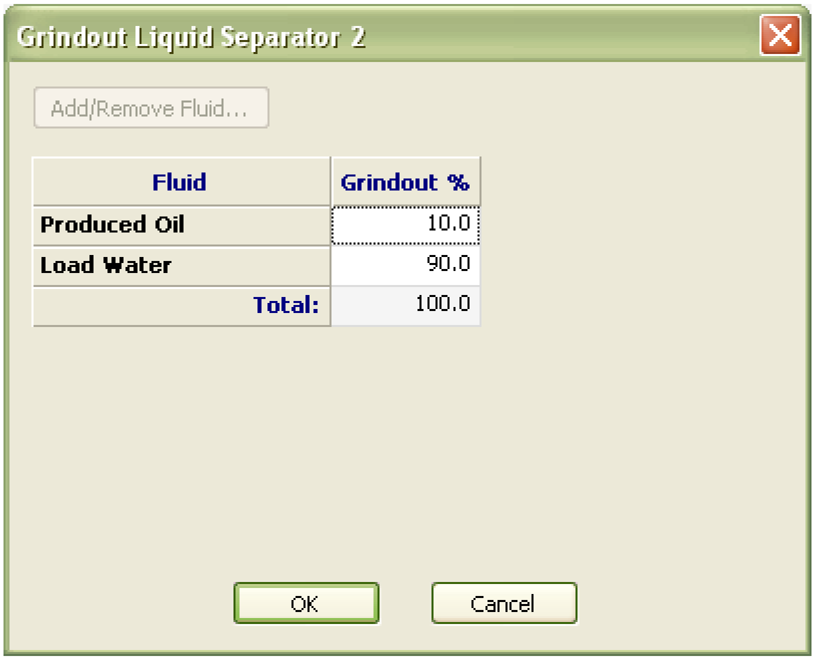


	Test Time				Data Summary			Liquid Separator 2				
	Date	Time	Cum	Note	Produced Oil	RCV LF (Water)	LF LTR (Water)	Volume	Liquid Rate	Liquid Cum	Produced Oil	Load Water
	dd/mm/yyyy	hh:mm:ss	Hrs.		M³	M³	M³	M³	M³/d	M³	M³	M³
1	01/03/2007	00:00:00	0.0000	Active Zone: Cardium								
2	01/03/2007	00:00:00	0.0000	Add Load Fluid: Load Water 10.0 M³								
3	01/03/2007	00:00:00	0.0000					0.00		0.00		
4	01/03/2007	01:00:00	1.0000					10.00	240.00	10.00		
5	01/03/2007	02:00:00	2.0000							10.00		
6	01/03/2007	03:00:00	3.0000							10.00		



	Test Time				Data Summary			Liquid Separator 2				
	Date	Time	Cum	Note	Produced Oil	RCV LF (Water)	LF LTR (Water)	Volume	Liquid Rate	Liquid Cum	Produced Oil	Load Water
	dd/mm/yyyy	hh:mm:ss	Hrs.		M³	M³	M³	M³	M³/d	M³	M³	M³
1	01/03/2007	00:00:00	0.0000	Active Zone: Cardium								
2	01/03/2007	00:00:00	0.0000	Add Load Fluid: Load Water 10.0 M³								
3	01/03/2007	00:00:00	0.0000					0.00		0.00		
4	01/03/2007	01:00:00	1.0000					10.00	240.00	10.00		
5	01/03/2007	02:00:00	2.0000							10.00		
6	01/03/2007	03:00:00	3.0000							10.00		
7	01/03/2007	04:00:00	4.0000							10.00		
8	01/03/2007	05:00:00	5.0000							10.00		
9	01/03/2007	06:00:00	6.0000							10.00		

At a valid Meter reading, Select the Grind-out event



The Grind-out event dialog allows for the entry of the relative proportions of the metered fluids.

	Test Time				Data Summary			Liquid Separator 2				
	Date	Time	Cum	Note	Produced Oil	RCV LF (Water)	LF LTR (Water)	Volume	Liquid Rate	Liquid Cum	Produced Oil	Load Water
	dd/mm/yyyy	hh:mm:ss	Hrs.		M³	M³	M³	M³	M³/d	M³	M³	M³
1	01/03/2007	00:00:00	0.0000	Summary: Entire Test (- 03/03/2007 11:00:00) Produced Oil 4.60 M³ RCV LF (Water) 9.40 M³ LF LTR (Water) 5.60 M³ LF Added (Water) 15.00 M³								
2	01/03/2007	00:00:00	0.0000	Active Zone: Cardium								
3	01/03/2007	00:00:00	0.0000	Add Load Fluid: Load Water 10.0 M³								
4	01/03/2007	00:00:00	0.0000		0.00	0.00	10.00	0.00		0.00	0.00	0.00
5	01/03/2007	01:00:00	1.0000		1.00	9.00	1.00	10.00	240.00	10.00	1.00	9.00
6	01/03/2007	01:00:00	1.0000	Liquid Separator 2 Grindout: Produced Oil 10.0 % Load Water 90.0 %								
7	01/03/2007	02:00:00	2.0000		1.90	9.10	0.90	1.00	24.00	11.00	1.90	9.10
8	01/03/2007	03:00:00	3.0000		2.20	9.13	0.87		8.00	11.33	2.20	9.13
9	01/03/2007	04:00:00	4.0000		2.50	9.17	0.83		8.00	11.67	2.50	9.17
10	01/03/2007	05:00:00	5.0000		2.80	9.20	0.80	1.00	8.00	12.00	2.80	9.20
11	01/03/2007	06:00:00	6.0000		3.25	9.25	0.75		12.00	12.50	3.25	9.25
12	01/03/2007	07:00:00	7.0000		3.70	9.30	0.70		12.00	13.00	3.70	9.30
13	01/03/2007	08:00:00	8.0000		4.15	9.35	0.65		12.00	13.50	4.15	9.35
14	01/03/2007	08:00:00	8.0000	Add Load Fluid: Load Water 5.0 M³								
15	01/03/2007	09:00:00	9.0000		4.60	9.40	5.60	2.00	12.00	14.00	4.60	9.40
16	01/03/2007	09:00:00	9.0000	Liquid Separator 2 Grindout: Produced Oil 90.0 % Load Water 10.0 %								
17	01/03/2007	10:00:00	10.0000	10 hour fluid gain summary (01/03/2007 00:00:00 - 01/03/2007 10:00:00) Produced Oil 4.60 M³ RCV LF (Water) 9.40 M³ LF LTR (Water) 5.60 M³ LF Added (Water) 15.00 M³								
18	01/03/2007	11:00:00	11.0000		4.60	9.40	5.60			14.00	4.60	9.40

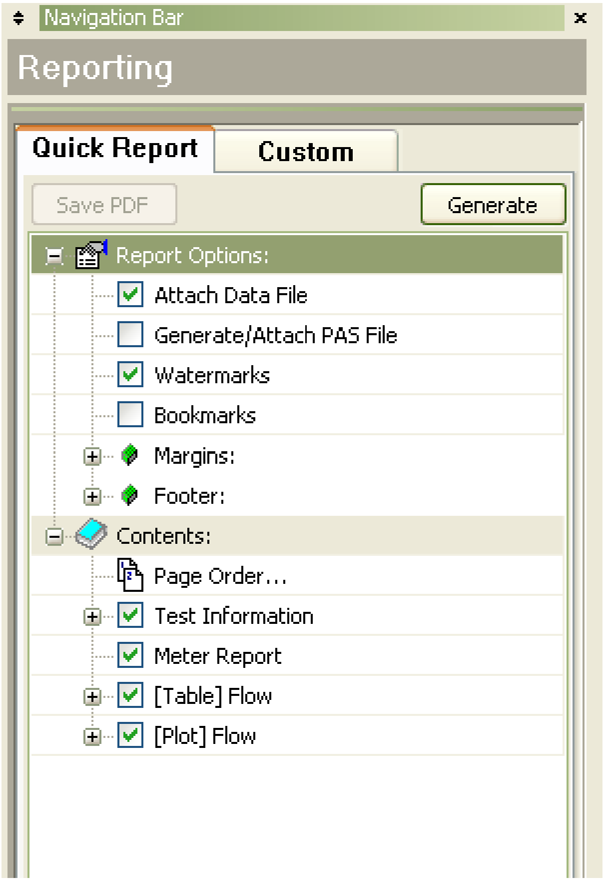
Data table with multiple events defined.

Reporting

The reporting engine in FlowTest generates report in PDF format directly and does not require any 3rd party PDF tools or printer drivers. The report view consists of a series of options in the navigation bar and a PDF viewer. The navigation bar options control the report contents and appearance.

There are two reporting modes “Quick Report” and “Custom Report”. Quick report generates reports based on a fixed format and is useful for generating quick reports in the field. Custom reports allow for a more detailed report based upon a number of standard and user defined templates.

Quick Report

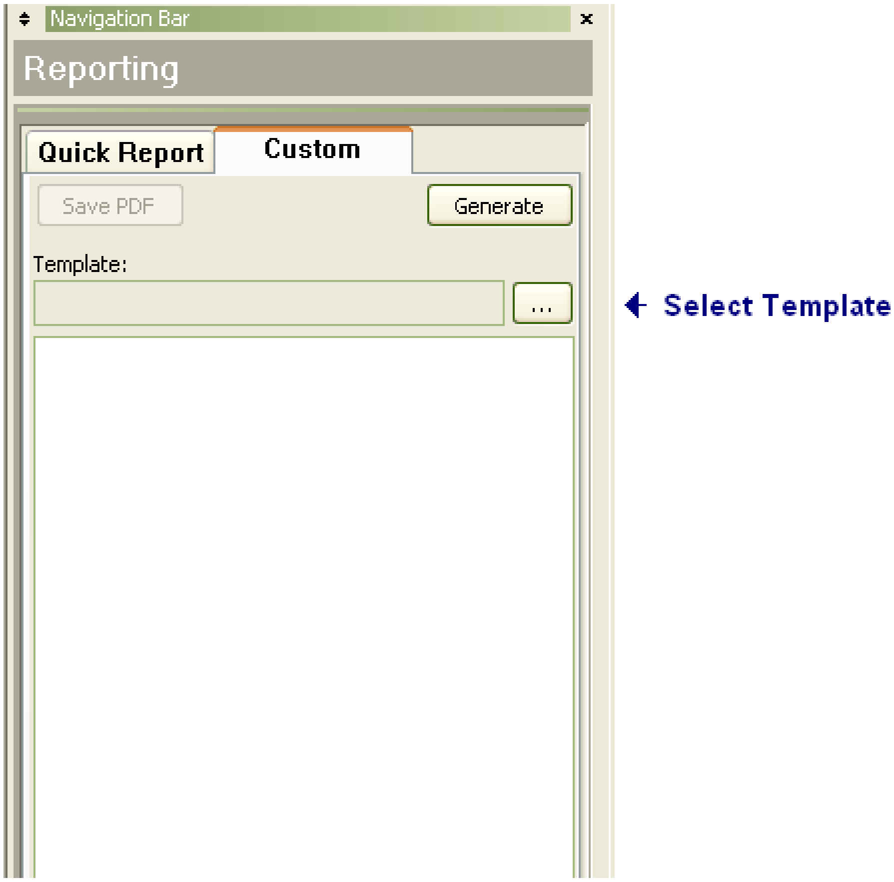


As described above, the quick report mode is useful for generating quick reports in the field the format of the report is fixed but does allow for control over the actual report contents.

To generate a Quick Report:

- Select the “Quick Report” tab in the report navigation bar.
- Specify the desired options for the report.
- Press the “Generate” button to create the report.

Custom Report



Custom reporting creates reports based upon a specified report template allowing for detailed reports specific to a particular test type or client. The custom report view is similar to the quick report with the addition of the template select button and display. The report options are displayed only after a report template has been loaded.

To Generate a Custom Report:

- Select the “Custom Report” tab in the report navigation bar.
- Load a report template by pressing the select template button.
- Specify the desired options for the report.
- Press the “Generate” button to create the report.

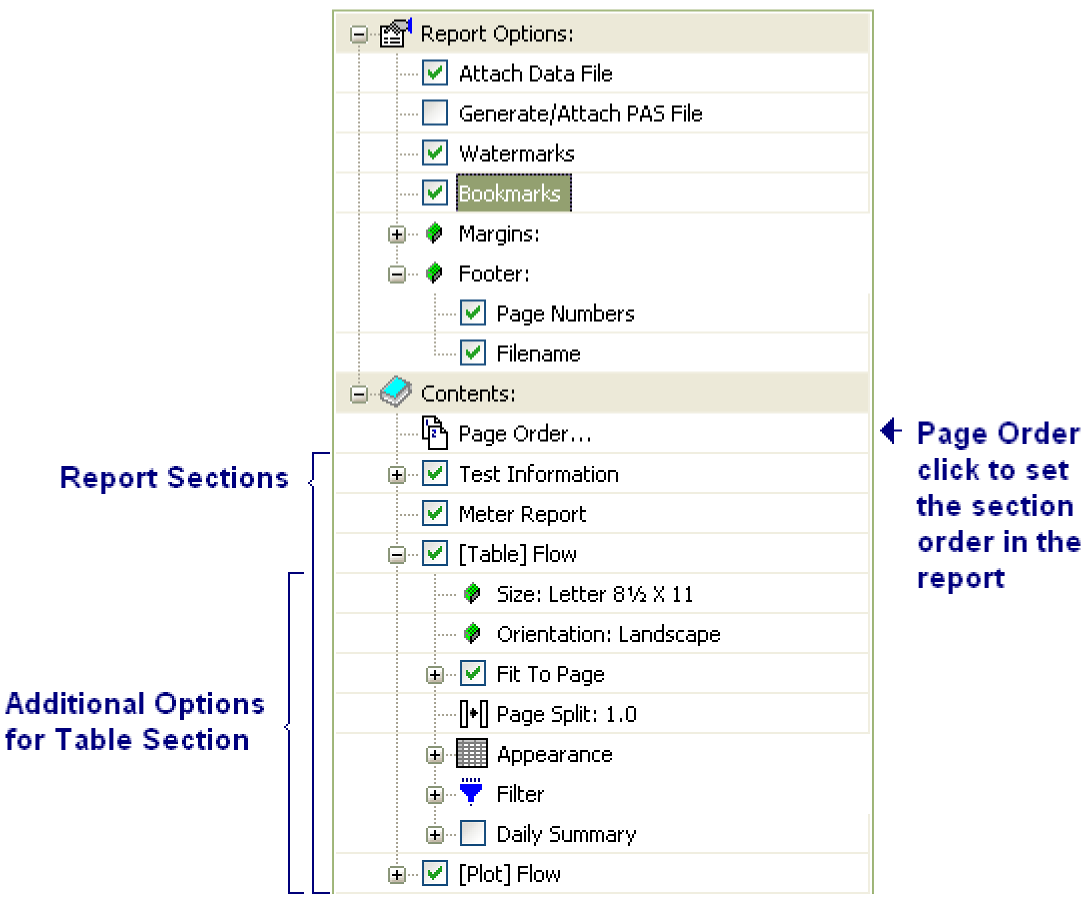
Report Options

- Attach Data File (embed the FlowTest data file as an attachment in the report)
- Generate/Attach PAS File (generate and embed a PAS file as an attachment in the report)
- Attach CSV File (embed a CSV file as an attachment in the report)
    - Based on Table: (select the table in the data file to base the CSV attachment on)
    - Include Well Header (adds the well header to the CSV attachment)
    - Include Column Header (adds the column/series names and units to the CSV attachment)
- Watermarks (quick report only) (adds images to the report)
- Bookmarks (creates a bookmark or table of contents in the report indexing the sections within the report)
- Margins: (quick report only) (set page margins)
- Footer: (quick report only)
    - Page Numbers (adds page numbers to the footer of each page)
    - Filename (adds the data file name to the footer of each page)

Contents:
The contents section of the report options represents the various sections that will be included in the final report. Each section represents a report page or group of pages depending on the section type.
Section Types include:

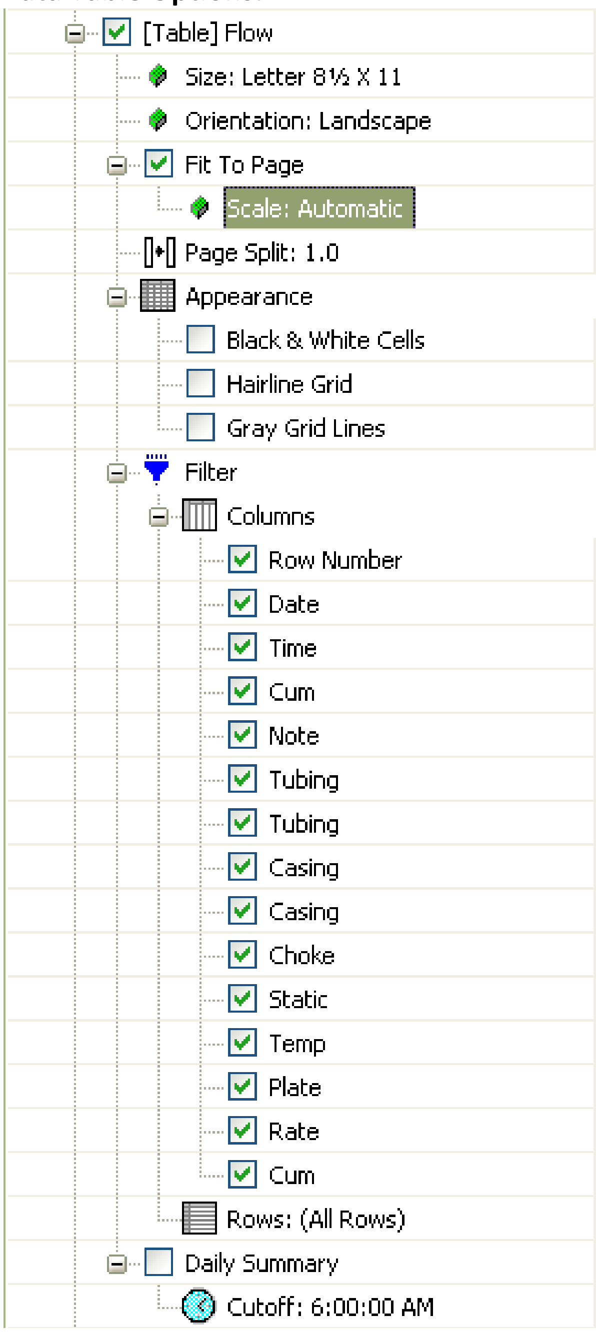
- Test Information
- Meter/Equipment report
- Data Table
- Data Plot
- Template defined sections.

Each section can be included or excluded from the report via a check box left of each section. In addition, a section may have additional configuration options available as indicated by the presence of a "+" (click to expand additional options).
In addition to the sections, a "Page Order" item can be used to specify the order of the sections within the report.



Content Section Descriptions:

Data Table Options:

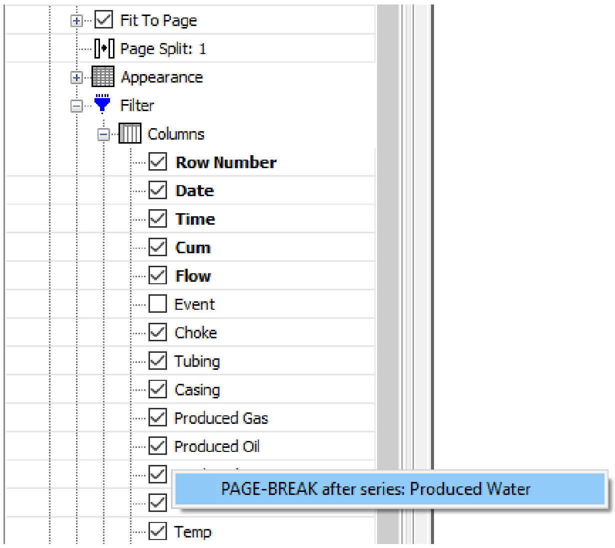


- Size (specify page size for the data table section)
- Orientation (specify page orientation Portrait/Landscape)

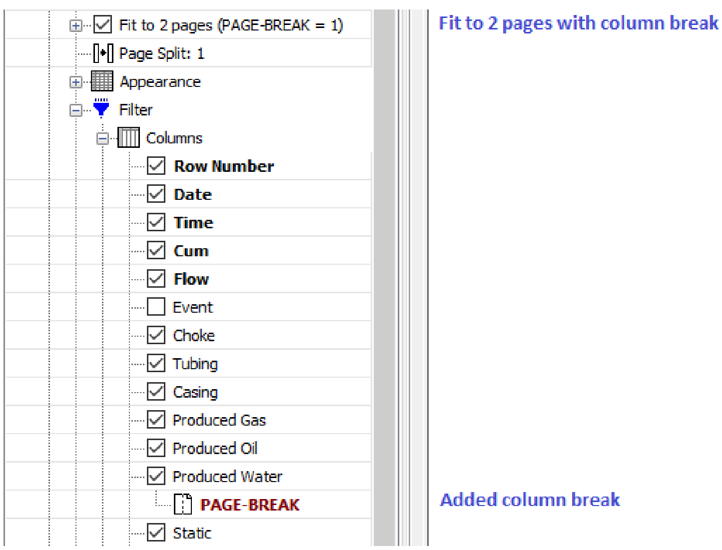
- Fit To Page (check item to automatically scale the output so that all table columns fit (width wise) on a single page)
    - Scale (if 'Fit To Page' is off, a scaling percentage can be entered to manually scale the output)
    - 'Fit To Page' can also be used to fit the report to multiple pages (width wise). This ability is useful when you have many table columns and fitting to a single page would become unreadable. In such cases you can specify page breaks after any column to split the report across multiple pages.
      See "Manual Column Breaks" below:
- Page Split (splits each page horizontally) *see example below*
- Appearance (specify appearance options of the table)
    - Black & White Cells (removes all coloring from the table)
    - Hairline Grid (prints the grid lines as a hairline (single pixel wide)
    - Gray Gridlines (print gridlines as light gray)
- Filter
    - Column (expand to display the columns in the table uncheck columns to exclude them from the report)
    - Rows (filters the data rows to include a specified range) *see example below*
- Daily Summary (Adds a daily summary to the footer of each page displaying the total and incremental cums)
    - Cutoff (specifies the daily cutoff time for the summary)

The report table section of the report includes one or more pages of table data depending on the size of the table and the options selected. In general the report generator will print the data table spanning multiple pages (as required). In the event that all the table columns do not fit horizontally on a single page the report generator will automatically insert column breaks and print additional columns on subsequent pages in the report. In order to force all columns on a single page use either the "Fit To Page" or manual scaling options.

Manual Column Breaks:
Manual column breaks can be added to the report table to control the (width wise) page spanning of the generated report when there are simply too many columns to fit on a single page.
Column page breaks are specified in the 'Column Filter" section of the report options by a "right click" on the column and selecting: "PAGE-BREAK after series:" menu option



Specify column breaks via a "right click" on the column



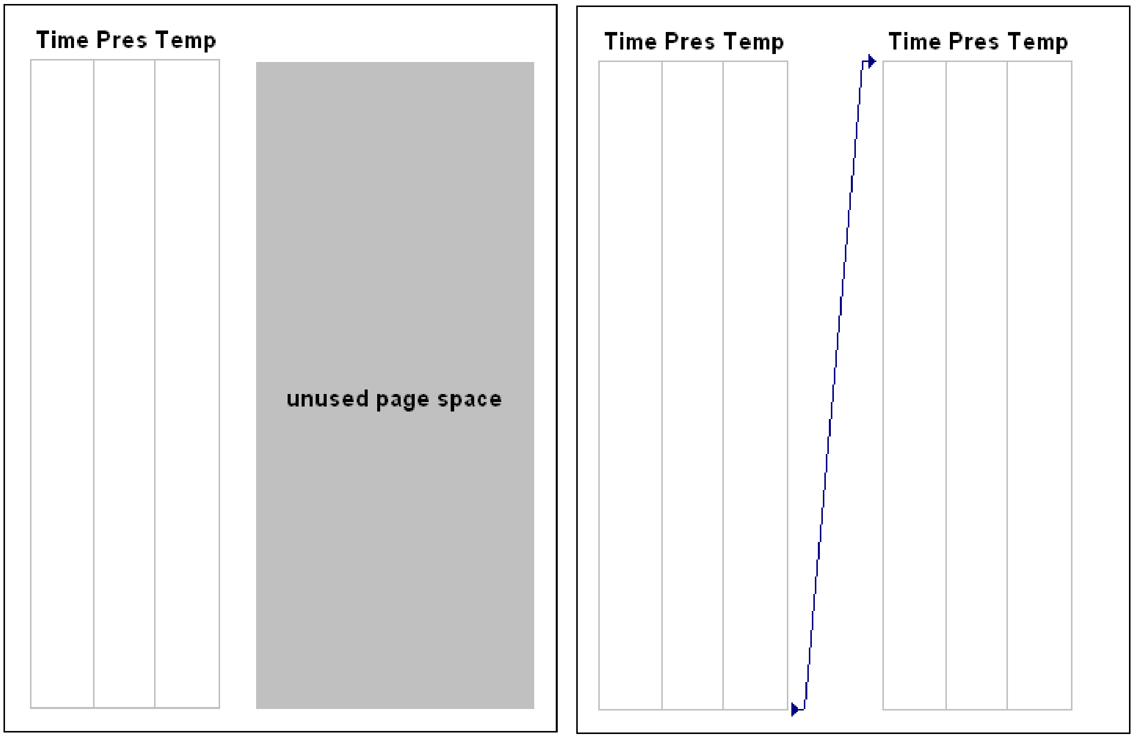
'Fit to page' now becomes 'Fit to 2 pages' with the addition of the column break.

Column breaks can be removed by a "right click' on the break or cleared entirely from the 'Fit to page' option.

<u>Generating the report will now auto fit to two pages across breaking at the column breaks.</u>

Page Split:

The page split option can be used to conserve page real-estate when the data table contains few columns. In the diagram below the usefulness of page splitting is illustrated for a wire line data set consisting of time, pressure and temperature columns.

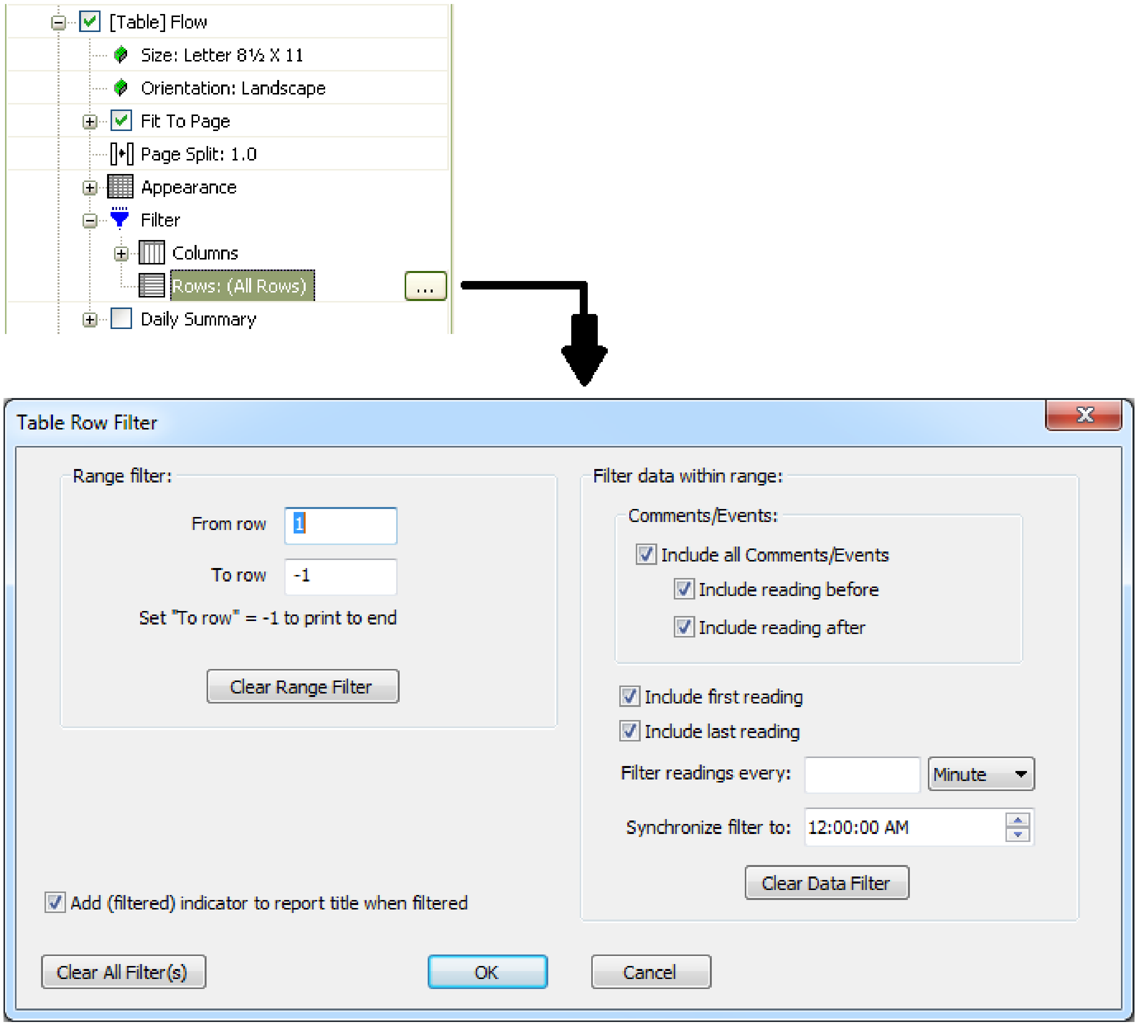


Page Split = 1

Page Split = 2

Row Filter

The row filter can be used to filter the reported rows for the data table. Select the “Rows” button under the table filter to display the “Table Row Filter” window.

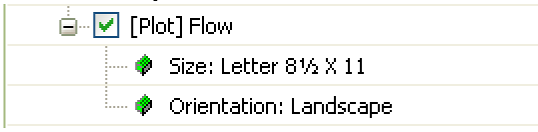


The “Table Row Filter” window has the following options:

- Range filter:
  The range filter can be used to specify a range (by row number) for the report specified by the ‘From row’ and ‘To row’ values. Specifying a value of -1 for the ‘To row’ value will select the last data table row.
- Filter Data within range:
  Within the selected range (Range filter) additional filtering can be applied, as a function of time.
  Options:
  - Include all Comments/Events Adds all comments to the output.
    - Include reading before Adds the reading before each comment to the output.
    - Include reading after Adds the reading after each comment to the output.
  - Include first reading Adds the first table reading to the output.
  - Include last reading Adds the last table reading to the output.

- Filter readings every: Specified the filter period in either of: hours, minutes or seconds.
- Synchronize filter to: Optional (default 12:00:00 AM) Specifies a start time for the filter.
  ex. Given a file with 1 hour readings and a filter value of 2 hours:
  A Synchronize value of 06:00:00 AM outputs even hour values.
  A Synchronize value of 05:00:00 AM outputs odd hour values.
- Add (filtered) indicator to report title when filtered selecting this option will append “(filtered)” to the report title when a filter is active.

Data Plot Options:



- Size (specify page size for the data table section)
- Orientation (specify page orientation Portrait/Landscape)

To change the report title for either the data table or plot… from the 'Data Entry' view click on either the plot or table and select "Report Title…" from the Plot or Table menu on the main menu bar.

Report Generation

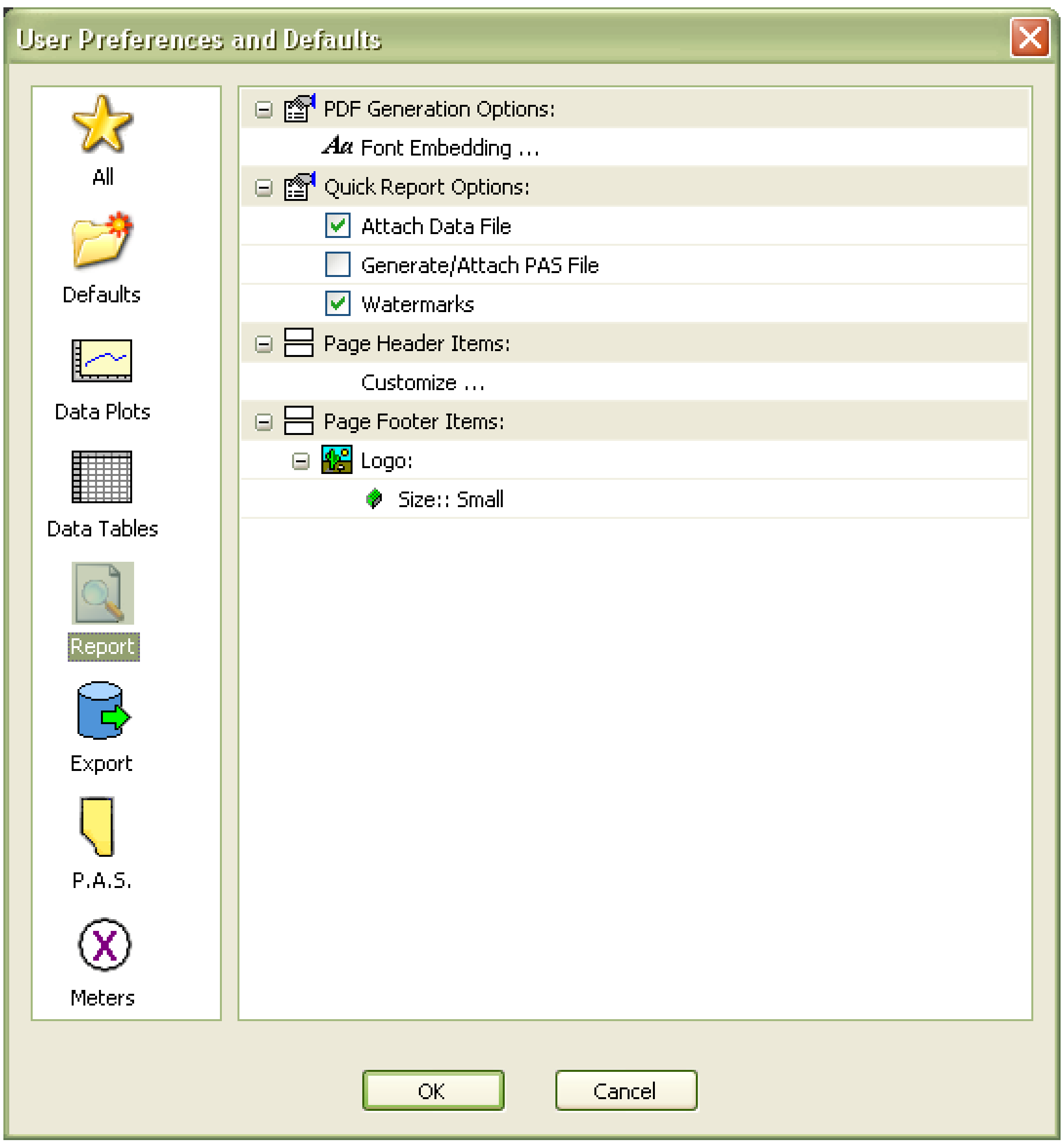
In order to see the effect of any changes made to the report options the “Generate” button must be pressed to generate a new report with the changes. A report can be saved by clicking the “Save PDF” button.

Report Preferences

The following options are available in the report section of the “User Preferences” window (see user preferences)

User Preferences

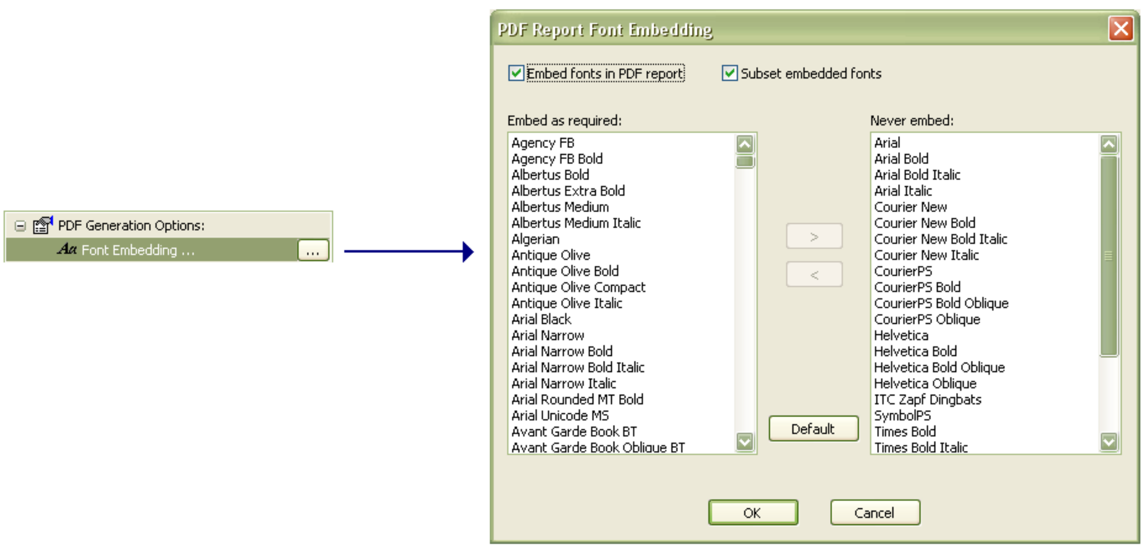
Press the ‘User Preferences’ toolbar button to display the “User Preferences” window.



- PDF Generation Options (options relating to the PDF document structure)
    - Font Embedding (specify how fonts are included in the PDF document) *see example below*
- Quick Report Options (Options specific to quick report generation)
    - Attach Data File (set default for new files)
    - Generate/Attach PAS File (set default for new files)
    - Watermarks (set default for new files)
- Page Header Items (customize the header items for quick and custom reports) *see example below*
- Page Footer Items (customize the footer items for quick and custom reports) *see example below*

Font Embedding

The font embedding option specifies the fonts to include/exclude in the PDF report as well as embedding an entire font or only a subset of the actual characters used in the report. These settings affect both the size of the PDF file and the compatibility when displayed/printed on computers that do not contain the original fonts. Some fonts are restricted by licensing conditions; such fonts will not be embedded in the PDF report.



The font embedding window displays all the fonts available on the computer in the list on the left, the list on the right contains fonts not to be embedded within the PDF report. Fonts can be moved between the two list by selecting the fonts and using the < and > buttons.

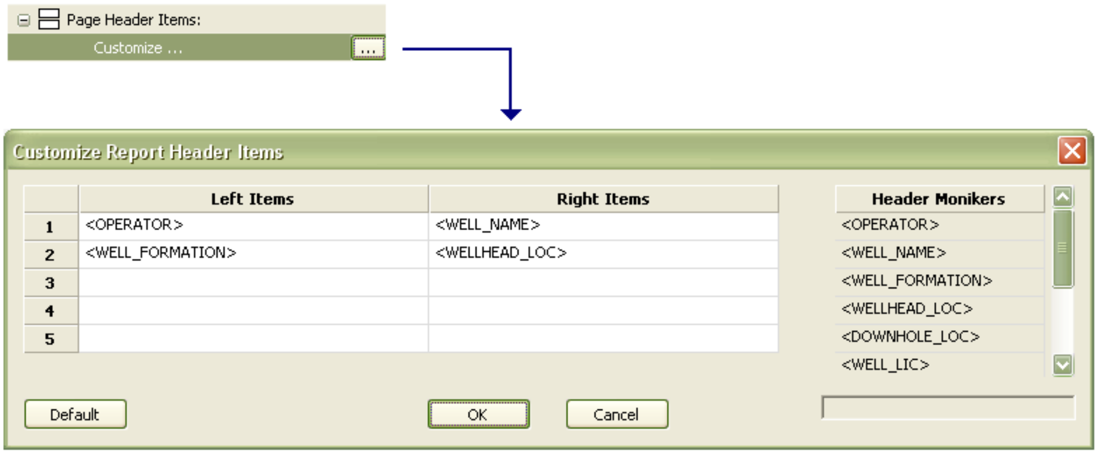
Additional options as follows:

- Embed fonts in PDF document (if this is un-checked no fonts will be embedded in the report)
- Subset embedded fonts (if checked a subset of the font will be embedded in the report otherwise the entire font is embedded)
- Default button (default sets the “Never Embed” list to exclude the PDF standard fonts (and aliases of the standard fonts))

The recommended default for font embedding is to embed, subset and exclude the standard fonts (as set when the default button is pressed).

Page Header Items

Items appearing in the header section of each report page can be customized via the ‘Report’ section in the ‘User Preferences’ dialog.



Up to 5 customizable header lines are available with each line containing a left and right justified item. Any fixed text may be specified as a header item along with replaceable smart tags. Replicable smart tags are key words enclosed by angle brackets <>. A list of valid smart tags is displayed in the right hand section of the dialog and represents values entered in the test information input screen.

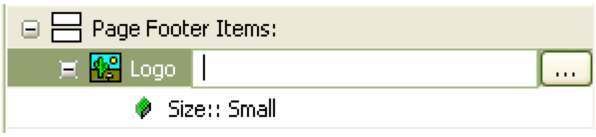
For example:
If the operator name is “ABC Oil” and the well name is “Well 1” Monikers will print as follows:

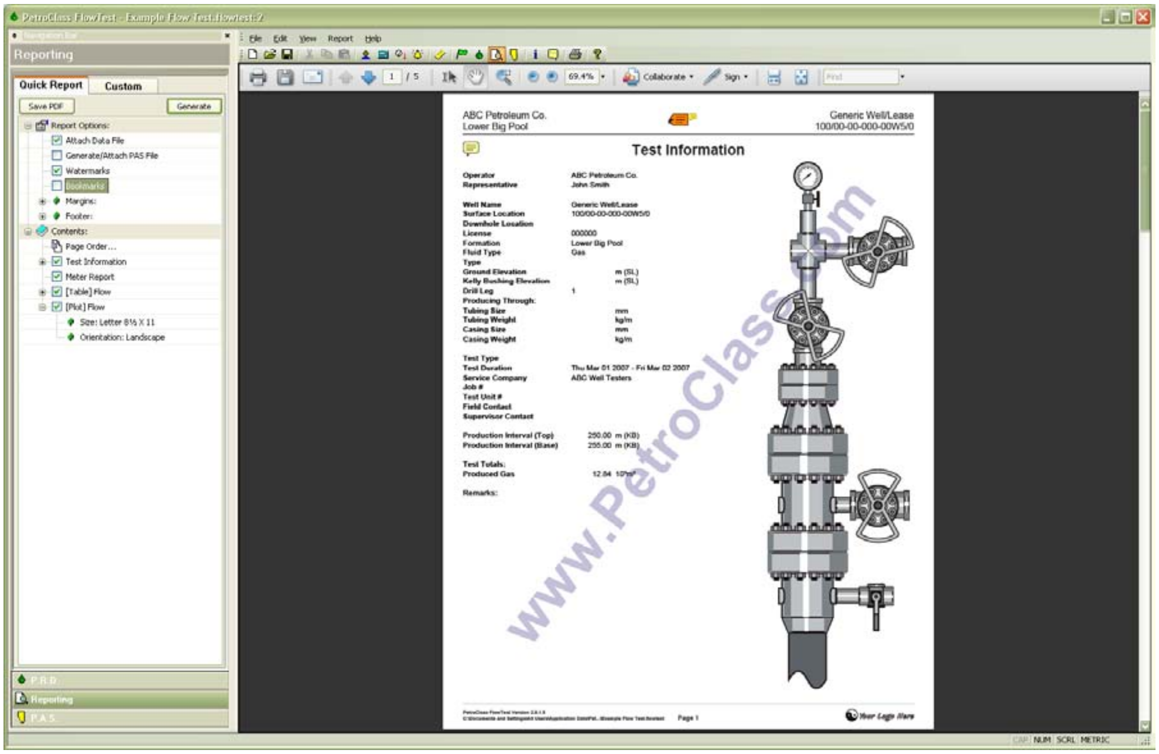
Moniker Text	Report Text
<OPERATOR>	ABC Oil
Operator: <OPERATOR>	Operator: ABC Oil
<WELL_NAME>	Well 1

It is important to note that the page header items are a template for all reports created by the computer. <u>Page header items should contain only smart tags and labels.</u> Test specific information should not be entered here as it will show up on ALL reports for every test generated by the computer!

Page Footer Items

A company logo can be added to the page footer by adding the image file as a logo the “Page Footer”



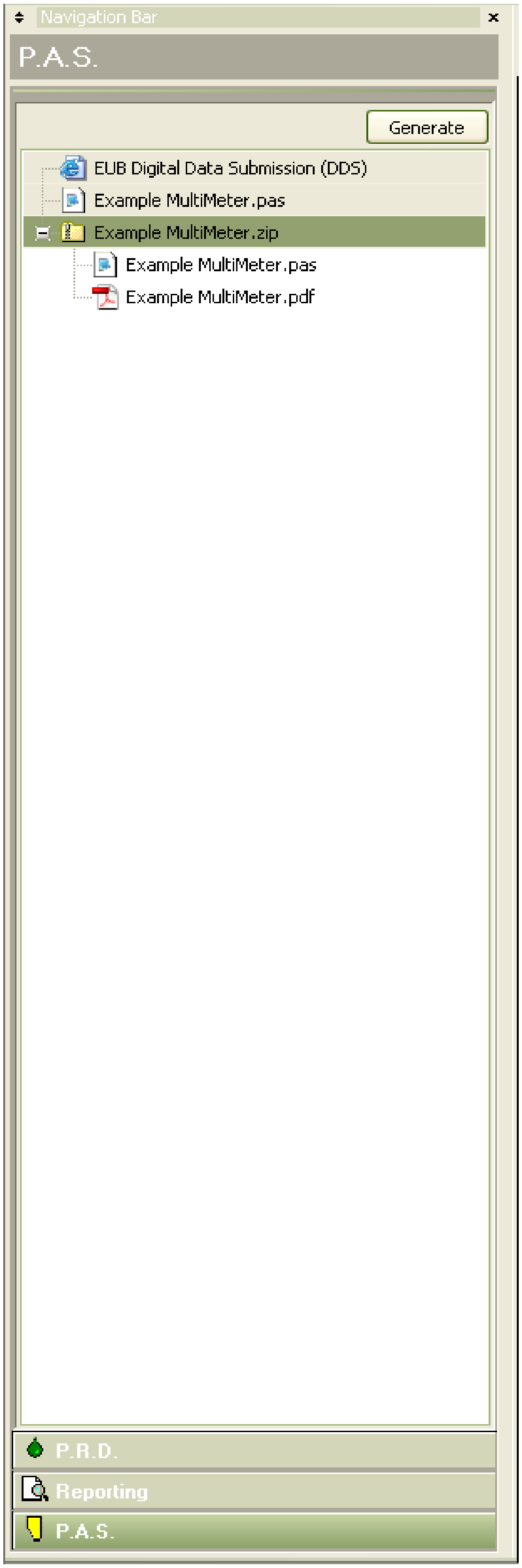


Generated report in FlowTest

P.A.S.

The PAS generator will create PRD V4.0 PAS file, of the current test data, for submission to the EUB. FlowTest implements an internal “zip” file compressor which can package the generated PAS file along with the current PDF report into a single “zip” file. A direct portal to the EUB Digital Data Submission site is provided, allowing the user to submit file directly from the FlowTest application.

Create PAS PRD file



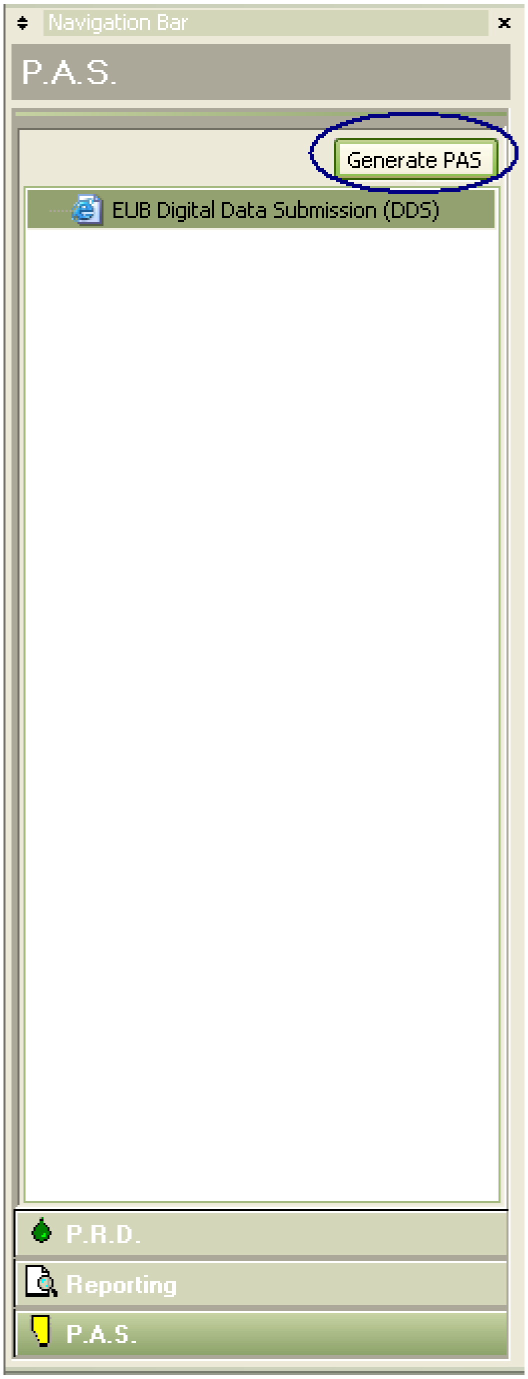
PAS Options:

The PAS PRD generator has several options for creating and packaging PAS file and reports.

The items in the PRD Navigation bar provide context sensitive views for each associated item when clicked on.

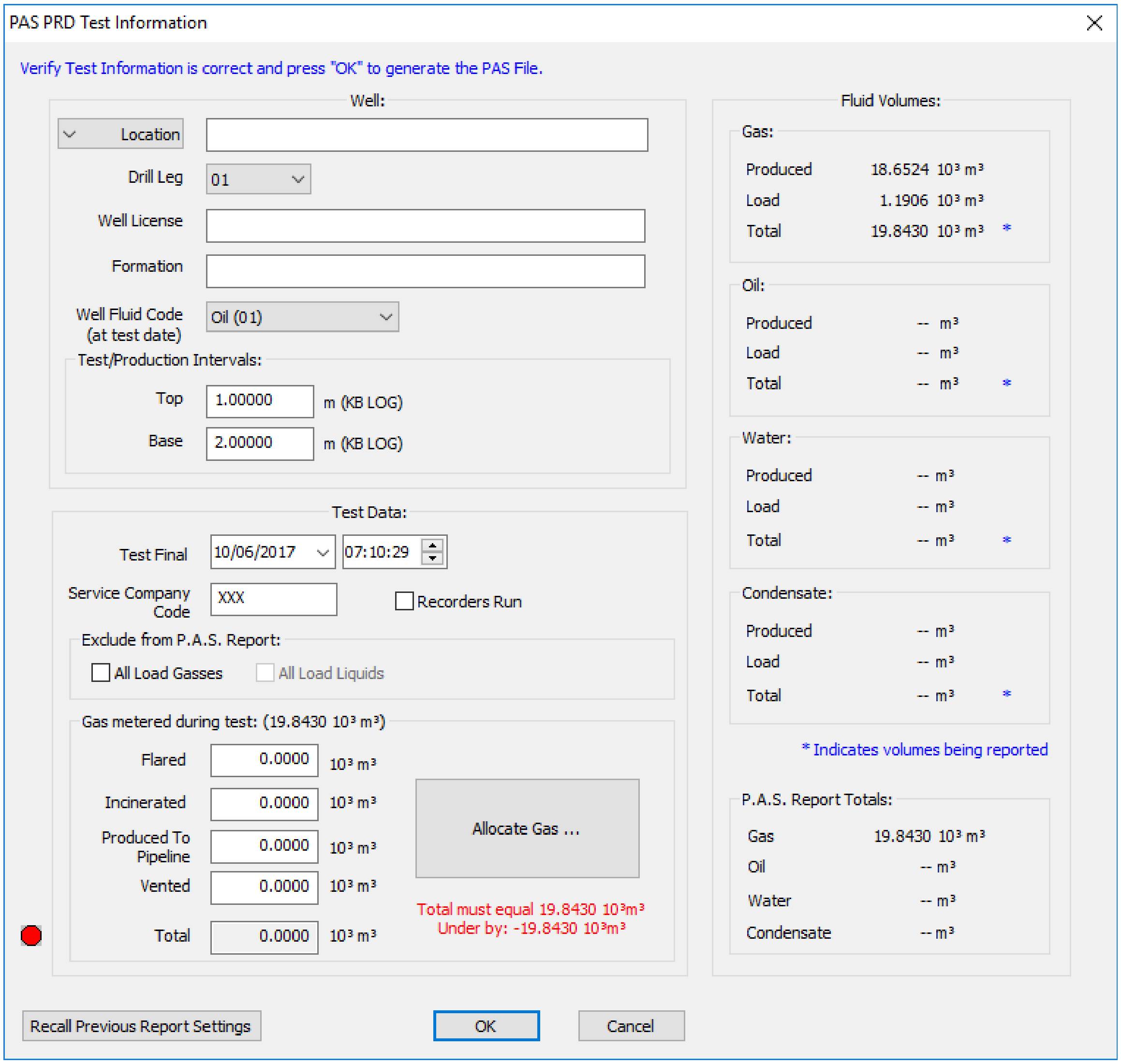
- EUB Digital Data Submission Displays a portal to the EUB submission site.
- ***.pas Displays the generated pas file in a native test format
- ***.zip Displays a view showing current files in the zip package as well as controls to add/ remove files. Files contained in the package are also displayed as sub items in the PAS Navigation bar. Clicking on the sub items will display their contents in the view.

The following will outline the steps to create a PAS file form the current data and package it with the current report for submission to the EUB. These steps assume a report has been generated (see Report view for instructions on generating reports).



1) Press the ‘Generate’ button on the PAS navigation bar to bring up the PAS PRD Test Information dialog.

PAS PRD Test Information

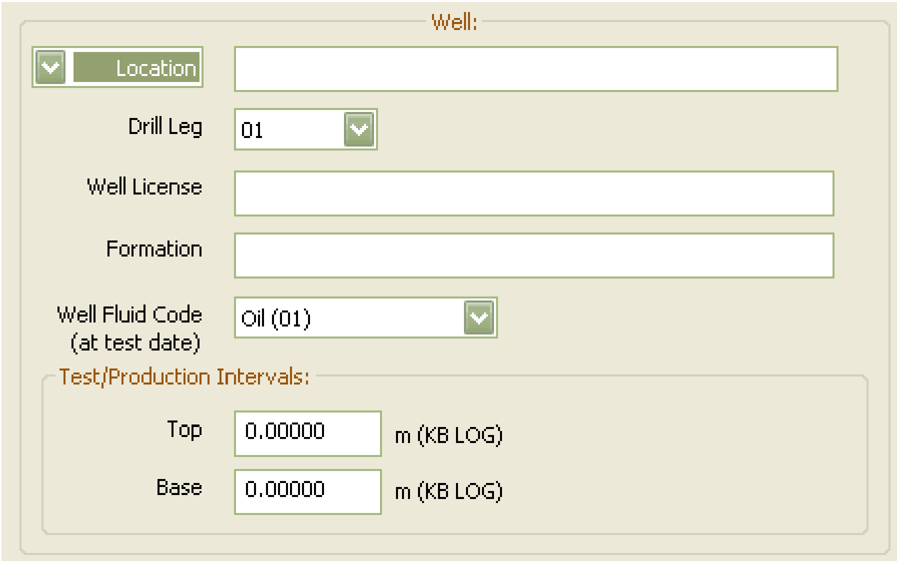


The PAS PRD Test Information dialog contains 3 main sections:

- Well Information
- Test Data
- Fluid Volumes

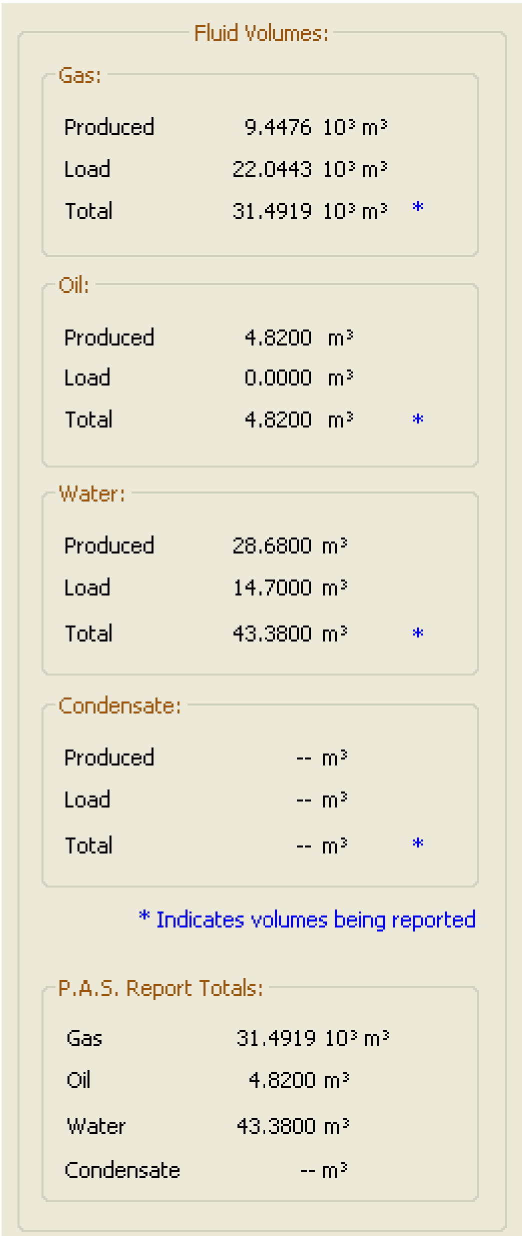
The sections are described below:

Well Information:



The Well Information section contains a copy of the data entered into the main test Information dialog (see 'Test Information' for a description of each field)

Fluid Volumes

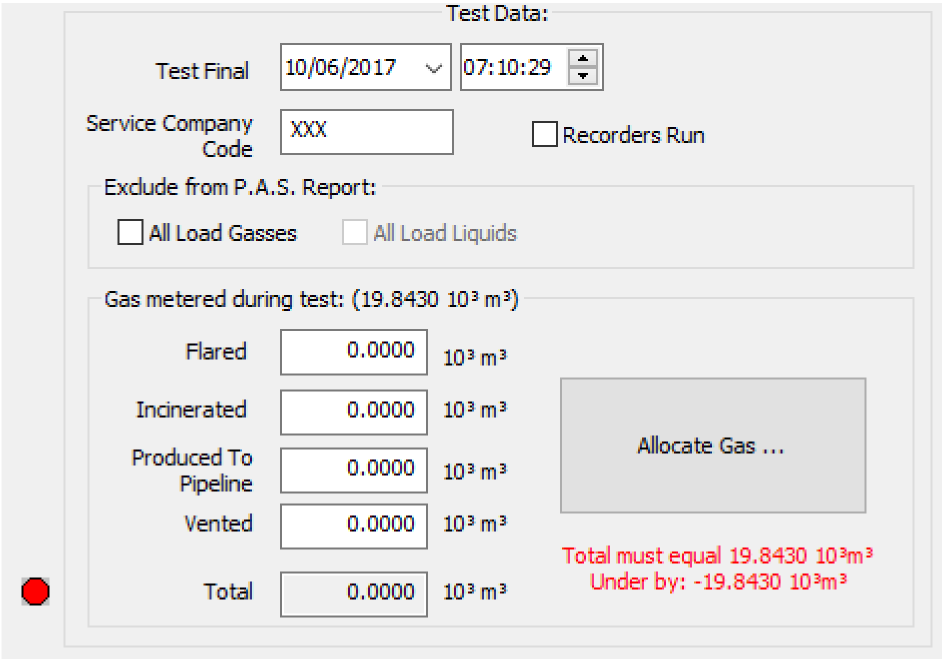


The Fluid Volumes display provides a detailed view of the respective fluid cumulative volumes metered during the test. The volume data is taken from the 'Data Summary' group and represents the total volume metered for each fluid type. A value displayed as '—', indicates the absence of that particular fluid type. For PAS reporting the fluid types are defined as; gas, oil, water and condensate. Each fluid type is further classified as either produced or load as described below:

- Gas
    - Produced (produced reservoir gas)
    - Load (recovered load gas)
    - Total (all metered gas Produced + Load)
- Oil
    - Produced (produced reservoir oil)
    - Load (recovered load oil)
    - Total (all metered oil Produced + Load)
- Water
    - Produced (produced reservoir water)
    - Load (recovered load water)
    - Total (all metered water Produced + Load)
- Condensate
    - Produced (produced reservoir condensate)
    - Load (recovered load condensate)
    - Total (all metered condensate Produced + Load)

A blue asterisk appears beside a single sub-type of each fluid type indicating the cumulative volume being reported in the PAS file for that fluid (see 'Test Data' description below).

Test Data:



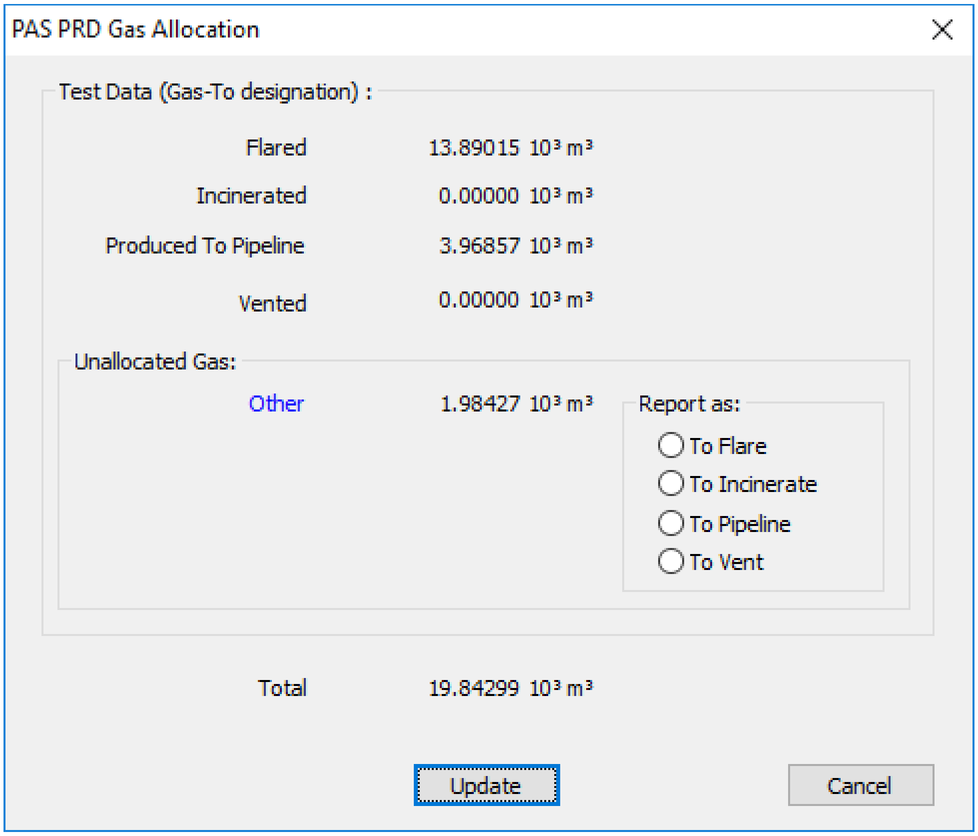
- Exclude from PAS Report
  As described above, the cumulative volume for each fluid type is a combination of produced and load fluids. If load fluid exists, you have the option to exclude the load fluid from the PAS report via the following two checkbox options:
    - All Load Gasses, excludes all load gas from the PAS report.
    - All Load Liquids, excludes all loads of type oil, water and condensate from the PAS report.

  Changing these options will update the 'Fluid Volumes' pane to reflect the new cumulative reported for each fluid.

- Gas metered during test
  PAS requires a destination of all gas reported and may be any combination of the flared, incinerated, produced to pipeline or vented. The respective volumes can be manually entered in the spaces provided or the 'Allocate Gas … ' button can be used to update the volumes from the test data.

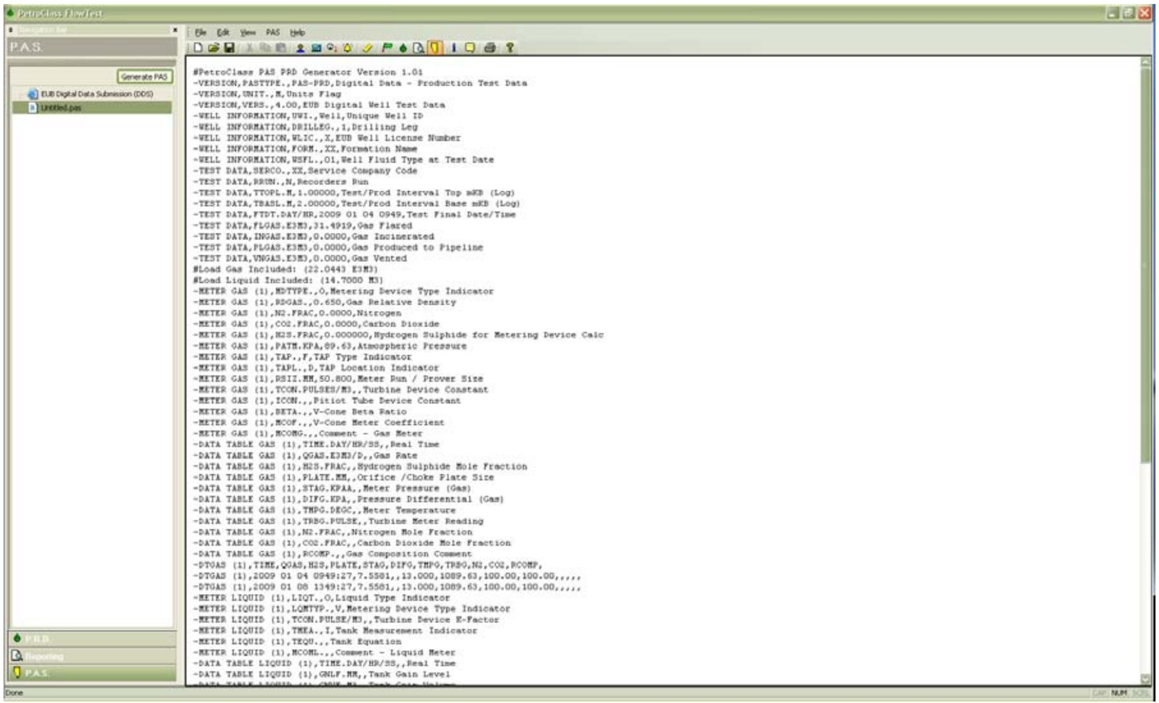
  The sum of the gas destinations must equal the total gas reported for the test, an error will be displayed to the right of the total if this is not the case.

  The 'Allocate Gas' button will display a new window showing the gas allocations defined in the test.

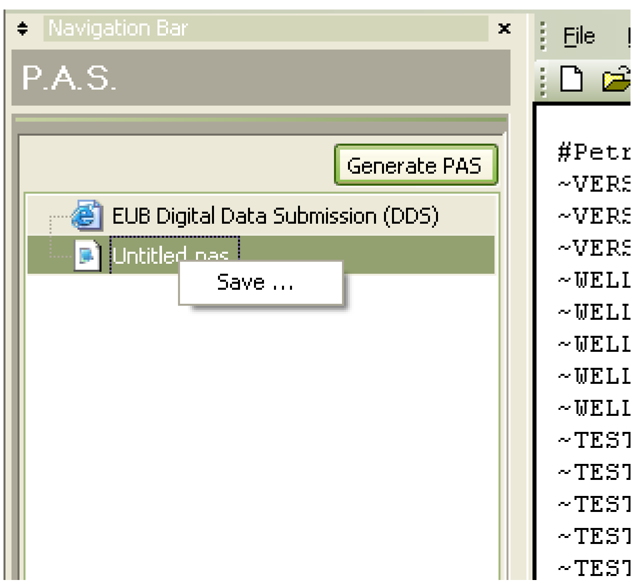


The ‘PAS PRD Gas Allocation’ window displays the respective flare, vent, incinerate, pipeline and other volumes reported from in the test data.
The ‘Other’ volume will be non zero when either the test does not use the ‘Gas to’ designations or gas was deliberately directed to ‘Other’. In this case the ‘Other’ gas volume will need to be reported as flare, incinerate, vent or to pipeline via one of the four radio selectors
Pressing the ‘Update’ button will transfer the volumes to the previous window.

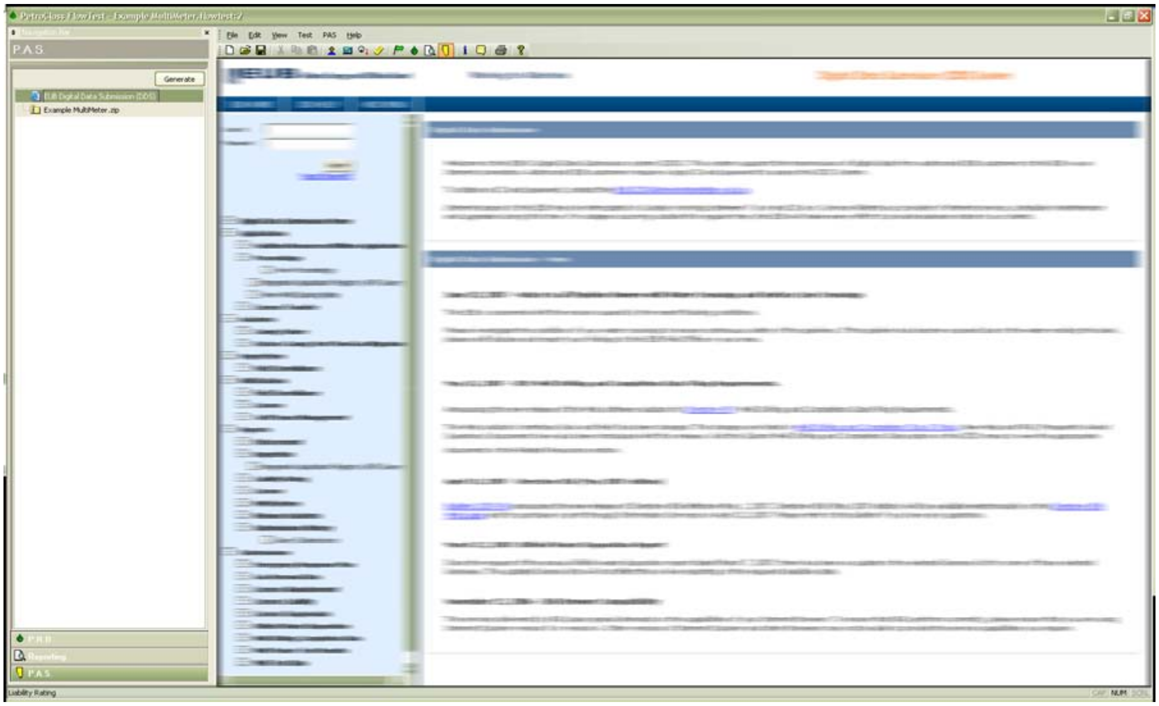
2) After entering all the required information press the ‘OK’ button on the dialog to generate the PAS file. The generated PAS file is then displayed as shown below.



3) Save the PAS file by right clicking the file in the tree and select ‘Save’



- EUB Digital Data Submission portal



PAS files can be submitted directly, from within FlowTest, by clicking on the “EUB Digital Data Submission (DDS) item in the PAS Navigation bar pane.

Read PAS PRD file

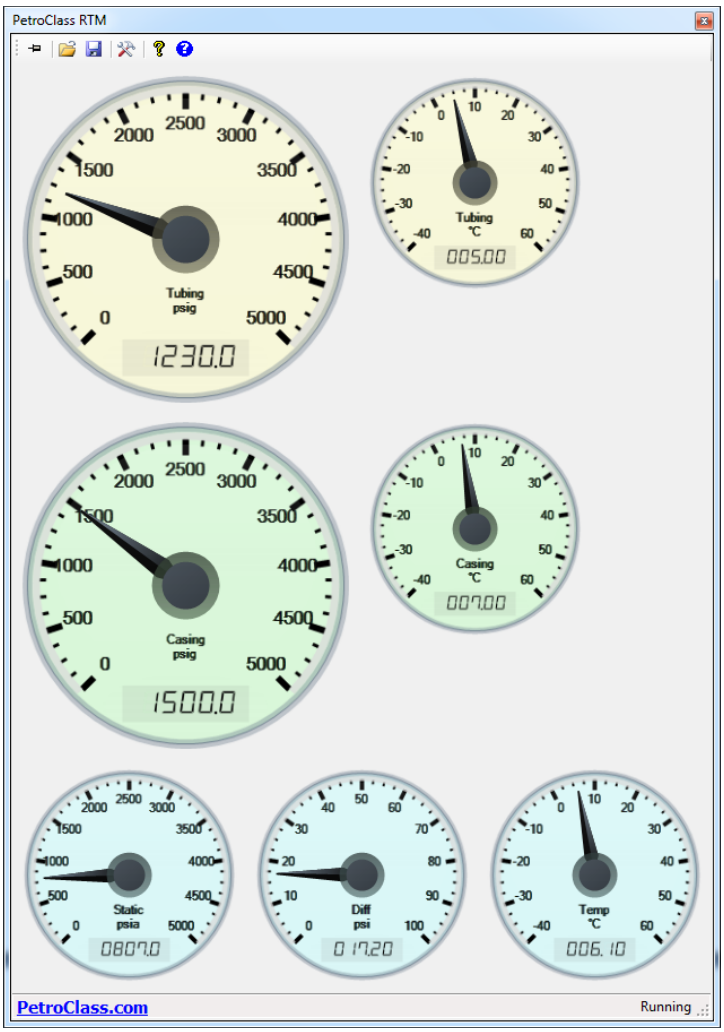
FlowTest can read PAS PRE V4.0 files directly. To read a PAS PRD file select "Import PAS…" from the File menu.

Real-Time

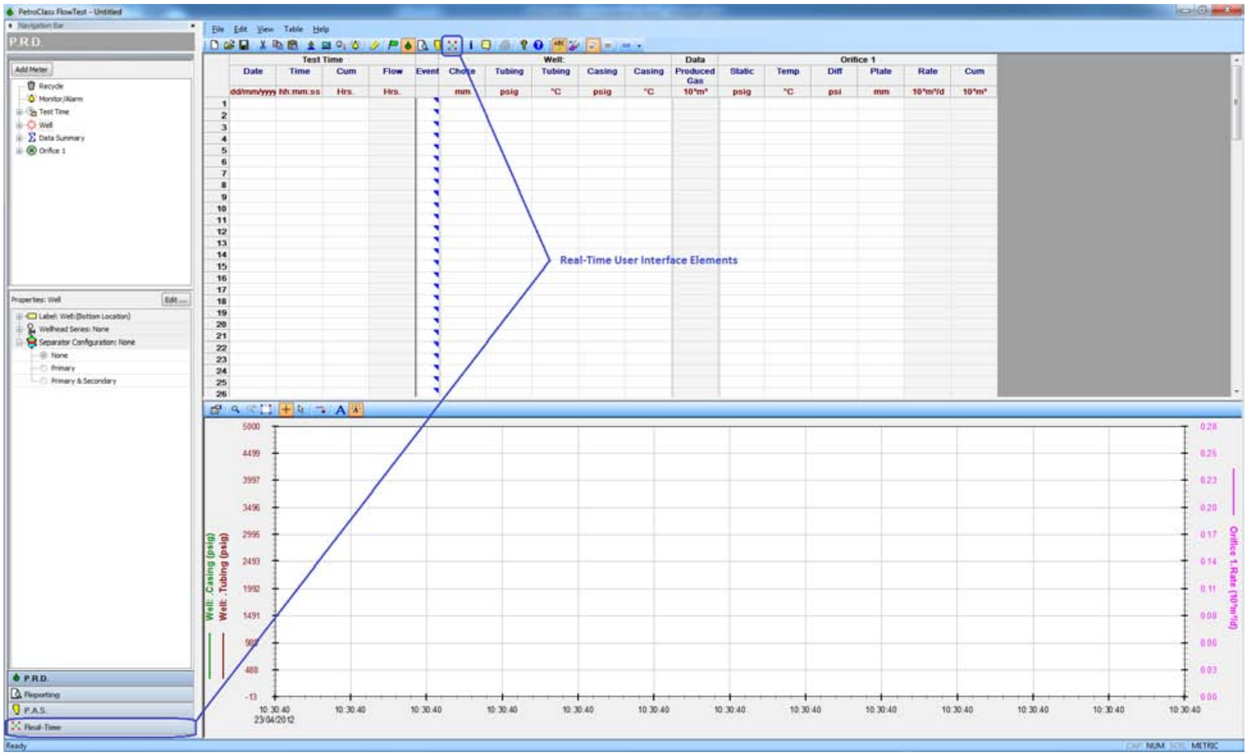
FlowTest incorporates real-time data acquisition for any input series with sample times up to one second. Real-time data is acquired via the PetroClass Real-Time Monitor (RTM) software tool. The RTM contains all the logic necessary to interface with the instrumentation hardware and provides a means of transferring the data to FlowTest in real time. *For information on configuring and using the RTM consult the PetroClass RTM user manual.*

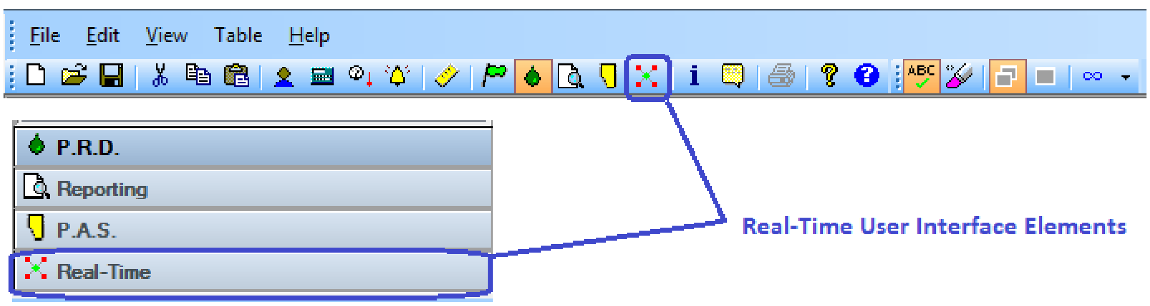
User Interface

The FlowTest real-time user interface is disabled (hidden) by default. The interface only becomes available when an RTM is detected (RTM is running). If an active RTM is detected when FlowTest first starts the real-time user interface is enabled, and made visible.



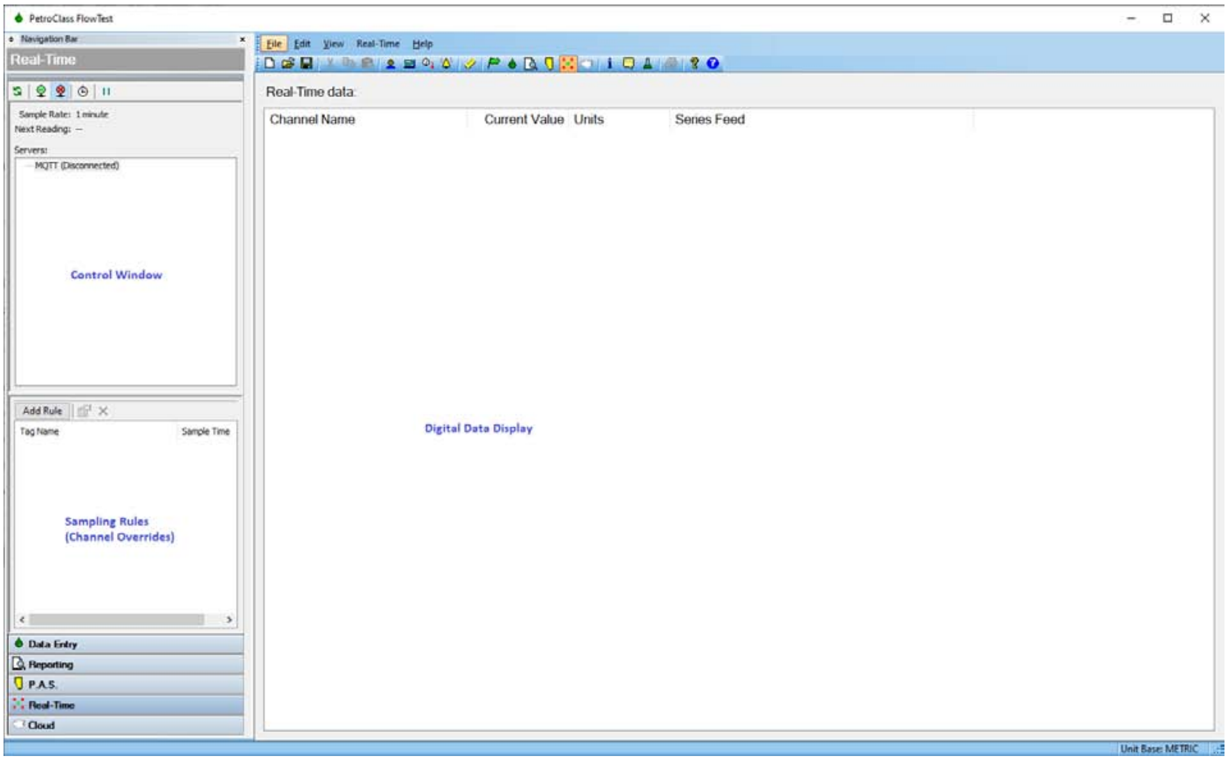
PetroClass Real-Time Monitor (RTM)





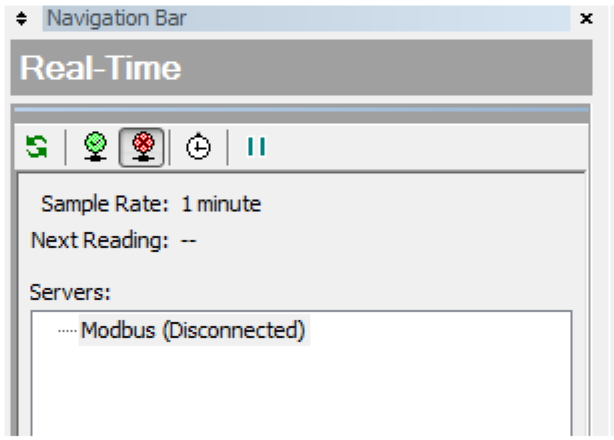
FlowTest Real-Time UI (enabled when the RTM is running).

Configuration



The real-time UI consists of three main windows, the control window, sample rules window and the digital data display.

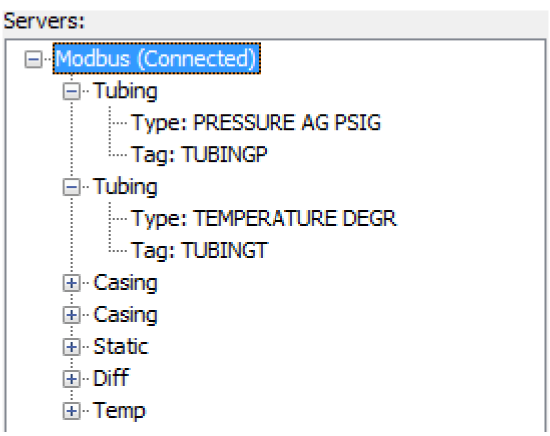
Control Window



Toolbar

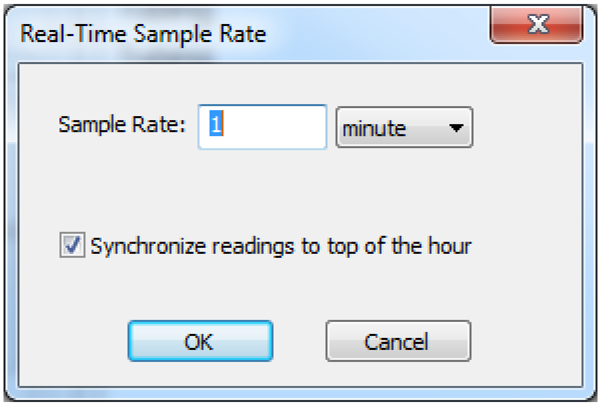
- Refresh Servers
- Connect Server
- Disconnect Server
- Sample Rate
- Pause

The control window displays all the RTM servers currently running and provides the means to set/adjust the data sample rate. The server list displays all the RTM servers currently running along with the connection status (connected/disconnected). To connect to a server, select the server in the list and press the 'Connect Server' toolbar button.



The server list will change to display the connected server status and provides additional information with respect to the channels available, type and series tag name.

The sample rate is the rate at which readings are updated in the FlowTest tables. To change the sample rate, press the 'Sample Rate' toolbar button.



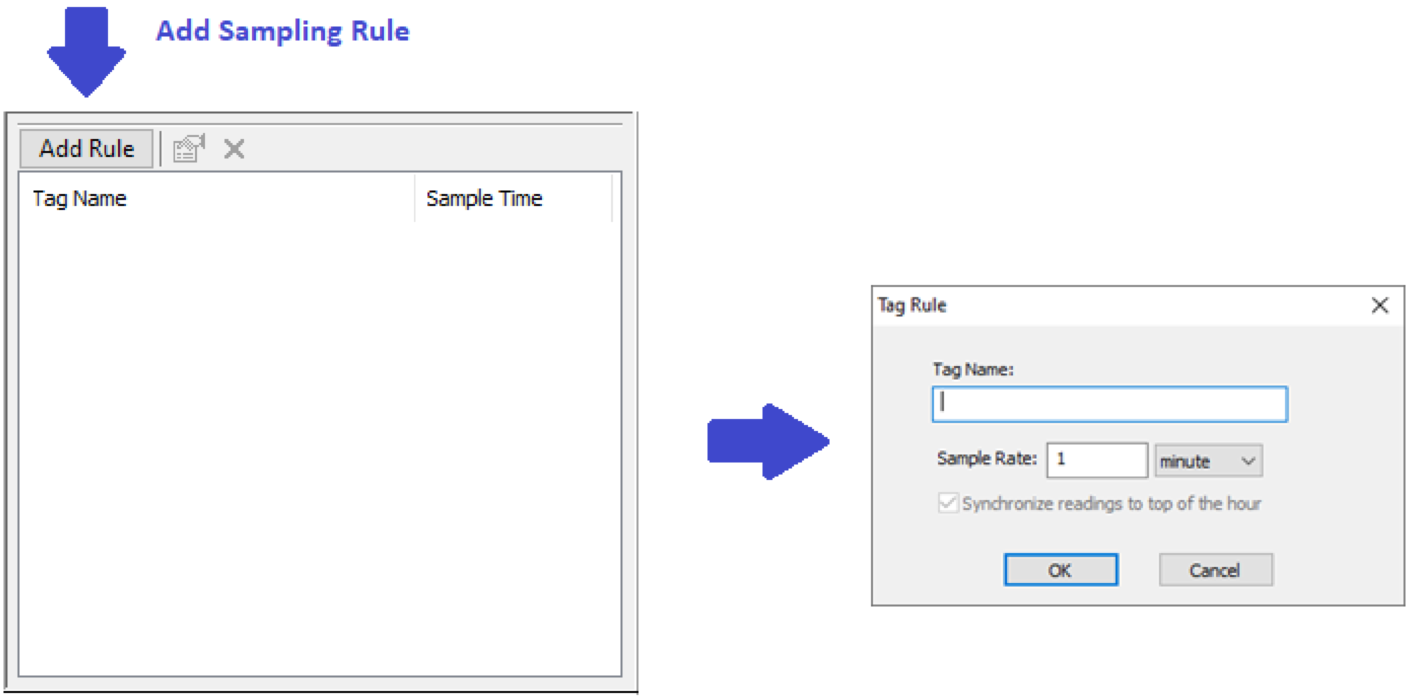
Sample Rate Window

Allowable sample rates range from 1 second to 60 minutes. 'Synchronize readings to top of hour' will update readings into FlowTest synchronized to the top of the hour, this feature makes the readings fall on even increments of minutes eliminating fractional second and minutes in the data tables.

The 'Pause' toolbar button will suspend the real-time update into FlowTest (it does not stop the readings as they will be cached during the pause and immediately updated when pause is removed). This feature is useful for updating table comments or generating reports/exports (basically any time you have several task to complete and you require consistent data for each task).

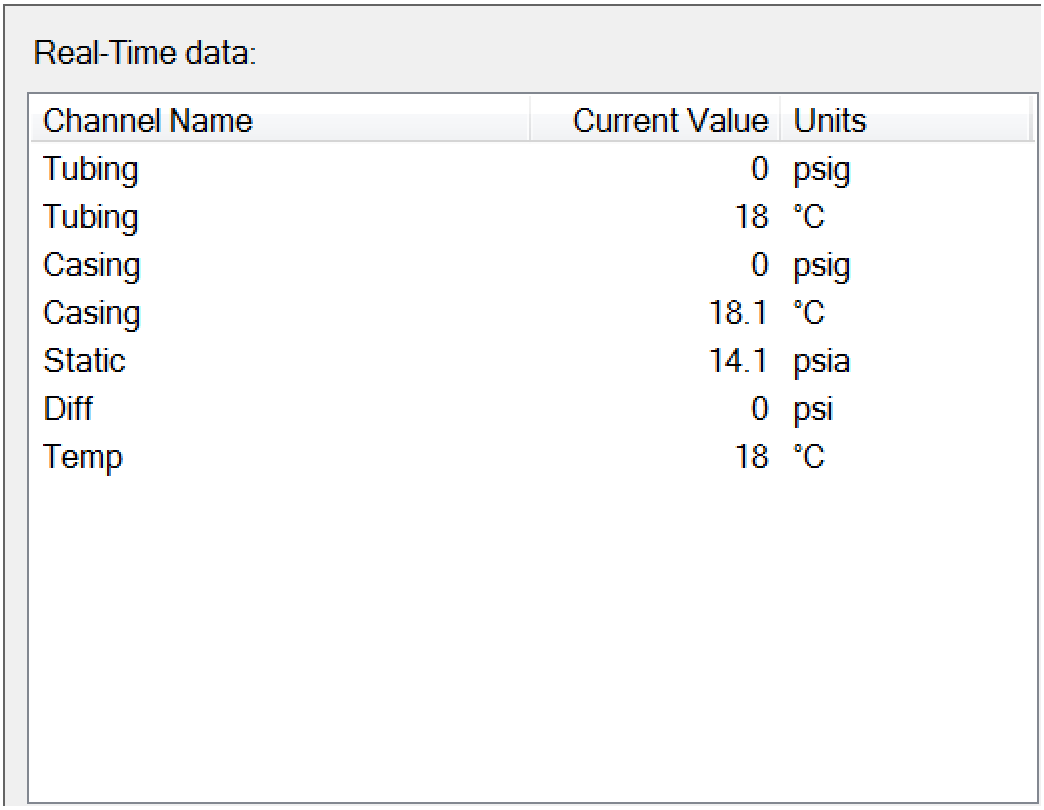
Rules Window

The rules window allows you to override the main channel sampling on a per-channel basis.



To change the sample rate for a single RTM channel press the “Add Rule” button then enter the tag name and new sample rate.

Digital Data Display

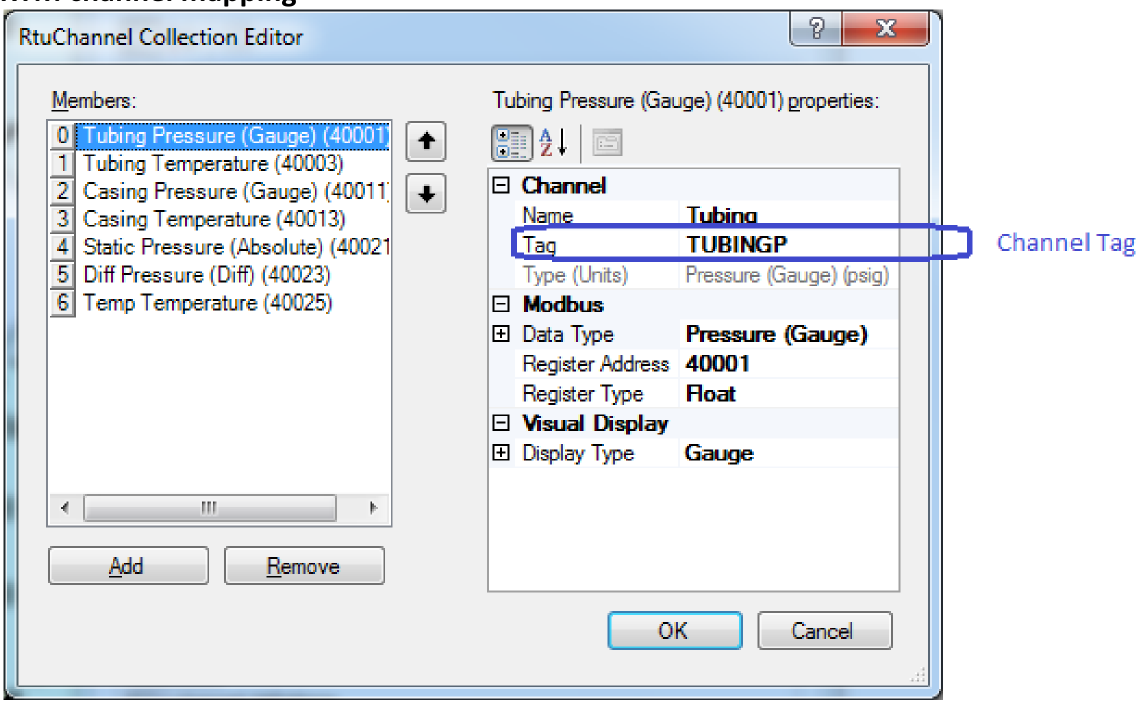


Digital Data Display The digital display displays all real-time data for connected servers. The data displayed is updated every second irrespective of the sample rate and pause status and is displayed in the units sent by the RTM.

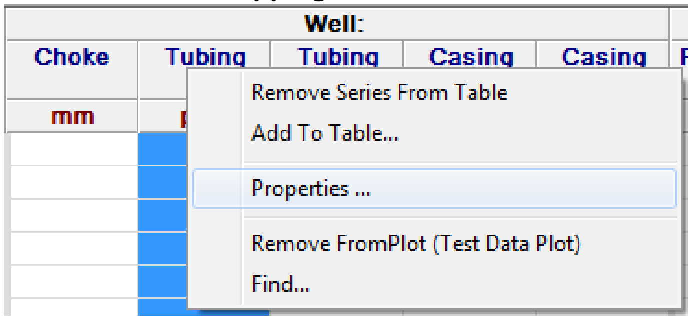
Mapping RTM channels to FlowTest series

In order for the real-time data to be transferred to FlowTest, RTM channels are mapped to FlowTest data series by using channel tags. Data from the RTM will be mapped to FlowTest series that have matching tags (see diagrams below).
***Tip** generally you would save series and channel mapping in FlowTest templates and RTM configuration files for a specific hardware arrangement.*

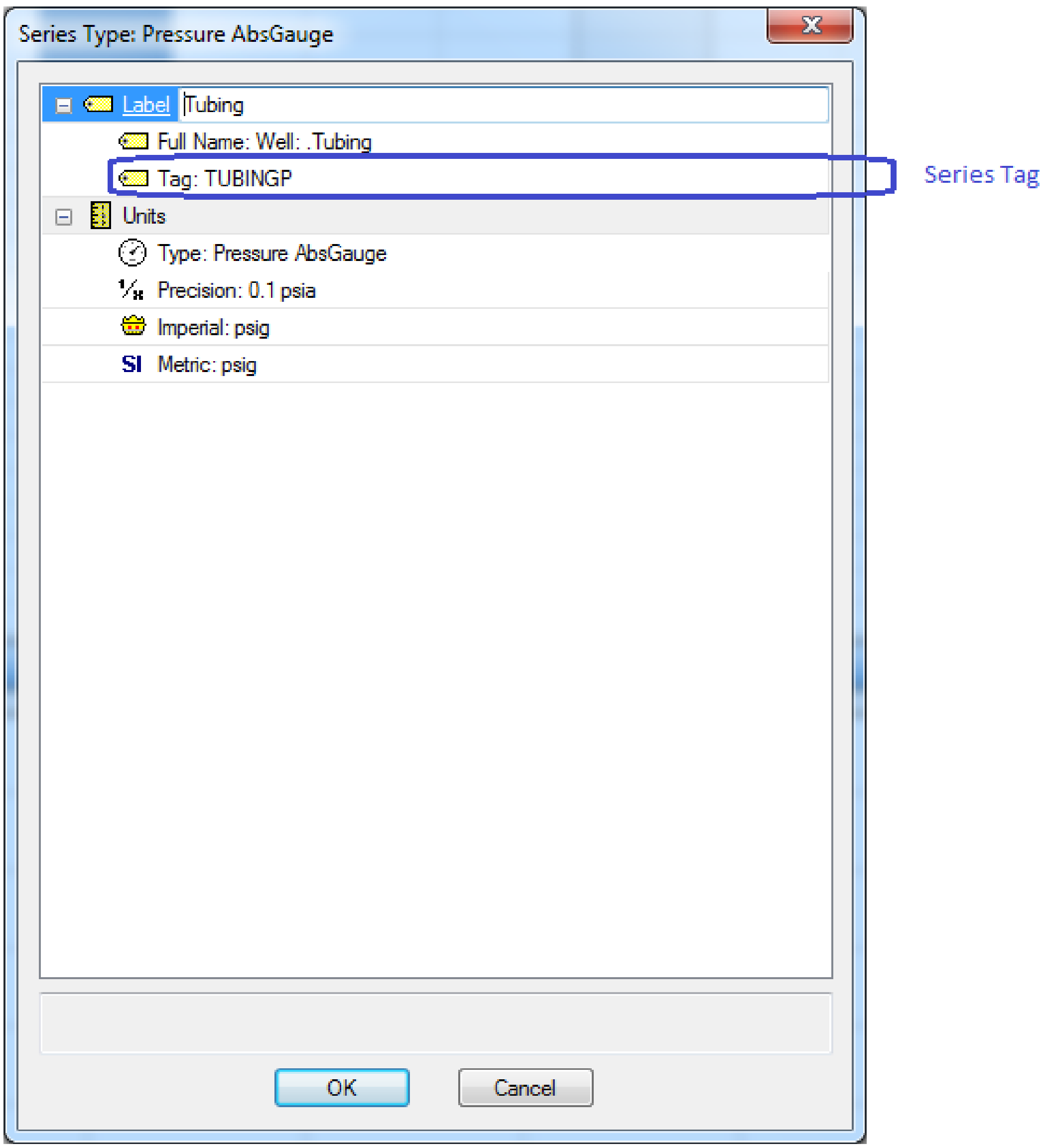
RTM channel mapping



FlowTest series mapping



"Right Click" series, select Properties



When the real-time servers are configured and connected in FlowTest, data transfer will begin to update the tables and plots in real time.

	Test Time					Well:					Data	Orifice 1					
	Date	Time	Cum	Flow	Event	Choke	Tubing	Tubing	Casing	Casing	Produced Gas	Static	Temp	Diff	Plate	Rate	Cum
	dd/mm/yyyy	hh:mm:ss	Hrs.	Hrs.		mm	psig	°C	psig	°C	10^3m^3	psia	°C	psi	mm	$10^3m^3/d$	10^3m^3
1	29/06/2012	10:26:00	0.0000	0.0000			0.0	18.00	0.0	18.10		14.1	18.00	0.00			
2	29/06/2012	10:27:00	0.0167	0.0000			0.0	18.00	0.0	18.10		14.1	18.00	0.00			
3	29/06/2012	10:28:00	0.0333	0.0000			0.0	18.00	0.0	18.10		14.1	18.00	0.00			
4	29/06/2012	10:29:00	0.0500	0.0000			0.0	18.00	0.0	18.10		14.1	18.00	0.00			
5	29/06/2012	10:30:00	0.0667	0.0000			0.0	18.00	0.0	18.10		14.1	18.00	0.00			
6	29/06/2012	10:31:00	0.0833	0.0000			0.0	18.00	0.0	18.10		14.1	18.00	0.00			
7	29/06/2012	10:32:00	0.1000	0.0000			0.0	18.00	0.0	18.10		14.1	18.00	0.00			
8	29/06/2012	10:33:00	0.1167	0.0000			0.0	18.00	0.0	18.10		14.1	18.00	0.00			
9	29/06/2012	10:34:00	0.1333	0.0000			0.0	18.00	0.0	18.10		14.1	18.00	0.00			
10	29/06/2012	10:35:00	0.1500	0.0000			0.0	18.00	0.0	18.10		14.1	18.00	0.00			
11	29/06/2012	10:36:00	0.1667	0.0000			0.0	18.00	0.0	18.10		14.1	18.00	0.00			
12	29/06/2012	10:37:00	0.1833	0.0000			0.0	18.00	0.0	18.10		14.1	18.00	0.00			
13	29/06/2012	10:38:00	0.2000	0.0000			0.0	18.00	0.0	18.10		14.1	18.00	0.00			
14	29/06/2012	10:39:00	0.2167	0.0000			0.0	18.00	0.0	18.10		14.1	18.00	0.00			
15																	
16																	

Troubleshooting

This section assumes that the RTM is configured and is communicating successfully with the instrumentation hardware. If the RTM is not communicating with the instrumentation hardware consult the RTM user manual.

Any detected errors in the configuration are displayed in red at the bottom of the screen and may include any of the following:

- Output Series: The series is an output (or calculated series) and is not a valid target for real-time data.
- Type Mismatch The series and channel types are not compatible i.e. you cannot assign a pressure to a temperature.

Some of the more common errors and solutions are given below:

- The real time window does not show up in FlowTest.
  The RTM server must be running prior to starting FlowTest. If FlowTest does not detect any servers when it is launched the real time window is not available.
  Solution: Start and configure the RTM then restart FlowTest.

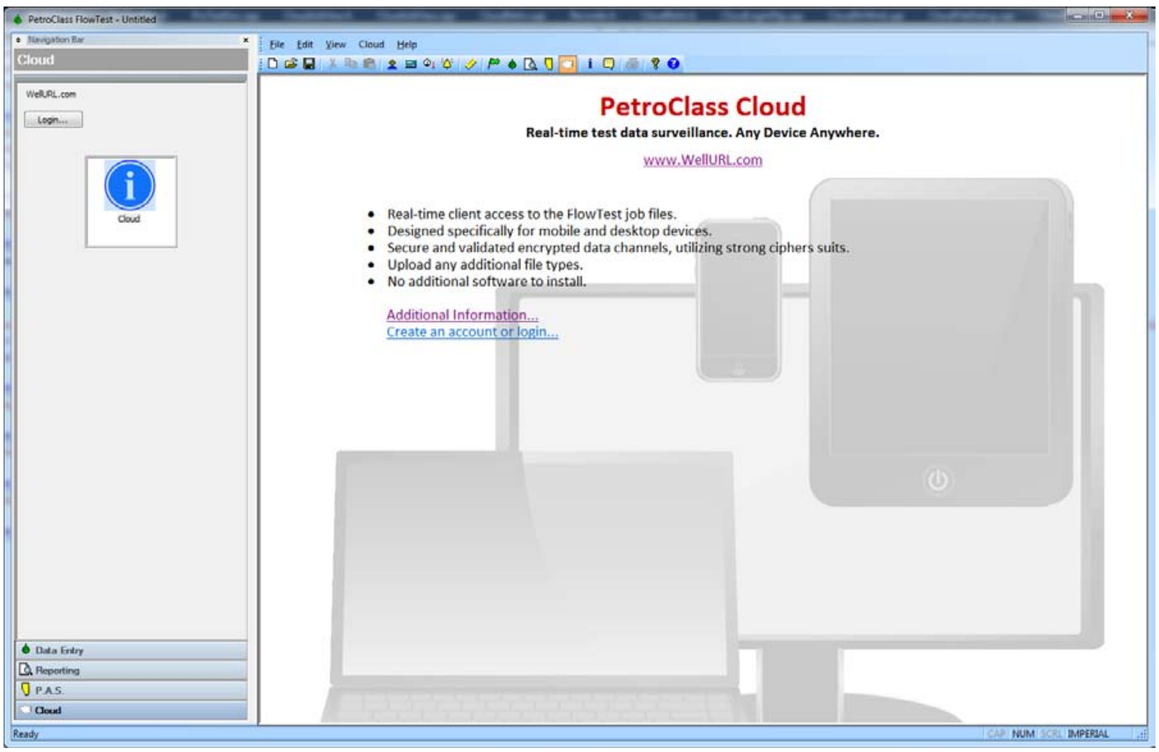
- The digital display does not show any channels. You must be attached to the server before any channels are displayed.
  Solution: Select the server and press the “Attach Server” button.
  Note: The server must have at least 1 configured channel in order to show up in the digital display.

- The data shows up in the window but the units are wrong. This is a RTM configuration issue, consult the RTM user manual.

- The data shows up in the window but does not get transferred to the series in FlowTest. The digital display has a column labeled “Series Feed” this column shows the series associated with the real time channel. If the “Series Feed” entry is empty there is either and error (displayed in the error window) or no matching series tag.
  Solution: For an error, the error condition must be resolved. For a tag mismatch you need to check the tag for the channel in the RTM and the tag in the series you want, both must match;

Cloud

The FlowTest cloud extensions allow for real-time synchronization of the active job to the PetroClass cloud server. Jobs on the cloud server can then be viewed by staff and clients using any standard web browser, including mobile devices. In addition to synchronizing the active job, the cloud can store additional job related files such as reports, csv exports, images etc.



*The PetroClass Cloud is offered to FlowTest users as a value added subscription service. For a limited time, an evaluation of the cloud extensions are available the FlowTest users free of charge **

The main differences between the evaluation and the subscription service are as follows:

- *The duration of the evaluation is limited to 3 months.*
- *The evaluation only allows for a single user, as such, it is not possible to create multiple users/clients and limit cloud access based upon the user. It is possible to allow multiple users to log into the cloud simultaneously, using the evaluation account.*
- *Evaluation cloud data is not backed-up on the server.*
- *Additional terms and conditions are described in the cloud EULA (available when activating the cloud account)*

** Cloud terms and conditions may change without notice.*

The remainder of this documentation describes the evaluation cloud functionality only. Document on the cloud subscription service is available either on the subscription cloud or by contacting PetroClass.

Getting started

To get started using the PetroClass cloud one must first activate the evaluation account.
A single evaluation account applies to all FlowTest licenses within your organization as such, when the account is activated with any FlowTest license, all other licensed copies of FlowTest will share the same account.

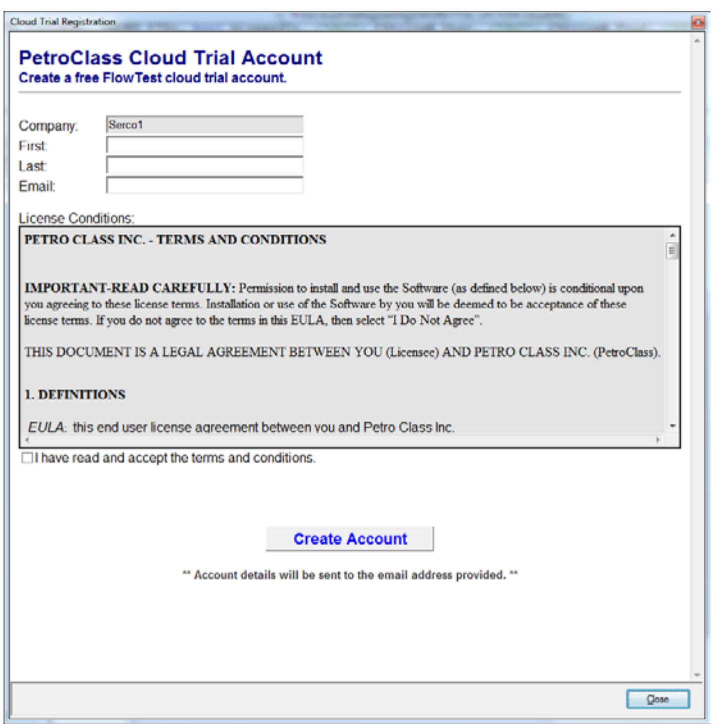
Note:
An active internet connection is required to access the PetroClass cloud. If you have an active connection and still cannot access the cloud, the computer may have a firewall configured to block internet access from external programs. Consult you IT personnel to verify that internet connectivity to FlowTest is enabled.

Creating an evaluation account

In order to use the FlowTest cloud you must first create an account on the system as follows:

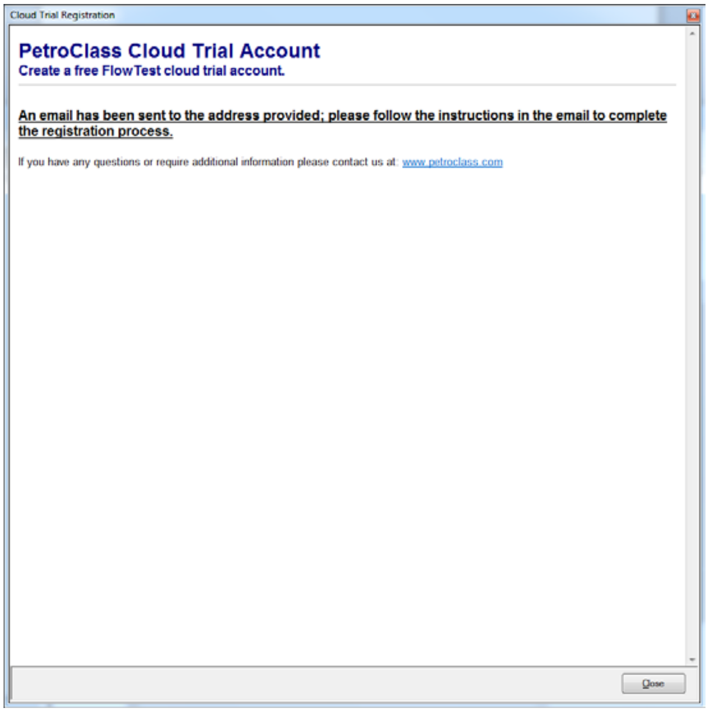
1. In the cloud navigation bar, click the ‘Login’ button or click the ‘Create an account or login…’ link in the main cloud view.

2. *A cloud registration form, similar to the one below, will be displayed.*
   If the cloud login window is displayed instead (see: Logging In below) then an account has already been registered for your company. In this case you will need to get the account information from the person that created the account and proceed to the ‘Logging In’ step below. If any other message is displayed, consult the cloud troubleshooting section for possible causes.



3. Fill out the cloud registration form and press the ‘Create Account’ button.

Upon successful registration, a message will be displayed informing you that an email has been sent to the address provided.



4. Open the email, sent by the cloud server, and follow the instructions contained within to activate the cloud account. **<u>**Note: You must activate the account by following the link in the email before the account can be used.</u>**

5. Proceed to the 'Logging In' section below.

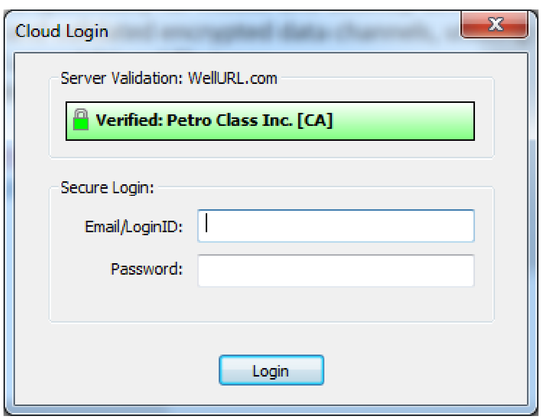
If you have multiple users' evaluating the FlowTest cloud functionality you must give them the login ID and password, as there is only a single evaluation account available for your entire company. For the evaluation, multiple accounts cannot be created but simultaneous logins using the same account are permitted.

Logging in

Logging into the cloud requires an activated account. If you do not have an active account, follow the instructions in the 'Creating an evaluation account' above.

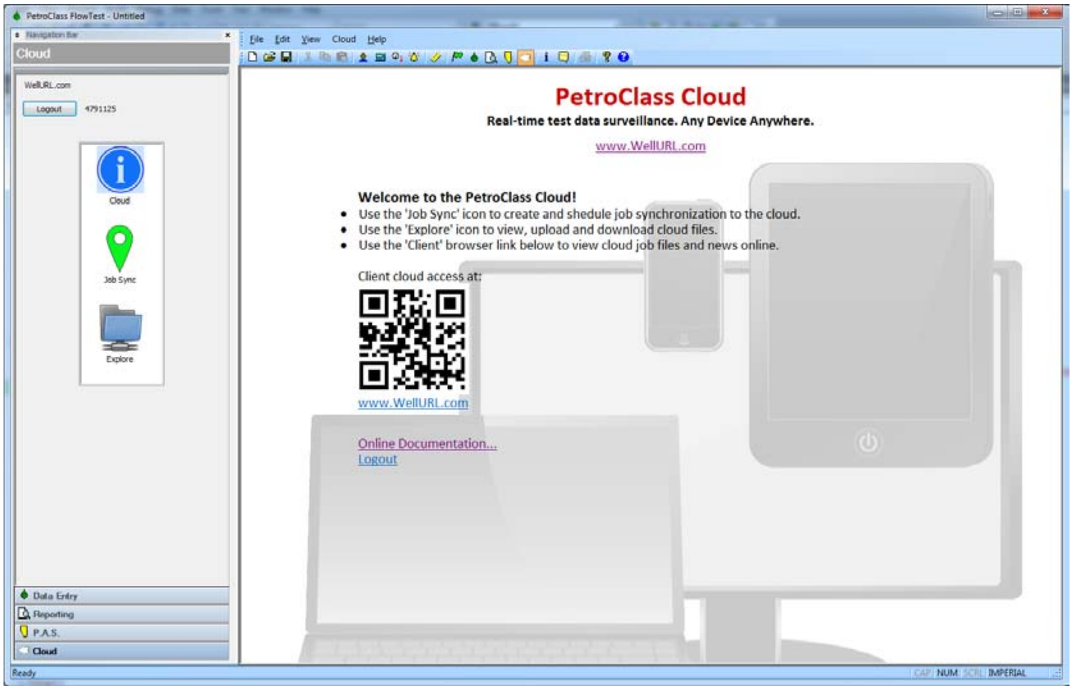
1. In the cloud navigation bar, click the 'Login' button or click the 'Create an account or login…' link in the main cloud view.

2. The cloud login window, similar to the one below, will be displayed.
   If any other message is displayed, consult the cloud troubleshooting section for possible causes.



3. Enter your login ID and password and press the 'Login' button.

4. Upon a successful login, the Cloud navigation bar and view will display additional cloud options as shown below:



The QR code (and the link below it) is the address used for client access to the cloud from any web browser.

In the cloud navigation bar, two additional icons are available once logged in. The icons functionality is as follows:

Main cloud page (documentation and links)

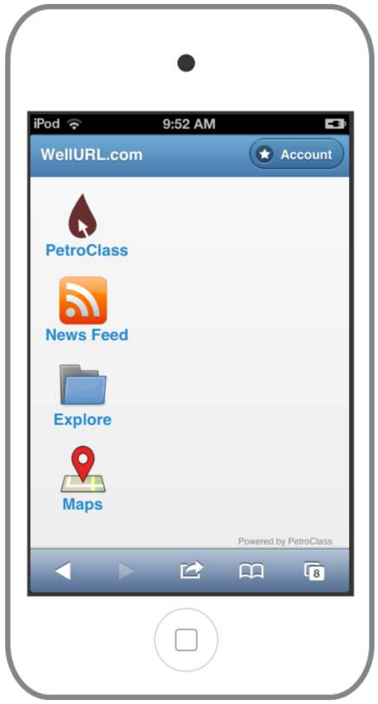
Synchronize the active FlowTest job to the cloud.

Explore cloud files. Upload, download and create cloud folders.

Client cloud access

To access the cloud from a web browser (client access) use the URL link address (or QR code) on the main cloud view in FlowTest.

Secure cloud login screen



Main cloud home screen (after login)

**** Use the same login ID and password from the FlowTest cloud registration.***

You can create a shortcut to the home page for easy future access.

Synchronizing a FlowTest job to the cloud

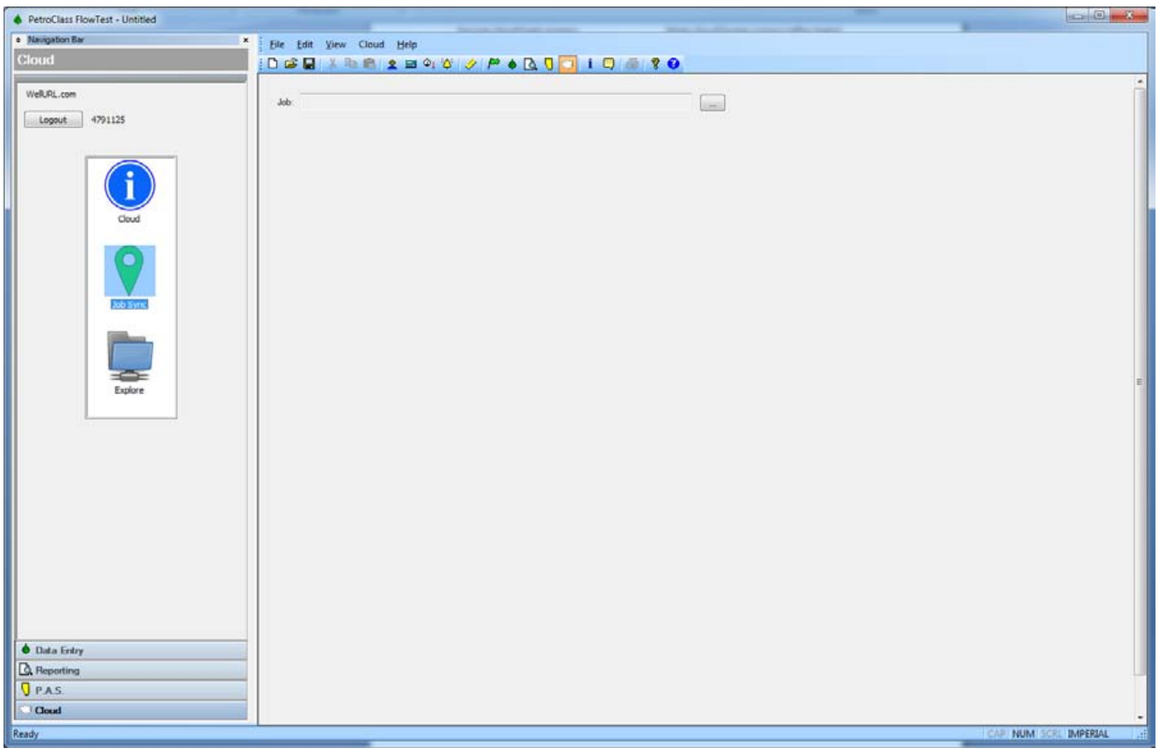
The current (active) FlowTest job can be synchronized to the cloud in real-time with either manual or automatic sync intervals. For simplicity, in this demonstration we will be working with an existing job (that already contains data).

Steps to synchronize a job to the cloud:

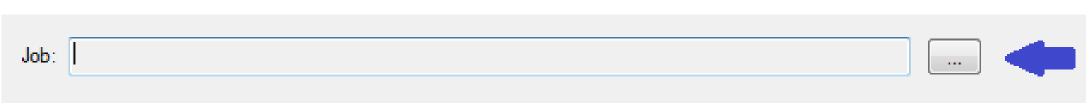
1. Open an existing FlowTest data file.

2. Go to the cloud navigation view and login.

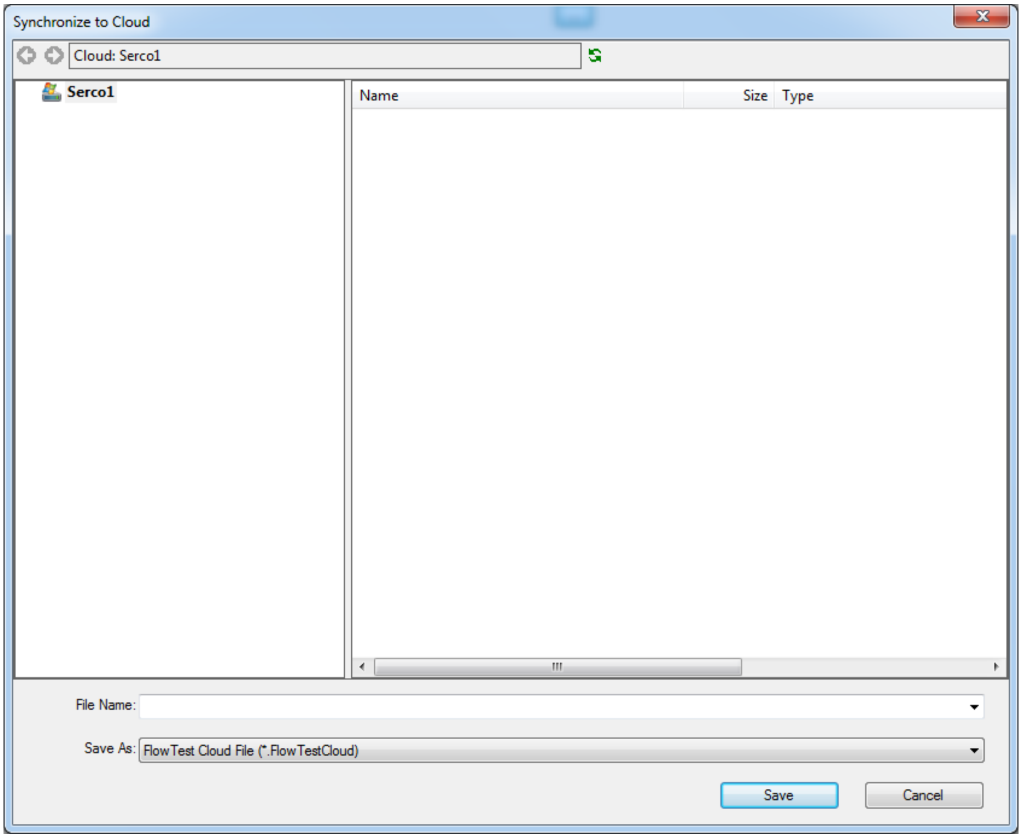
3. In the cloud navigation view select the 'Job Sync' icon to get the following view:



4. In the cloud view, press the '…' button



5. The ‘Synchronize to cloud’ window opens up to allow you to specify a name and location for the job on the cloud server.

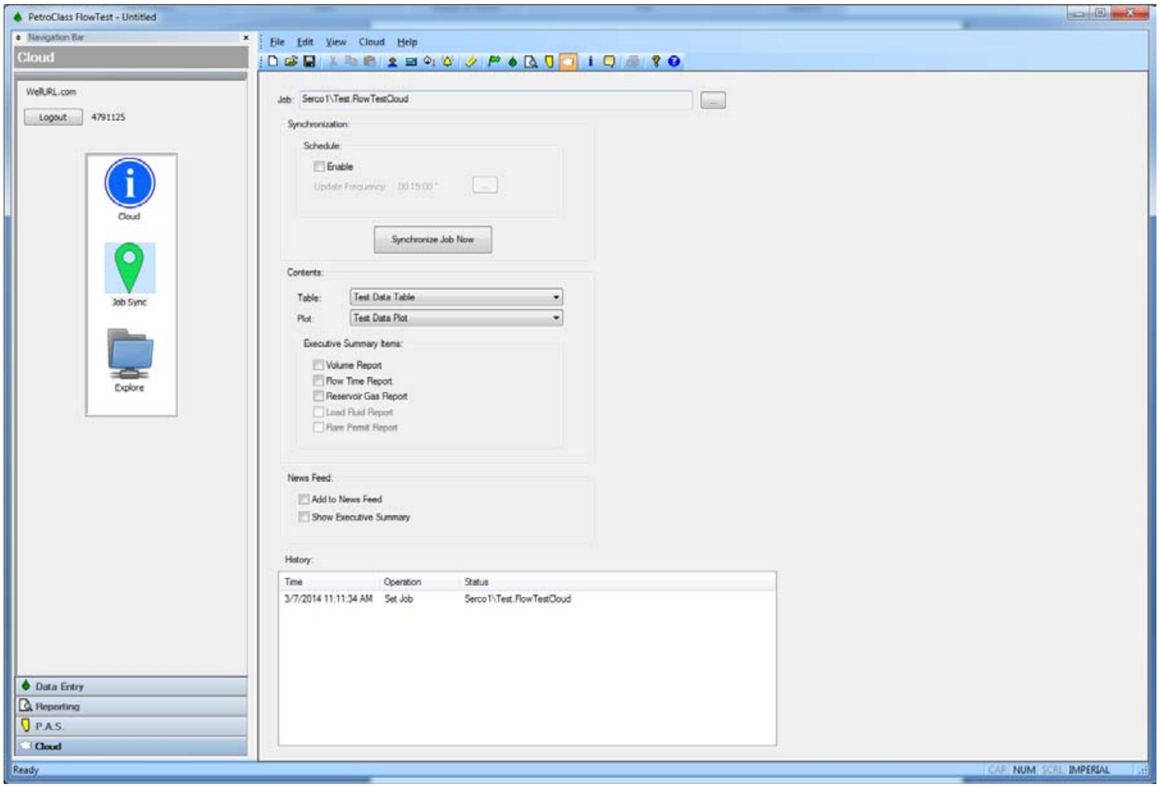


6. The ‘Synchronize to cloud’ window shows a list of folders and FlowTest cloud files that currently exist in the cloud. From here you can create the cloud file by specifying a file name in the desired folder location.

   To create folders of otherwise navigate this window; see the ‘View, upload and download cloud files’ section below.

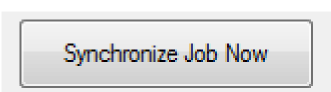
   Specify a file name and location and click ‘Save’.

7. The main cloud window will now show additional synchronization for the job as shown below:

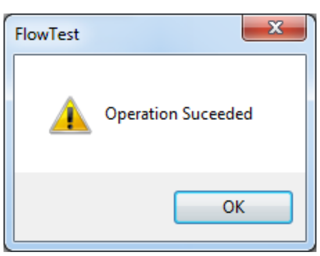


A description of the options in this view will be described in detail below.

8. Using the default settings, manually synchronize the data file to the cloud by pressing the 'Synchronize Job Now' in the cloud view.

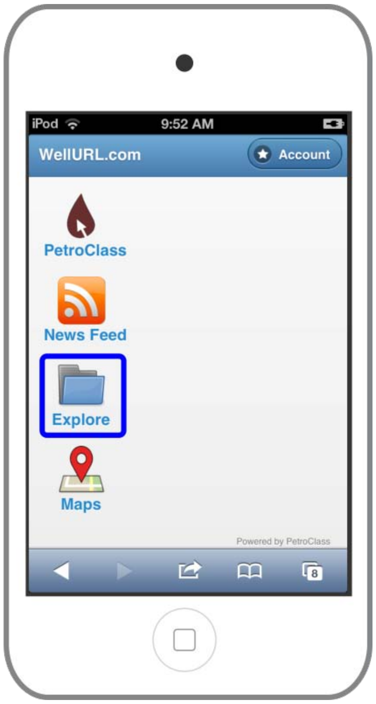


9. At this point you should receive confirmation that the sync was successful with the following message:

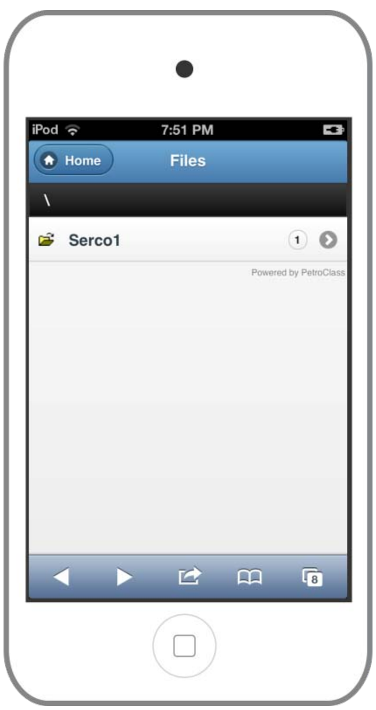


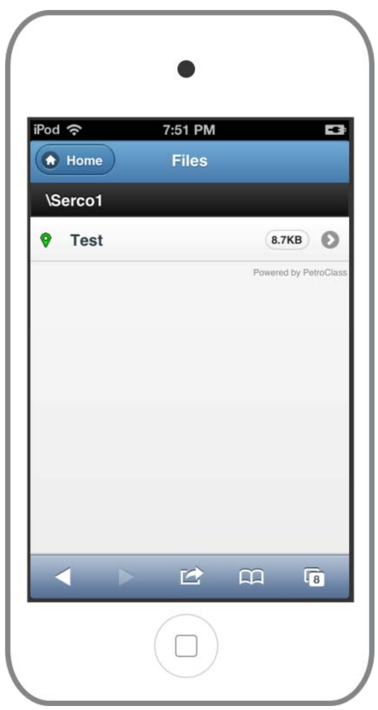
10. Log into the cloud with a web browser to view the job in the cloud.
    For instructions on how to do this see the 'Client cloud access' section above.

11. From the client cloud view select the 'Explore' icon.



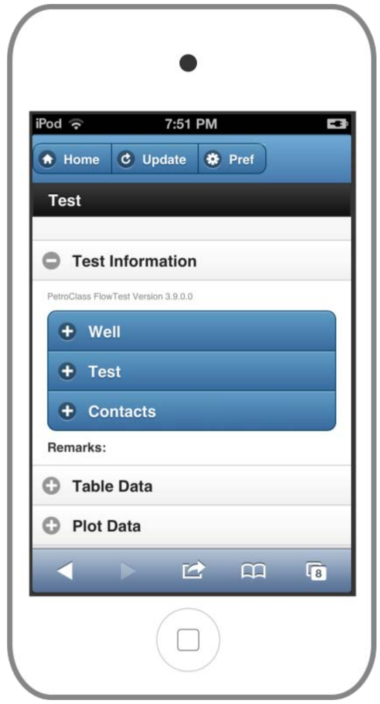
12. Navigate the file view(s) to the location where the file was saved.



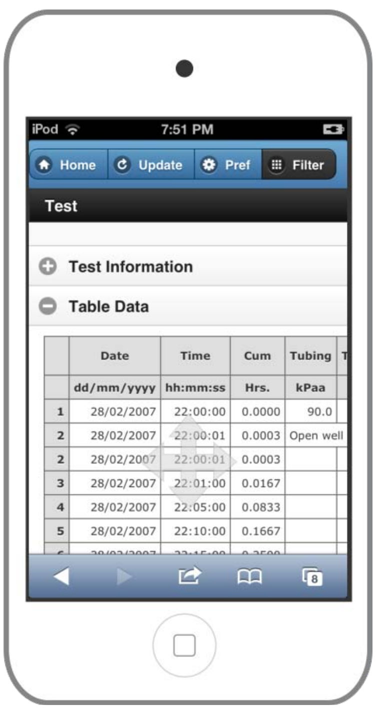


13. Select the job file to load the job.

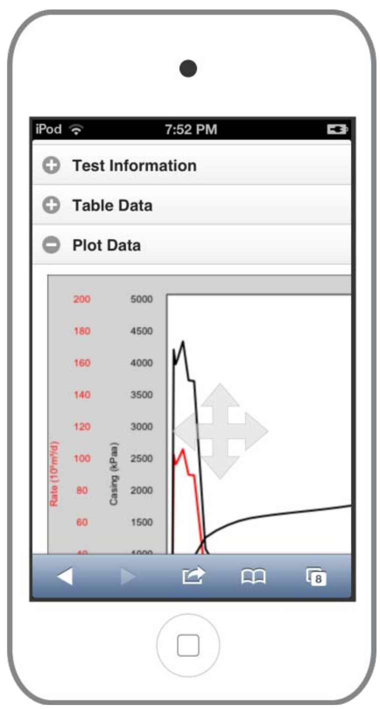
Job view



Test Info (sections expandable)



Data Table (pan and zoom)



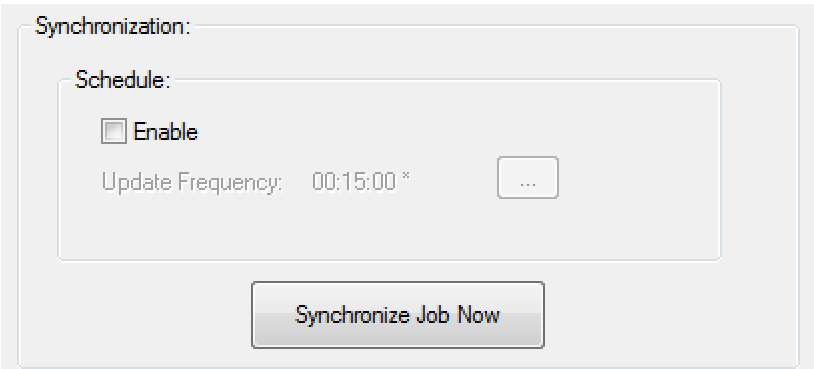
Data Plot (pan and zoom)

FlowTest cloud job screen shots. For additional information consult the cloud user manual.

Additional Synchronization options:

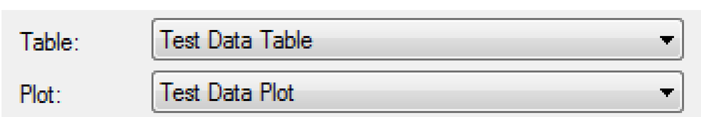
Within the 'Job Sync' view, the following options are available to automate and customize the cloud synchronization.

- Automatic synchronization
  An automated synchronization schedule can be set whereby the active job is synchronized to the cloud in the background at regular intervals. As shown below:

  To enable the automated Synchronization, check the 'Enable' button and specify the update frequency.
  Note: You can still force a manual sync at any time by pressing the 'Synchronize Job Now' button.

- Specify the data table and plot to send
  In the 'Contents section there are two drop boxes to configure which table and plot are synchronized to the cloud. As shown below:

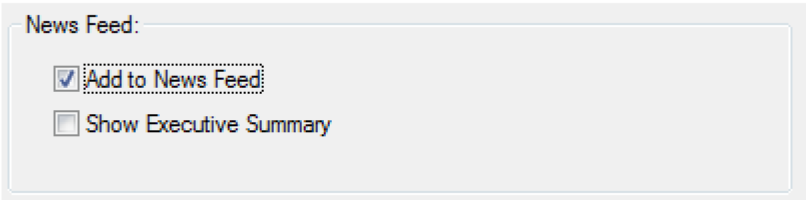
  

- Executive Summary and News Feed items
  The Executive Summary and News Feed items are used together to add value to the job synchronization. Within the client cloud interface there are essentially two ways of viewing cloud files (be they FlowTest jobs or other uploaded files) As we have seen above, we can view cloud files in a standard folder hierarchy via the 'Explore' icon in the main cloud view. The second way to view cloud file is via the 'News Feed' icon. The news feed displays news threads (with associated jobs or files) in a chronological order.

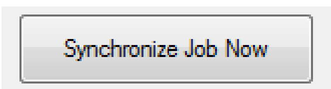
  The best way to illustrate the news feed and executive summary is with an example as follows:

Job Synchronization add to News Feed

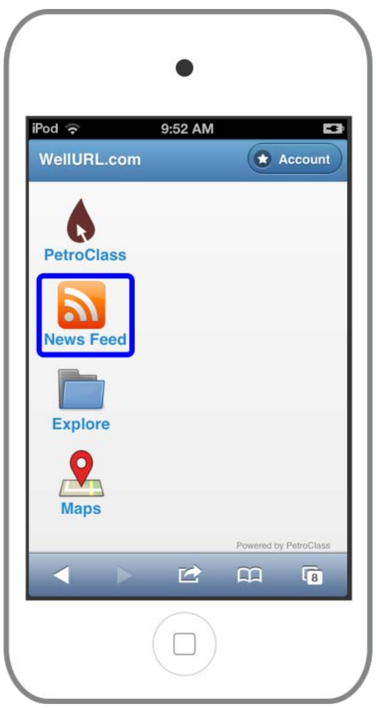
1. Enable the ‘Add to News Feed’ checkbox option.

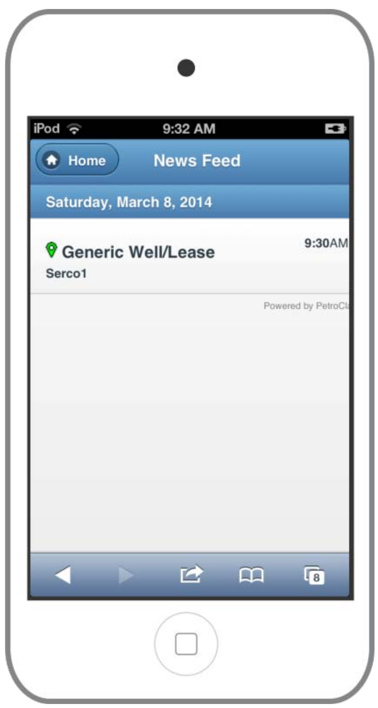


2. Click the ‘Synchronize Job Now’ in the cloud view.



3. From the client cloud view select the ‘News Feed’ icon.





The job now shows up in the news feed. The job can be loaded by selecting the job thread in the news feed.

Executive summary items

Executive summary items are value added charts that appear within the job thread in the news feed. FlowTest currently has five summary reports available as follows:

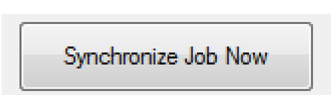
1. **Volume Report** Bar chart of total test volumes.
2. **Flow Time Report** Pie chart off Flowing and shut-in time.
3. **Reservoir Gas Report** Pie chart of reservoir gas by destination.
4. **Load Fluid Report** Pie chart of RCV and LTR.
5. **Flare Permit Report** Pie chart of flared gas to permit volume.

Some of the chart items may be grayed out (unavailable) if the test contains no data to generate the report. For example if there is no load fluid being recovered, then the load fluid report is made unavailable.

An example with new feed executive summary charts:

1. Enable the ‘Show Executive Summary’ option and select all available reports.

2. Click the ‘Synchronize Job Now’ in the cloud view.



3. Resulting executive summary reports in the news feed.

Note: When re-synchronizing job files in the news feed the previous job thread is replaced by the current thread, and moved to the top of the news feed. This effectively keeps a single, per job, thread in the news feed.

Synchronization Technical Note:

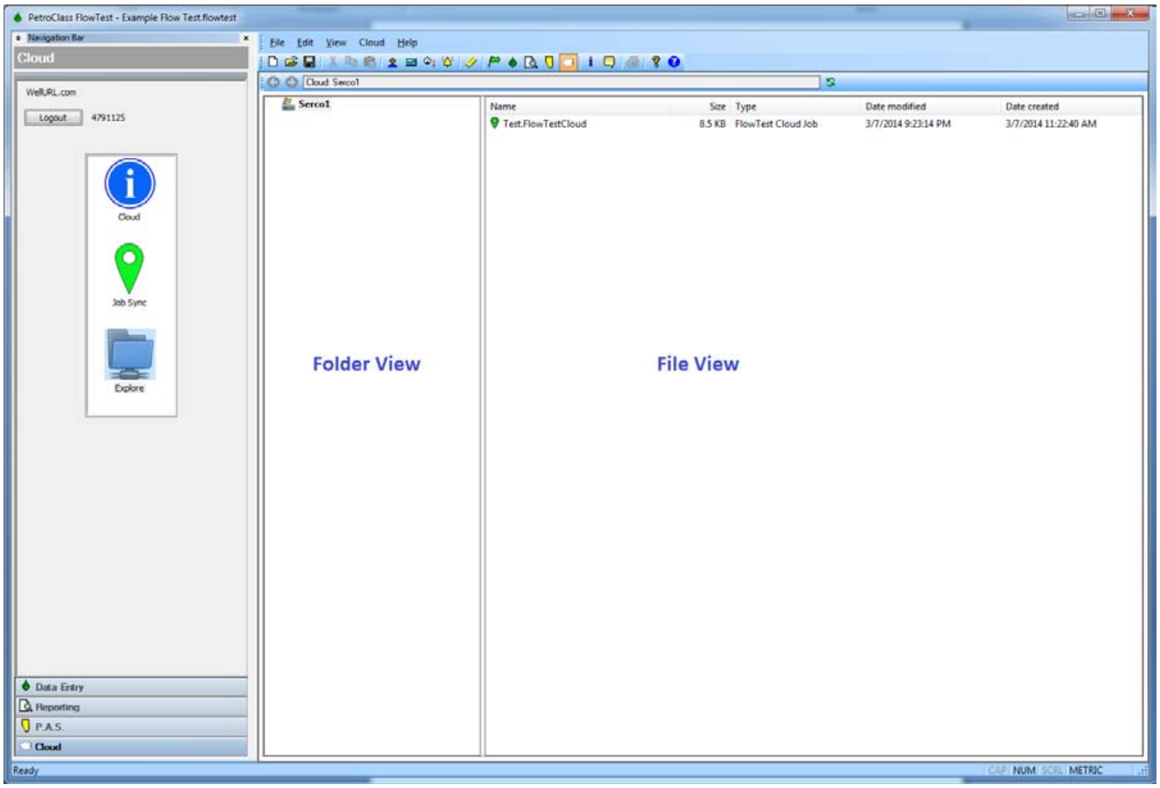
The FlowTest job synchronization utilizes a highly efficient, proprietary, delta compression algorithm to minimize the data transfer over the internet. Our proprietary algorithm (operating in the background) detects and sends only the compressed changes between consecutive synchronization sessions over the internet.

We realize that internet data bandwidth is expensive in the field and, as a result, we have dedicated a great deal of effort in conserving this resource. The net effect is you can synchronize more frequently without the fear of burning up you mobile or satellite data plan.

View, upload and download cloud files

FlowTest contains a cloud explorer to manage cloud files and folders. The cloud explores allows you to do standard operations such as creating directories, uploading files, downloading files and deleting files.

The cloud explorer is accessed via the ‘Explore’ icon in the cloud navigation bar.

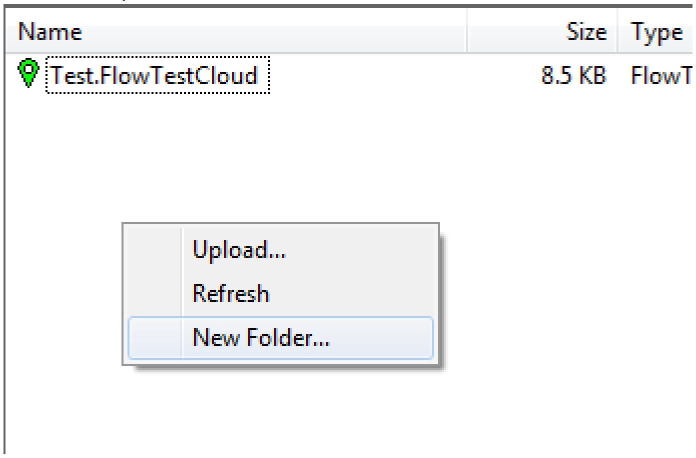


The explorer has two main parts, the left pane displays a hierarchical view of the cloud folders and the right pane displays the files and folders contained in the selected (left pane) folder.

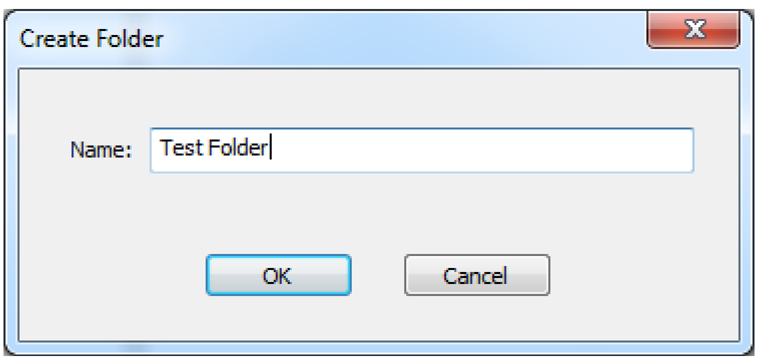
Petro Class Inc.

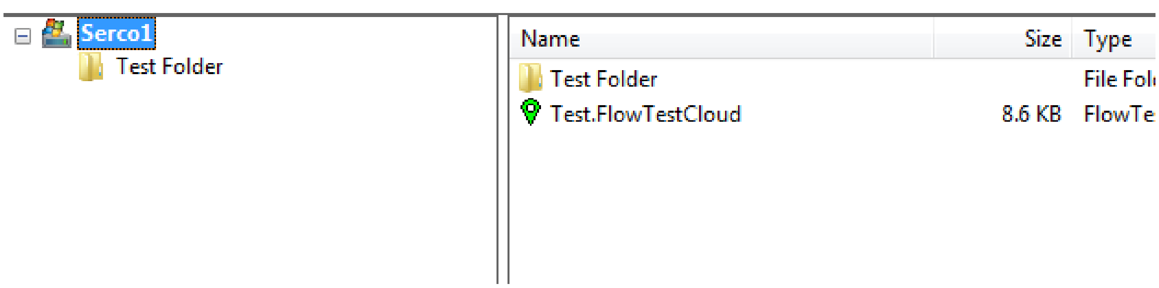
Common operations:

- Create Folder
  To create a new folder (in the file view) right click anywhere in the blank area of the file view (i.e. not on a file name) and select ‘New Folder…’



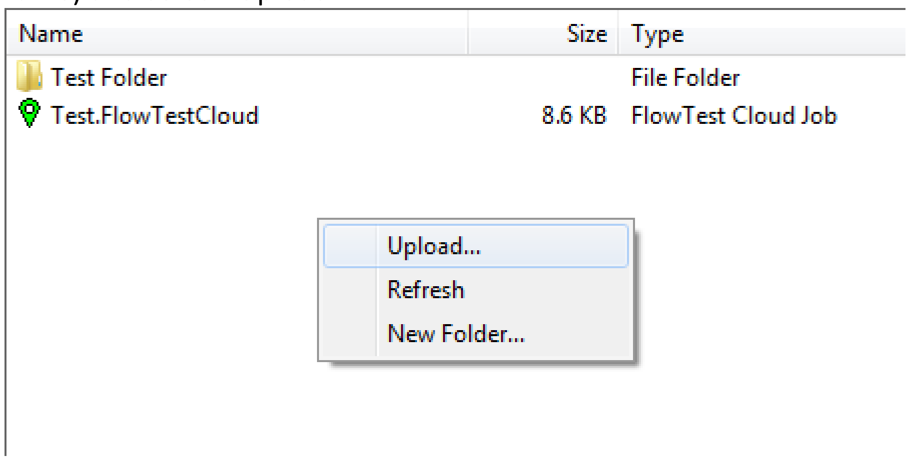
In the Create Folder window, name the folder and select ‘OK’

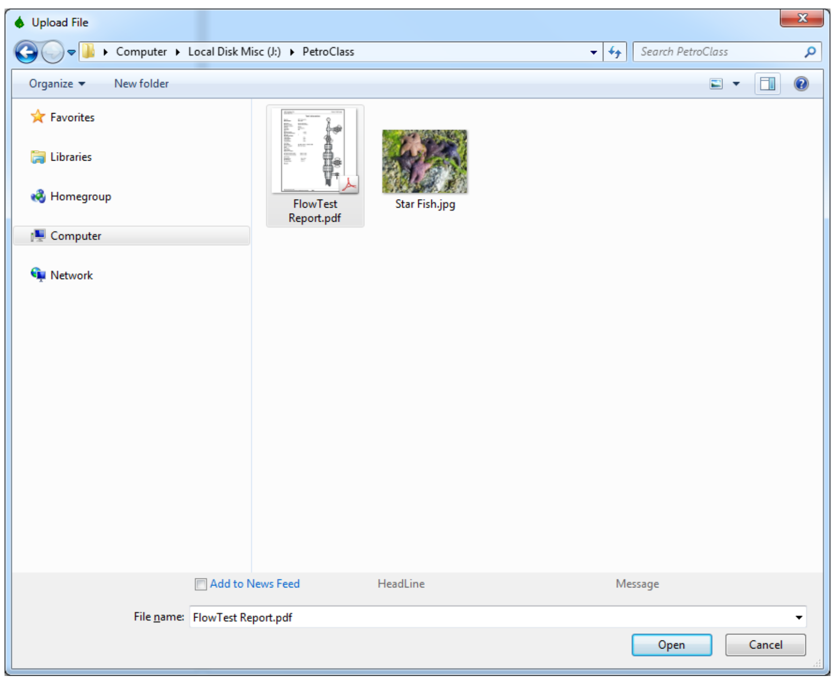




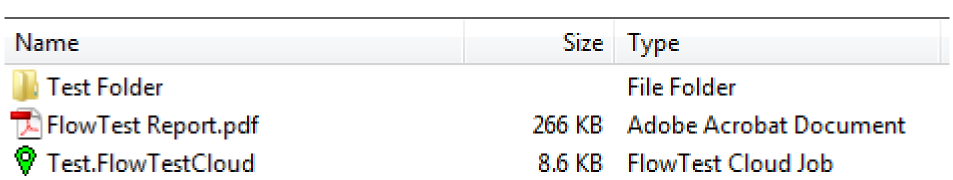
The new folder now appears in both views.

- Upload a file
  To upload a file (in the file view) right click anywhere in the blank area of the file view (i.e. not on a file name) and select ‘Upload...’



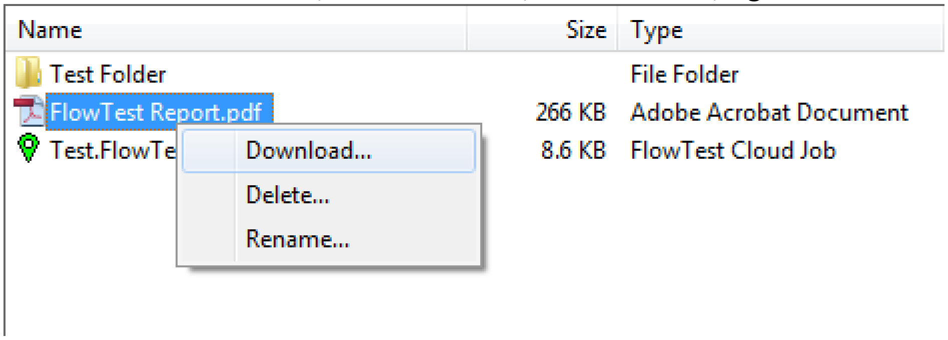


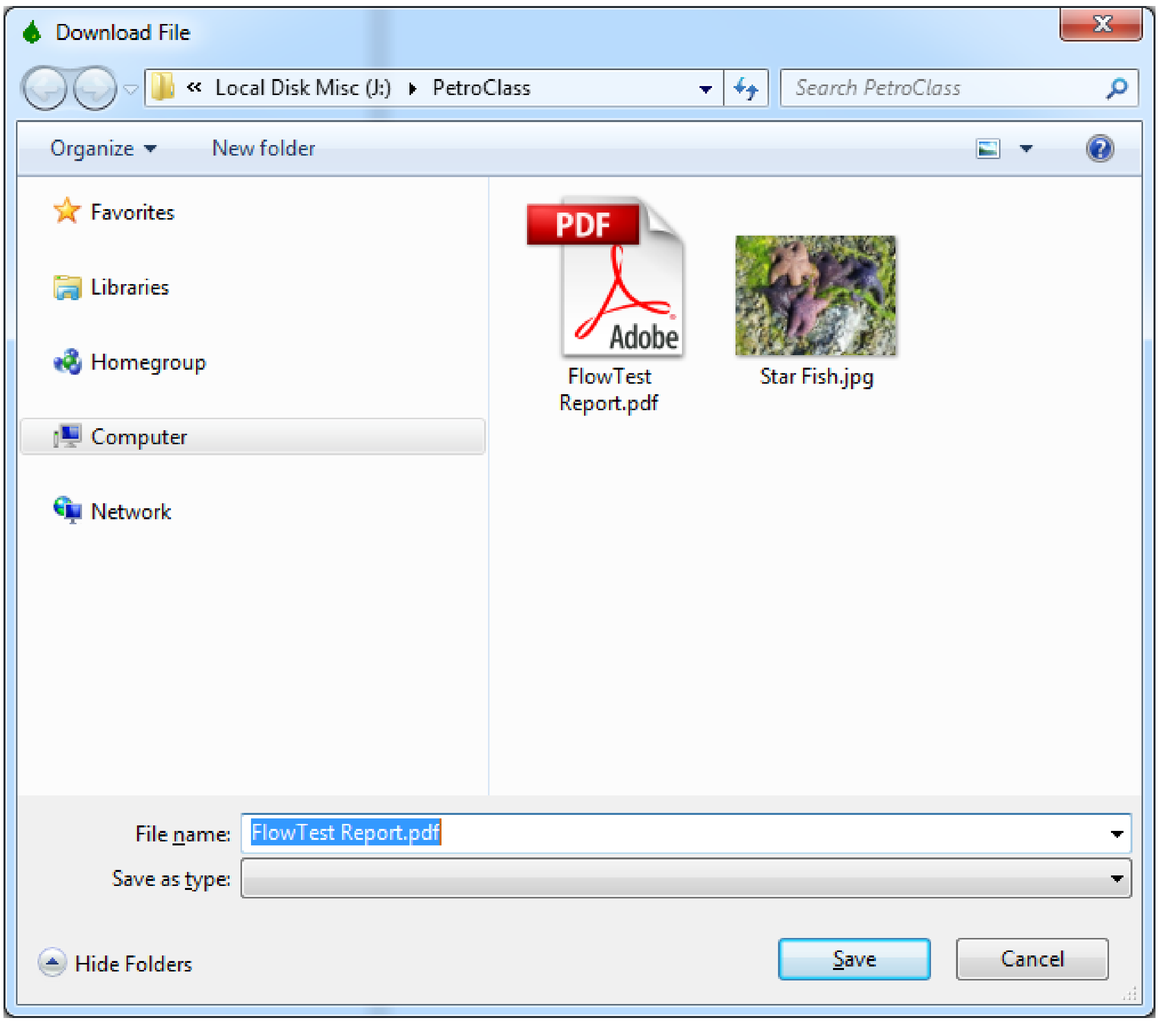
In the ‘Upload File’ window select the file to upload and click the ‘Open’ button.



The file is transferred to the cloud and appears in the file view.

- Download a file
  To download a cloud file, in the file view, select the file, right click and select 'Download'

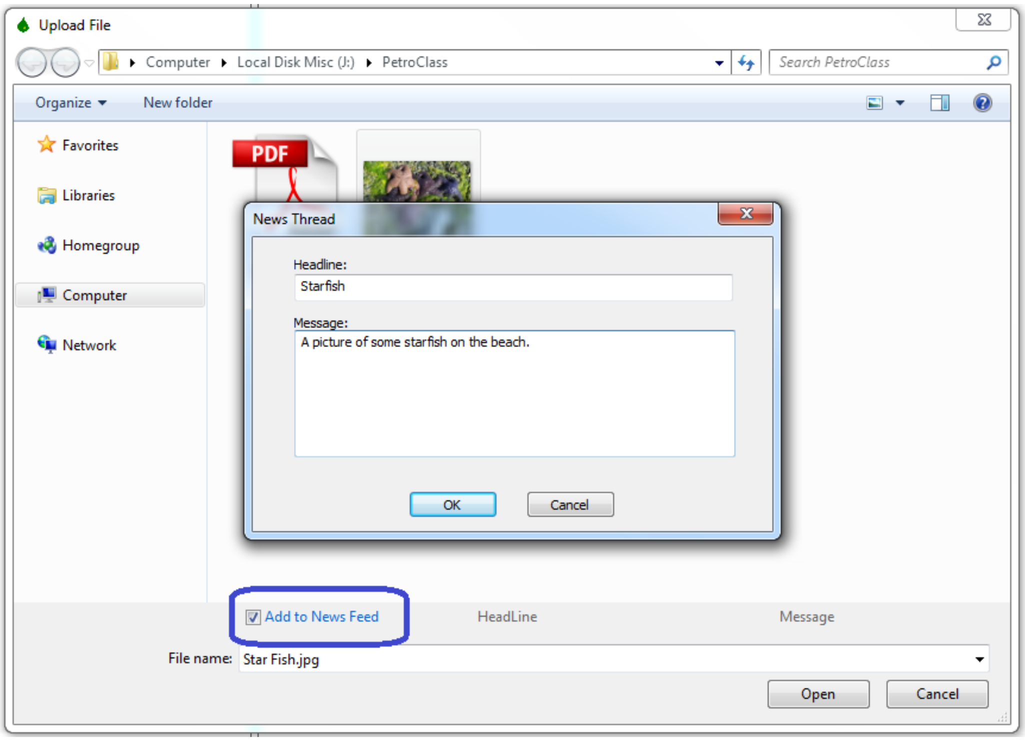




In the 'Download File' window, select the destination for the download and click the 'Save' button.

Uploading Files and adding to the news feed

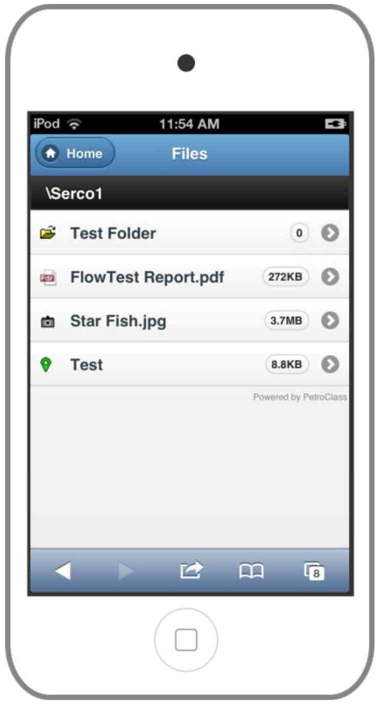
When uploading files to the cloud you can specify that the file reference is added to the news feed. In the 'Upload File' enable the 'Add to News Feed' option as follows:



When 'Add to News Feed' is selected, the 'News Thread' window is displayed and requires a headline for the news thread and an optional message.

The uploaded file is uploaded to the specified location, with the addition of creating a thread in the news feed referencing the file. If the news file is a picture then a thumbnail image of the file will also appear in the news thread as shown below.

Uploaded picture file in news feed

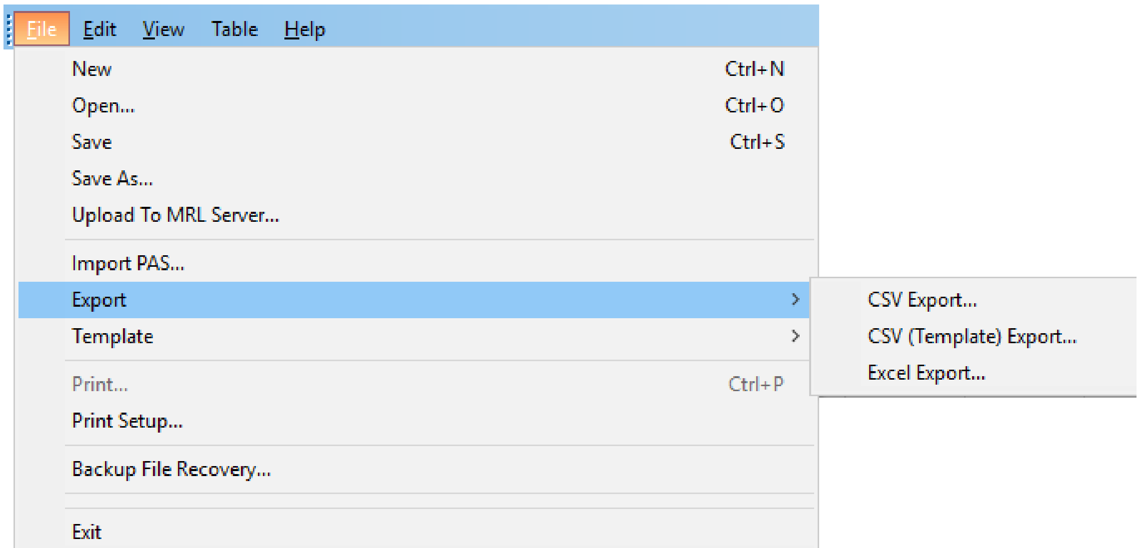


Uploaded files in cloud explore

Select the file to view or download files from the cloud.

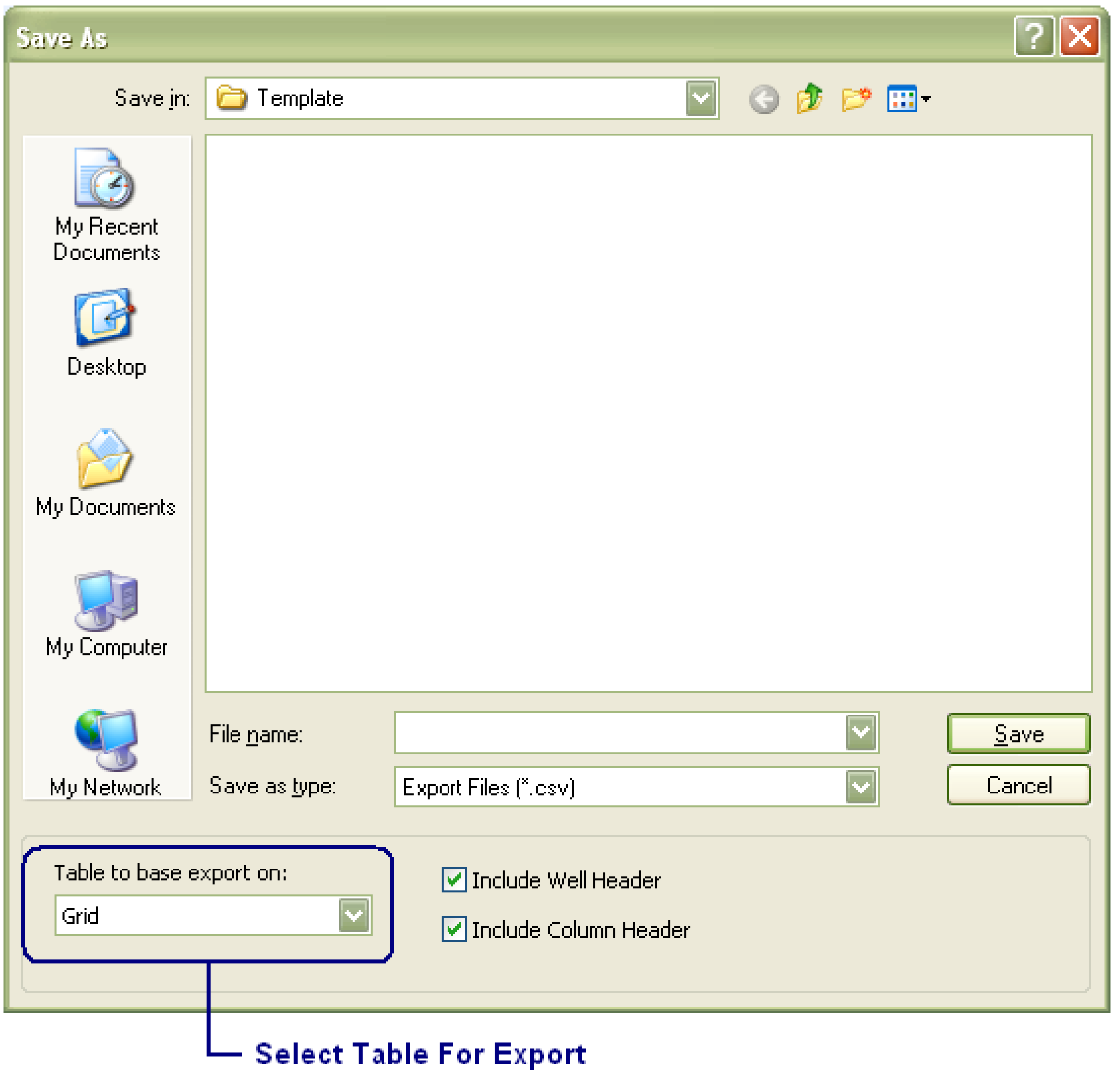
Data Exporting

FlowTest provides three data export options: two comma separated value (CSV) modes and a direct to Microsoft Excel format. To export the current data set select ‘Export’ from the File menu.



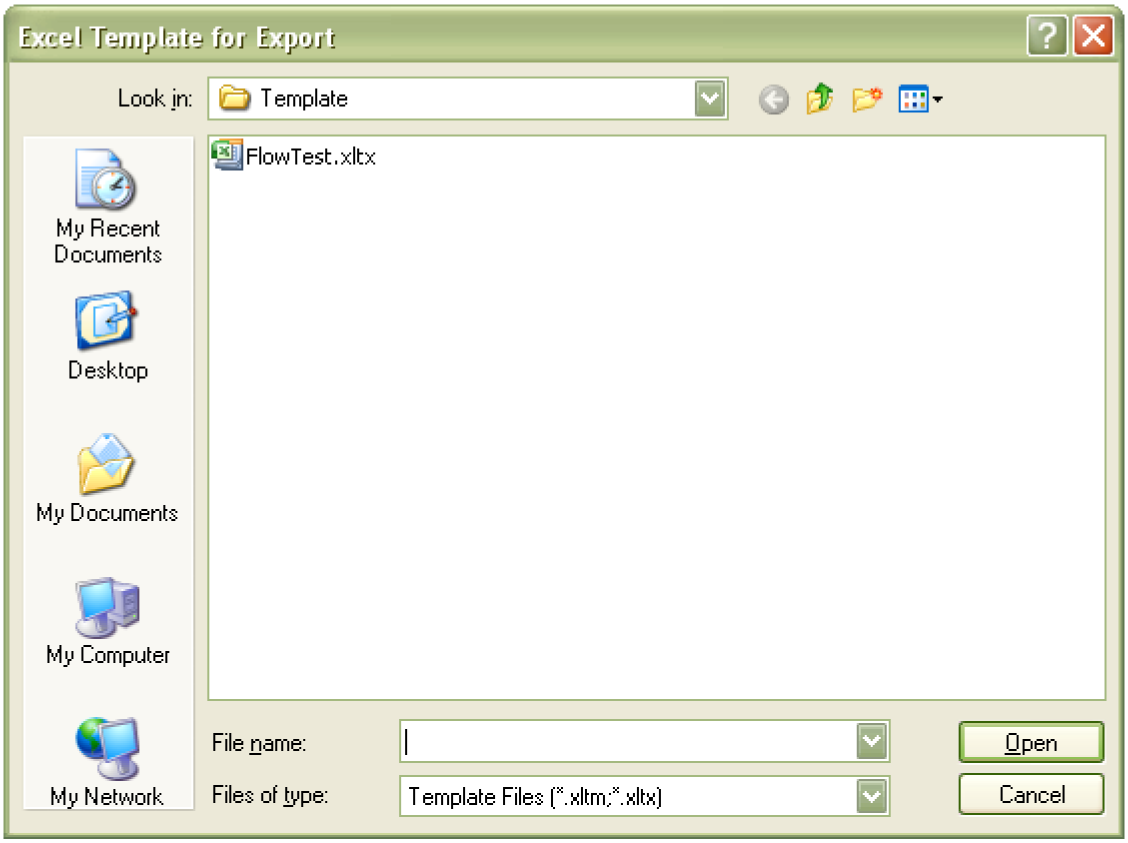
CSV Export

The CSV export allows for a single data table to serve as a template for the data being exported.
Create a CSV export by selecting the 'Export CSV' option from the Export menu. In the export dialog select the table to base the export on, optionally include the well information and column headers, enter a name for the CSV file and select Save.

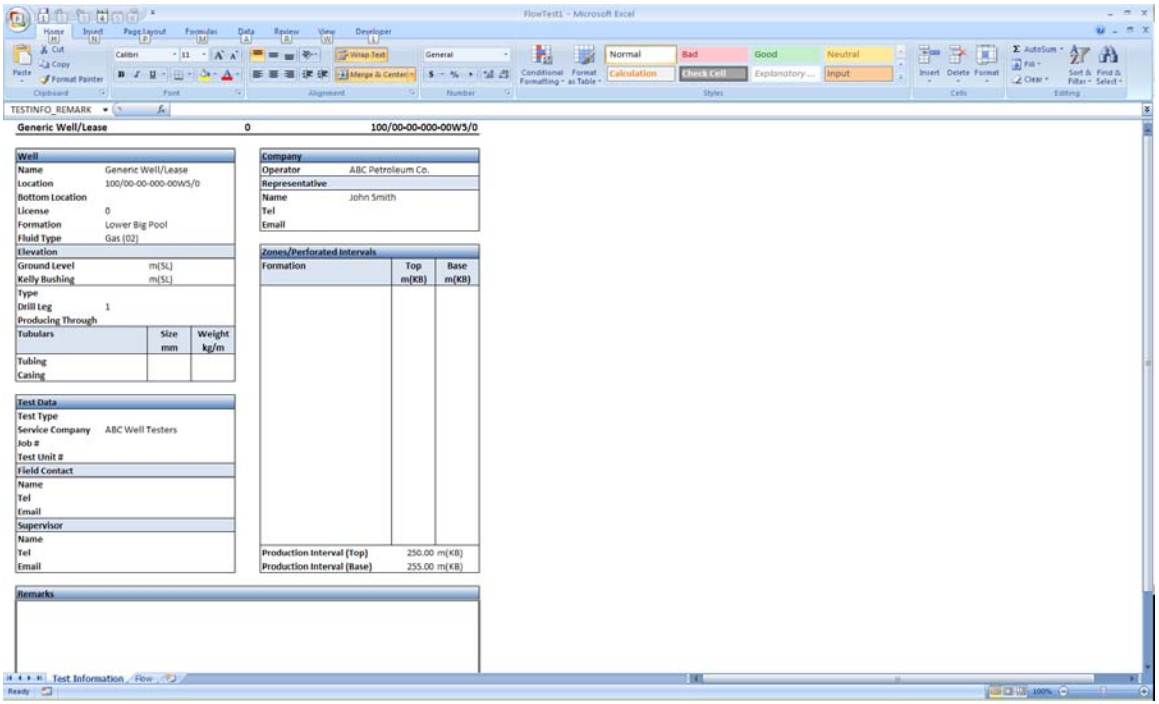


Excel Export

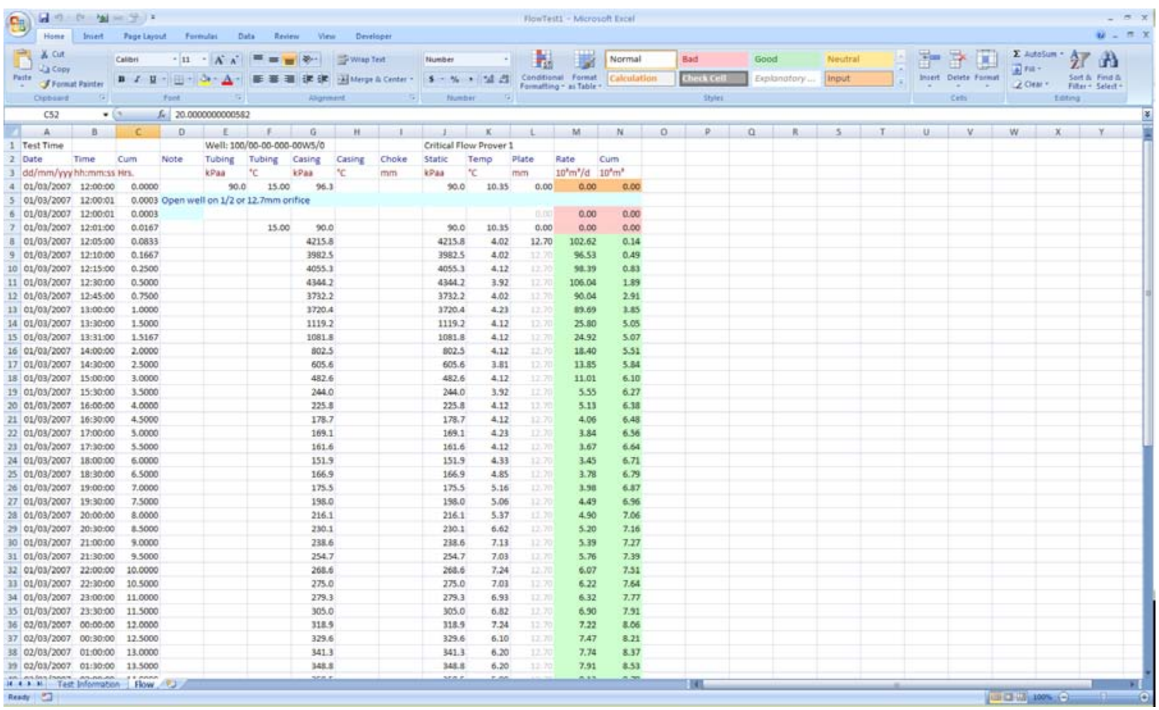
The Excel export directly transfers the current FlowTest file into Microsoft Excel. In order to use this export, excel must be installed on the computer running FlowTest.
Create a Excel export by selecting the 'Export Excel option from the Export menu. In the export dialog select the template to base the export on, and select Open.



The export will launch a new instance of Microsoft Excel containing the exported data.



Example: Excel export Sheet1



Example: Excel export Sheet2

Data is exported as multiple sheets within Excel. Sheet 1 contains well, company and test information. The remaining sheets will contain each table in the FlowTest file.

Note:
For Microsoft Excel versions prior to Excel 2007

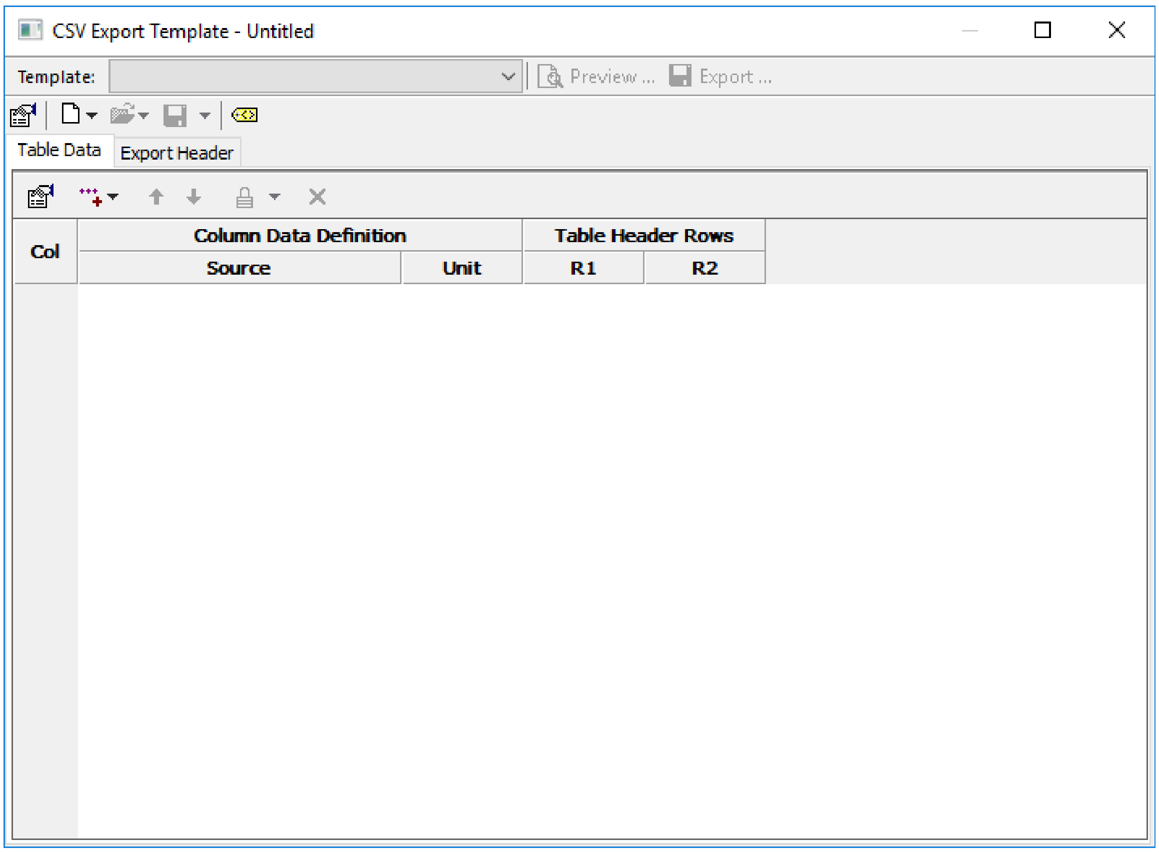
The template provided (FlowTest.xltx) is compatible with Microsoft Excel 2007 and newer. If you have a previous version of Excel installed, and the export will not open the template file, Microsoft provides an "office compatibility pack" free of charge, allowing previous office products to open office 2007 files.
The office Compatibility pack is available for download at:
http://www.microsoft.com/downloads/details.aspx?FamilyId=941b3470-3ae9-4aee-8f43-c6bb74cd1466&displaylang=en

Optionally; one can open the template in Excel 2007 and save a copy in an Excel 2003 or earlier format.

Advanced export functionally is available, allowing for customized exports tailored to specific client requirements. For detailed information on creating custom Excel exports see: Custom Excel Exports in Appendix A.

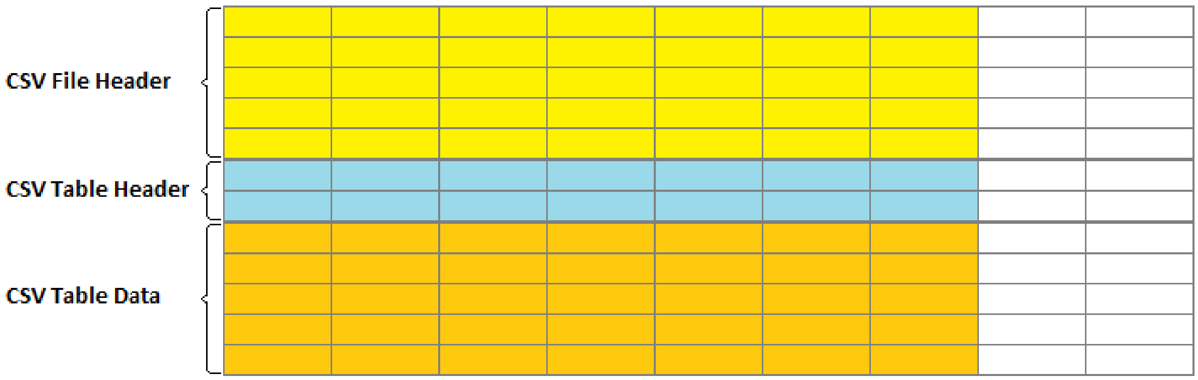
CSV Template Export

The CSV template export allows you to precisely control the format of CSV file. Unlike the standard CSV export (based on a given data table in the FlowTest file) the CSV export template allows you to define an export to conform to a strict export definition allowing for precise control over the data exported, order and unit s. The ‘Custom Excel’ export templates also provide this functionality, but at a cost of simplicity and ease of use.



CSV Template Export window (open via the: File, Export, CSV (Template) Export … menu)

The main components of a CSV template export:



The CSV file generated by the template export has 3 sections:

1. The CSV file header can be 0 to 30 rows by any number of columns, consisting of any free form text entries. The header typically consists of test information and can include any 'smart tags' from the 'Test Information' window.
2. The CSV table header can be 0 to 5 rows by the number of series (columns) included in the export. The table header typically includes the series name and the units for the export.
3. The CSV table data rows are determined by the number of readings in the FlowTest file where the numbers of columns are determined by the number of series (columns) included in the export.

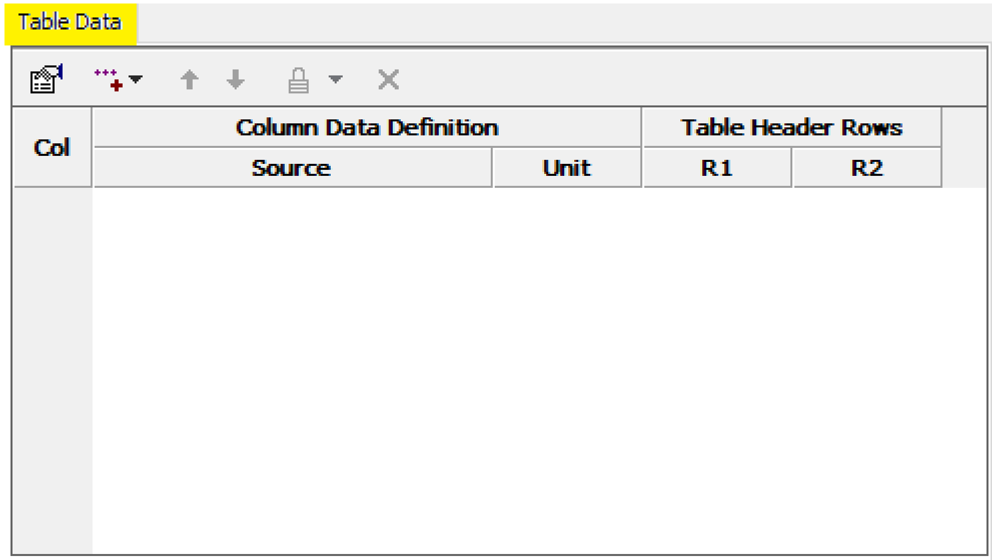
CSV Template Export Window Components:

Main Toolbar:

The main toolbar of the export window serves two main functions:

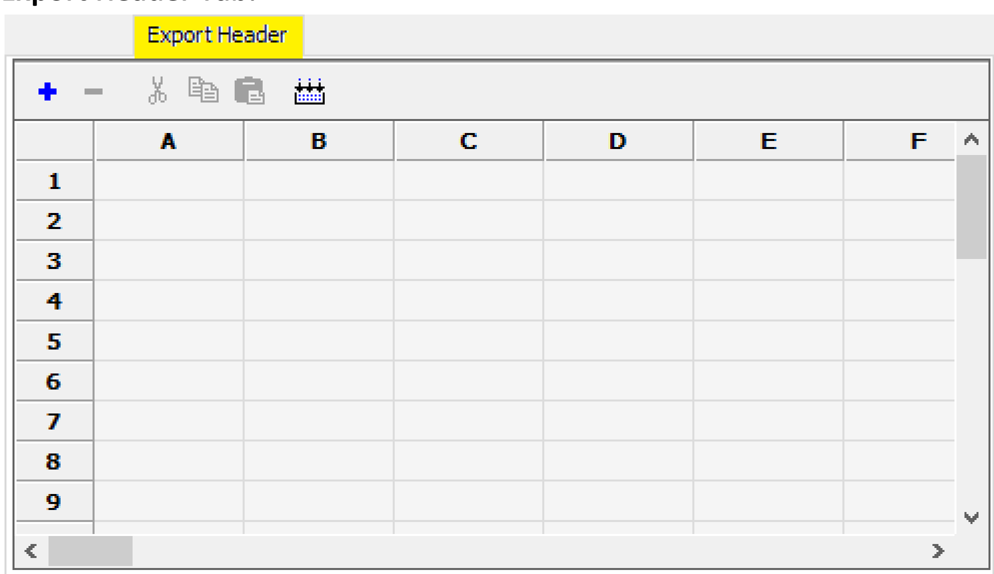
1. The top bar is used to load a template based on a FlowTest table or a previously saved template. The 'Preview…' and 'Export…' buttons allow you to preview and save the CSV file. Generally users will use this bar to generate an export.
2. The second bar is used to define (or customize) the export. It allows you to Open/Save templates and manage (rename/delete) all saved templates in the FlowTest file.

Table Data Tab:



The ‘Table Data’ tab defines the CSV Table Header & Data sections.
Here you can select the FlowTest series that determine the exported columns and configure the (number and type) of the table header rows.

Export Header Tab:



The ‘Export’ header tab defines the CSV File Header section.
Her you control how many rows the header will be and the header contents.

Using the Export:

To get a feel of how the export works we will first provide a few examples and then drill down into greater detail in a reference section below.

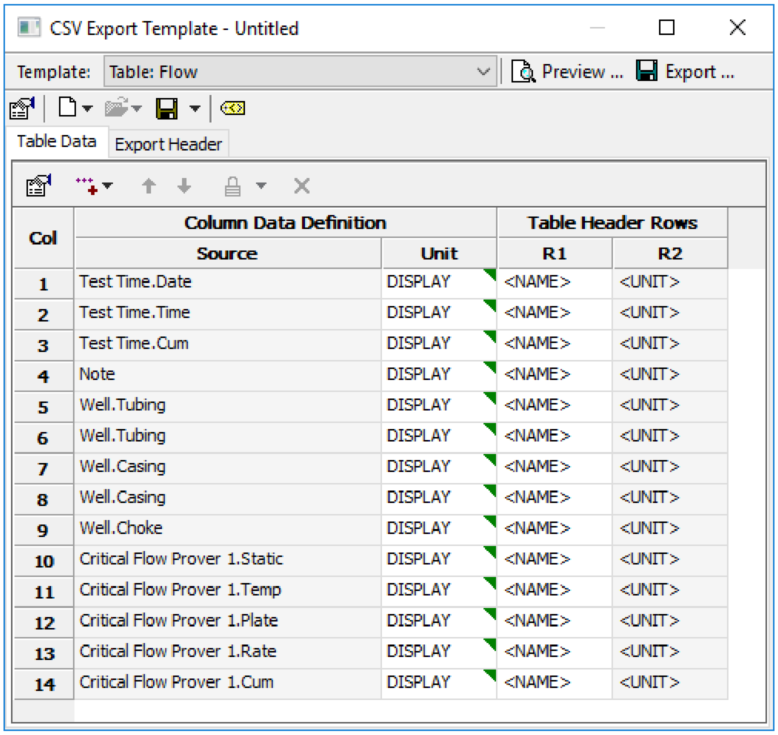
In its simplest form, the CSV template export can mirror the same functionality as the basic CSV table export.

To generate a CSV file for a FlowTest data table via the template export:

1. Open the export window.
2. In the top toolbar, select a FlowTest data table from the template dropdown.
3. Press either the ‘Preview…’ or ‘Export…’ buttons to generate the export.
4. Done!

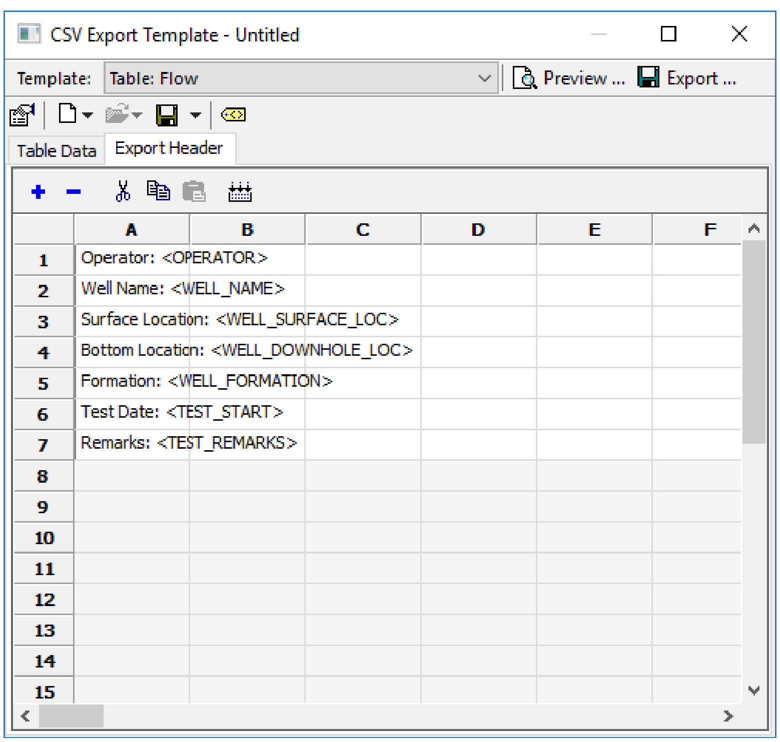
The CSV file generated basically mirrors that generated via the standard (table based) CSV export.

If we load an example file and select the table we see this:



Col	Column Data Definition		Table Header Rows	
	Source	Unit	R1	R2
1	Test Time.Date	DISPLAY	<NAME>	<UNIT>
2	Test Time.Time	DISPLAY	<NAME>	<UNIT>
3	Test Time.Cum	DISPLAY	<NAME>	<UNIT>
4	Note	DISPLAY	<NAME>	<UNIT>
5	Well.Tubing	DISPLAY	<NAME>	<UNIT>
6	Well.Tubing	DISPLAY	<NAME>	<UNIT>
7	Well.Casing	DISPLAY	<NAME>	<UNIT>
8	Well.Casing	DISPLAY	<NAME>	<UNIT>
9	Well.Choke	DISPLAY	<NAME>	<UNIT>
10	Critical Flow Prover 1.Static	DISPLAY	<NAME>	<UNIT>
11	Critical Flow Prover 1.Temp	DISPLAY	<NAME>	<UNIT>
12	Critical Flow Prover 1.Plate	DISPLAY	<NAME>	<UNIT>
13	Critical Flow Prover 1.Rate	DISPLAY	<NAME>	<UNIT>
14	Critical Flow Prover 1.Cum	DISPLAY	<NAME>	<UNIT>

The ‘Table Data Tab’ has been populated with the table series.
The table header contains 2 rows: 1) Series Name 2) Units



	A	B	C	D	E	F
1	Operator: <OPERATOR>					
2	Well Name: <WELL_NAME>					
3	Surface Location: <WELL_SURFACE_LOC>					
4	Bottom Location: <WELL_DOWNHOLE_LOC>					
5	Formation: <WELL_FORMATION>					
6	Test Date: <TEST_START>					
7	Remarks: <TEST_REMARKS>					
8						
9						
10						
11						
12						
13						
14						
15						

The ‘Export Header Tab’ contains the header items (as defined in the ‘User Preferences’ CSV header items.
Pressing the ‘Preview… ‘ button, displays…

CSV Export Viewer

Save CSV ... | Aa Fixed Font

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Operator: ABC Petroleum Co.													
2	Well Name: Generic Well/Lease													
3	Surface Location: 100/00-00-000-00W5/0													
4	Bottom Location:													
5	Formation: Lower Big Pool													
6	Test Date: Thu Mar 01 2007													
7	Remarks:													
8	Date	Time	Cum	Note	Tubing	Tubing	Casing	Casing	Choke	Static	Temp	Plate	Rate	Cum
9	dd/mm/yyyy	hh:mm:ss	Hrs.		kPaa	°C	kPaa	°C	mm	kPaa	°C	mm	$10^3m^3/d$	10^3m^3
10	01/03/2007	12:00:00	0.0000		90.0	15.00	96.3			90.0	10.35	0.00	0.00	0.00
11	01/03/2007	12:00:01	0.0003	Open well on 1/2 " (12.7 mm) prover plate								0.00		
12	01/03/2007	12:01:00	0.0167			15.00	90.0			90.0	10.35	0.00	0.00	0.00
13	01/03/2007	12:05:00	0.0833				4215.8			4215.8	4.02	12.70	102.62	0.14
14	01/03/2007	12:10:00	0.1667				3982.5			3982.5	4.02	12.70	96.53	0.49
15	01/03/2007	12:15:00	0.2500				4055.3			4055.3	4.12	12.70	98.39	0.83
16	01/03/2007	12:30:00	0.5000				4344.2			4344.2	3.92	12.70	106.04	1.89
17	01/03/2007	12:45:00	0.7500				3732.2			3732.2	4.02	12.70	90.04	2.91
18	01/03/2007	13:00:00	1.0000				3720.4			3720.4	4.23	12.70	89.69	3.85
19	01/03/2007	13:30:00	1.5000				1119.2			1119.2	4.12	12.70	25.80	5.05
20	01/03/2007	13:31:00	1.5167				1081.8			1081.8	4.12	12.70	24.92	5.07
21	01/03/2007	14:00:00	2.0000				802.5			802.5	4.12	12.70	18.40	5.51
22	01/03/2007	14:30:00	2.5000				605.6			605.6	3.81	12.70	13.85	5.84
23	01/03/2007	15:00:00	3.0000				482.6			482.6	4.12	12.70	11.01	6.10
24	01/03/2007	15:30:00	3.5000				244.0			244.0	3.92	12.70	5.55	6.27

More Advanced exports:

In the example above we created an export based on a data table in the FlowTest file. This export essentially mirrors the same functionality as the CSV Table Export. This is both good and bad:
<u>The good is: The export always reflects the configuration of the FlowTest data table.</u>
<u>The bad is: The export always reflects the configuration of the FlowTest data table.</u>

We will now illustrate the true power of template exports but should make clear an import distinction between the 'CSV Table Export' and the 'CSV Template Exports'

<u>TEMPLATE EXPORTS ARE NOT BASED ON A FLOWTEST DATA TABLE!</u>

Although you can load a FlowTest data table as an initial template definition (and is often a handy starting point), the true power come from the fact that you can then customize the template, save the result for subsequent exports.
As such two important distinctions arise:

1. A saved template may be snapshot of the data table at the time it was saved. However, if columns were added, removed or re-ordered in the data table these changes will not reflected when the template is opened!
2. Whereas opening a table, builds a template based on the current table configuration, and reflects the current data table state!

<u>ONCE AGAIN:</u>
<u>TEMPLATE EXPORTS ARE INDEPENDENT OF ANY FLOWTEST DATA TABLE!</u>
<u>AND AS A RESULT ARE IMMUNE TO CHANGES IN THE FLOWTEST DATA TABLES.</u>

Example case 1:

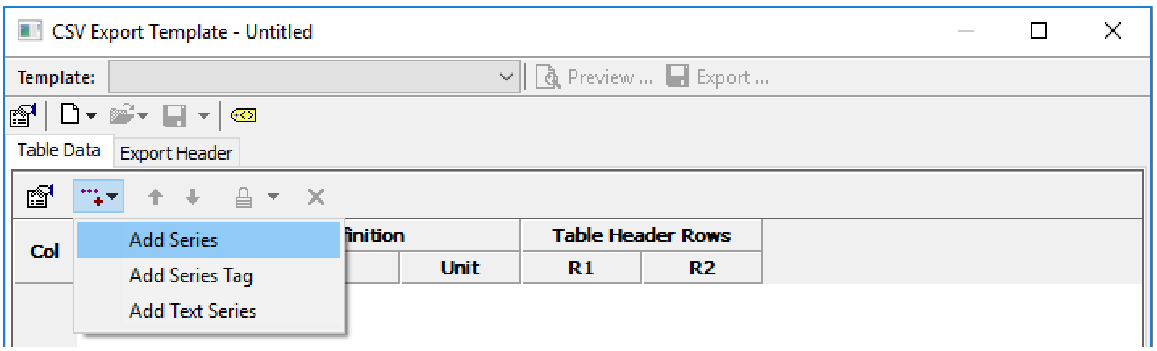
Create a CSV export that has the following table columns:

Date, Time, Comments, Tubing Pressure, Casing Pressure, and Gas Rate.

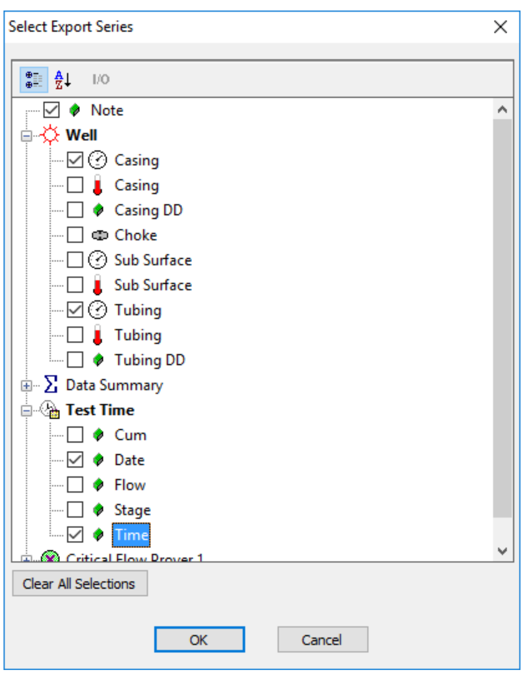
Where: Date is formatted as YYYY/MM/DD, Time is HH:MM:SS, Pressures are in psig and gas rate is MCF/D.

Note: If you have a Data table containing the required export columns you can load the table then remove and re-order the columns to match the export.

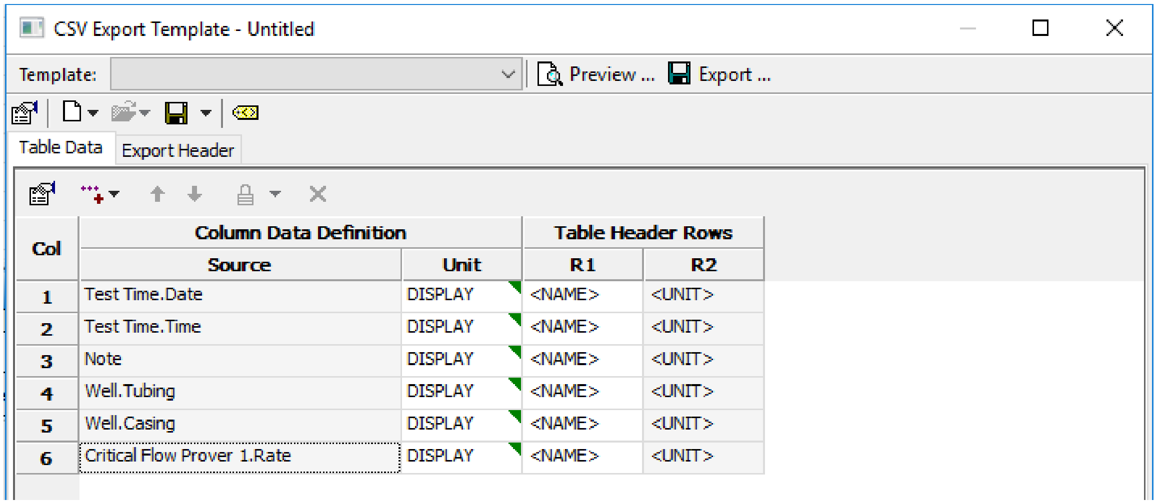
We will start with a blank template and add the columns in manually.



Use the 'Add Series' button to select the required series.



Select the series required, and press OK



Ensure that the series are in the correct order. To move series, first select the series(s) by clicking on the 'col' numbers then use the up/down arrow buttons to reposition.

At this point we have the 6 required export columns (positioned in the correct order).

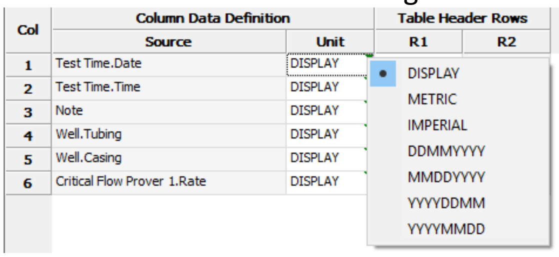
Next we need to ensure that the units are set to the export requirements.

Looking at the export window above we have 5 columns of information as follows:

1. Col — This is the column position in the export.
2. Source — This is the series that feeds the export column.
3. Unit — This defines the units that the series will export in.
4. R1 — This is the first header row in the export data table.
5. R2 — This is the second header row in the export data table.

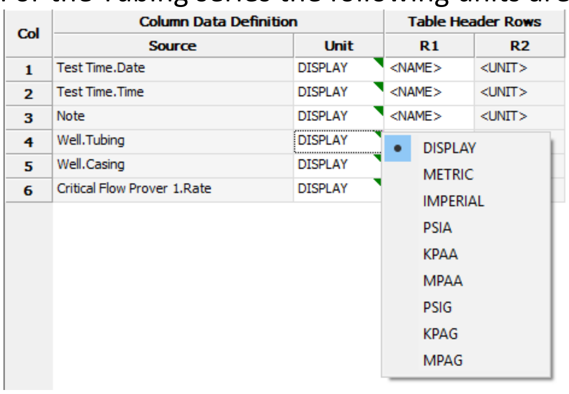
The Unit column defines the exported units for the series by default the export units are 'DISPLAY' clicking on the green corner arrow in the cell displays a list of available units for the respective series. (All series contain the definitions of: DISPLAY METRIC and IMPERIAL where DISPLAY is the currently displayed unit, METRIC is the default metric units and IMPERIAL is the default imperial unit).

For the date series the following units are available:



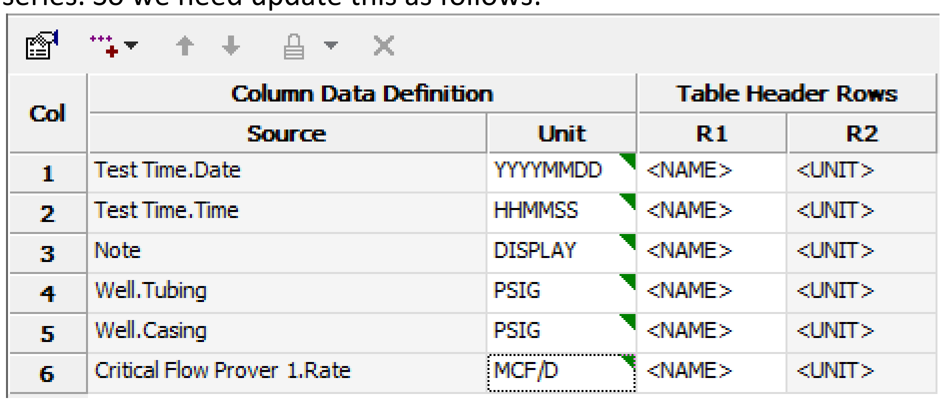
Col	Column Data Definition		Table Header Rows	
	Source	Unit	R1	R2
1	Test Time.Date	DISPLAY		
2	Test Time.Time	DISPLAY		
3	Note	DISPLAY		
4	Well.Tubing	DISPLAY		
5	Well.Casing	DISPLAY		
6	Critical Flow Prover 1.Rate	DISPLAY		

For the Tubing series the following units are available:



Col	Column Data Definition		Table Header Rows	
	Source	Unit	R1	R2
1	Test Time.Date	DISPLAY	<NAME>	<UNIT>
2	Test Time.Time	DISPLAY	<NAME>	<UNIT>
3	Note	DISPLAY	<NAME>	<UNIT>
4	Well.Tubing	DISPLAY		
5	Well.Casing	DISPLAY		
6	Critical Flow Prover 1.Rate	DISPLAY		

So basically we do not want the Units to be 'DISPLAY' as they will change as the user changes units for any series. So we need update this as follows:



Col	Column Data Definition		Table Header Rows	
	Source	Unit	R1	R2
1	Test Time.Date	YYYYMMDD	<NAME>	<UNIT>
2	Test Time.Time	HHMMSS	<NAME>	<UNIT>
3	Note	DISPLAY	<NAME>	<UNIT>
4	Well.Tubing	PSIG	<NAME>	<UNIT>
5	Well.Casing	PSIG	<NAME>	<UNIT>
6	Critical Flow Prover 1.Rate	MCF/D	<NAME>	<UNIT>

The R1 and R2 columns specify the data table header rows in the export.

By default the two header rows are created where the first row (R1) is the series name and the second (R2) is the units. (the number and type of header rows can be configured in the 'Table Data' properties window)

For the R1, R2 columns the following tags are available:

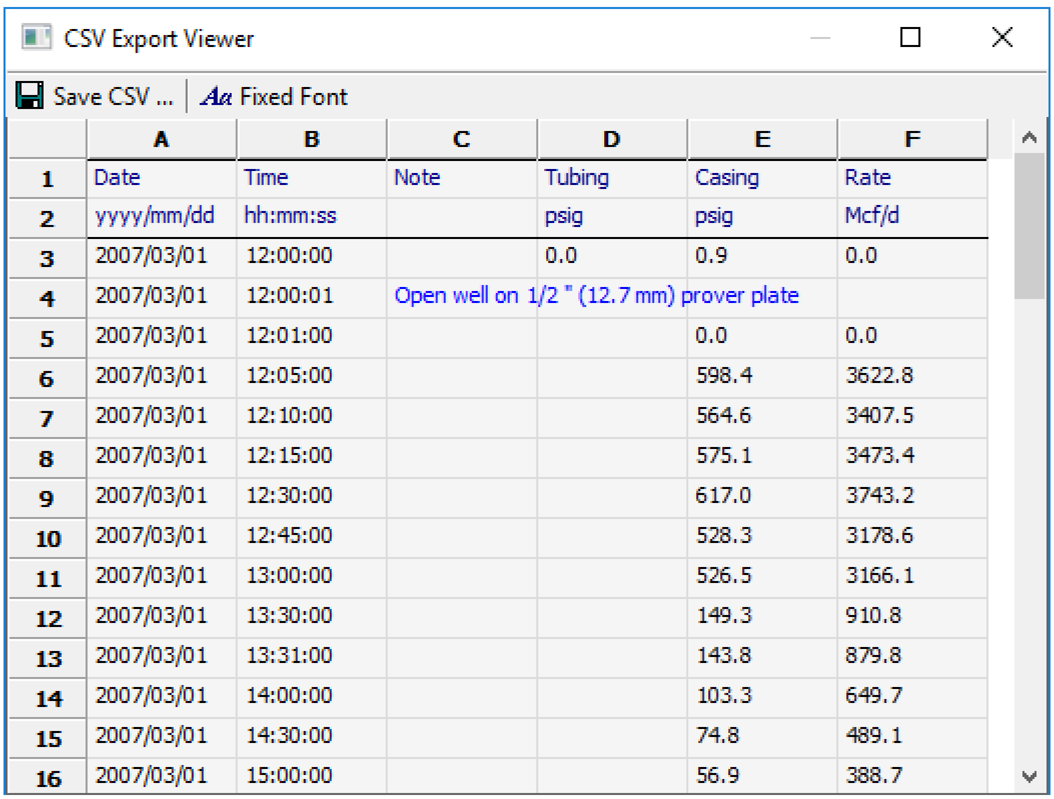
The <NAME> tag pulls in the series name for the export.

The <UNIT> tag pulls in the series unit text (as specified by the 'Unit' column).

Note: The <NAME> tag pulls in the current series name which can change if the user changes it. If you require a fixed name for the export you can simply type it in.
Additionally the <UNIT> tag uses the default FlowTest unit names i.e. psig or kPag if you require a different representation the unit name can be overridden by not using the <UNIT> tag.

For this example we will leave the R1 and R2 tags as is.

At this point we can preview the export as follows:

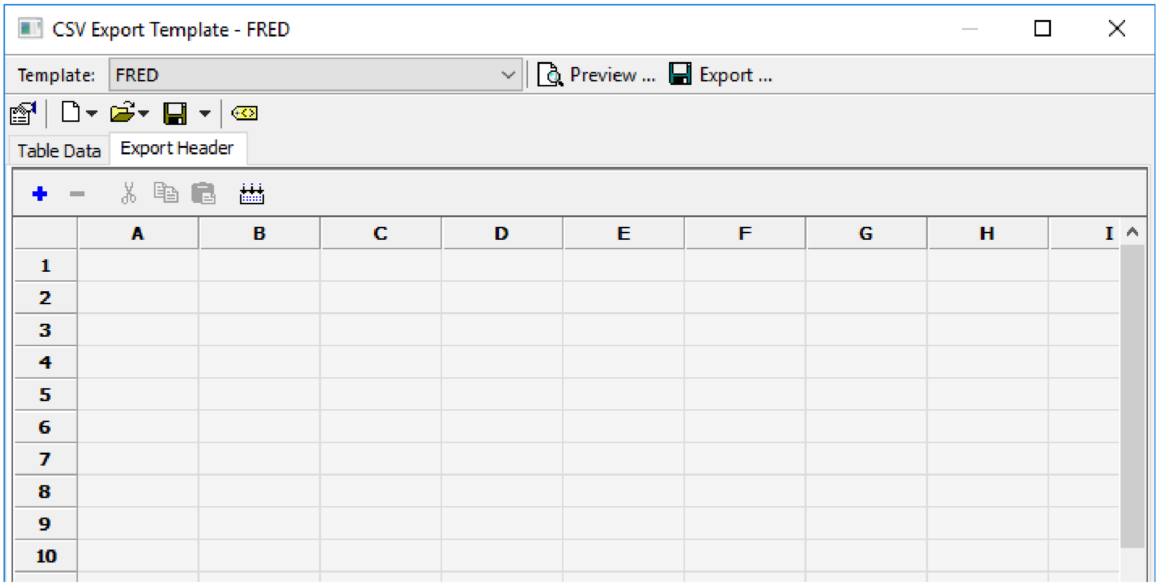


	A	B	C	D	E	F
1	Date	Time	Note	Tubing	Casing	Rate
2	yyyy/mm/dd	hh:mm:ss		psig	psig	Mcf/d
3	2007/03/01	12:00:00		0.0	0.9	0.0
4	2007/03/01	12:00:01	Open well on 1/2 " (12.7 mm) prover plate			
5	2007/03/01	12:01:00			0.0	0.0
6	2007/03/01	12:05:00			598.4	3622.8
7	2007/03/01	12:10:00			564.6	3407.5
8	2007/03/01	12:15:00			575.1	3473.4
9	2007/03/01	12:30:00			617.0	3743.2
10	2007/03/01	12:45:00			528.3	3178.6
11	2007/03/01	13:00:00			526.5	3166.1
12	2007/03/01	13:30:00			149.3	910.8
13	2007/03/01	13:31:00			143.8	879.8
14	2007/03/01	14:00:00			103.3	649.7
15	2007/03/01	14:30:00			74.8	489.1
16	2007/03/01	15:00:00			56.9	388.7

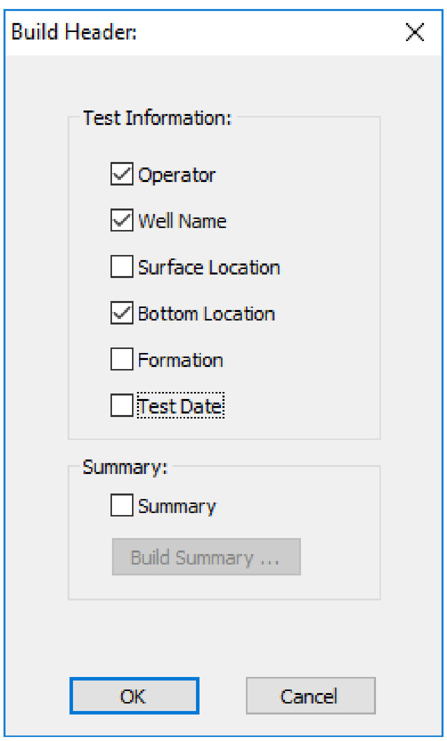
So even though the FlowTest data table maybe showing the data in metric units the export converts the data as required.

The export looks good, but is missing a file header.

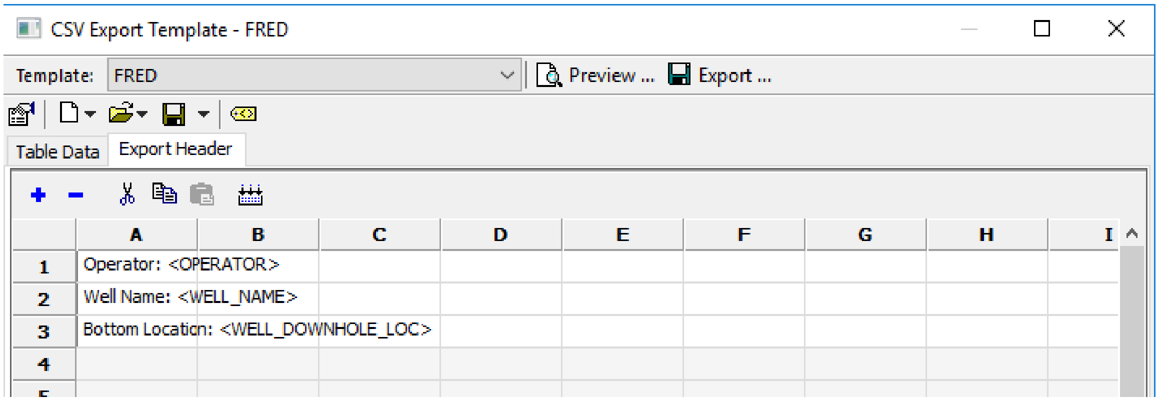
Add a file header by switching to the 'Export Header' tab.



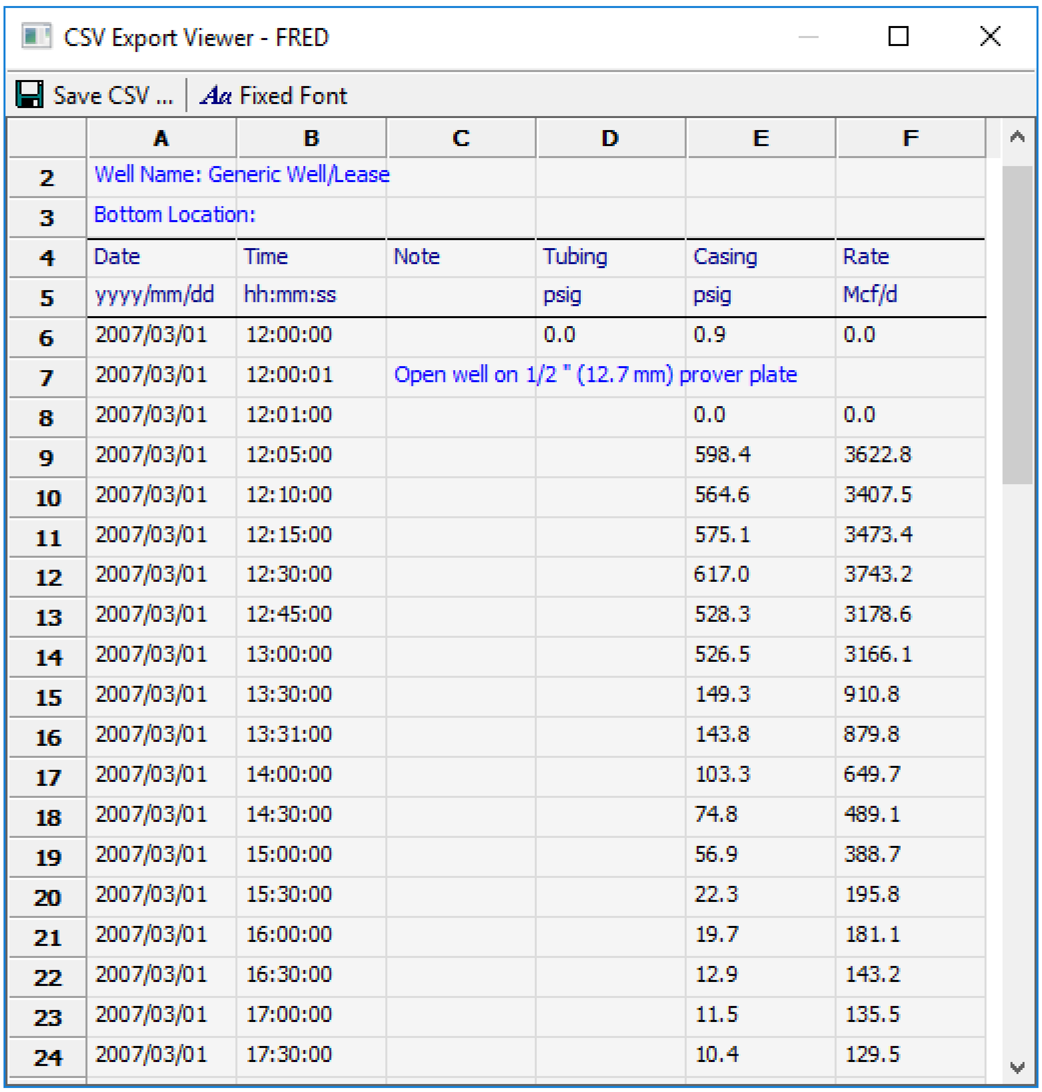
We can build a simple header quickly by using the 'Build Custom Header' toolbar button
And selecting the items we want. 



Select 'OK'



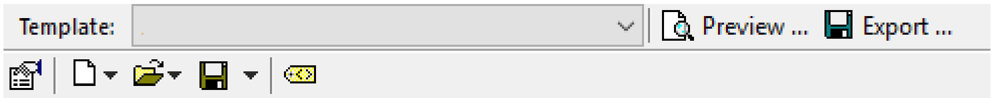
Header with added items.



	A	B	C	D	E	F
2	Well Name: Generic Well/Lease					
3	Bottom Location:					
4	Date	Time	Note	Tubing	Casing	Rate
5	yyyy/mm/dd	hh:mm:ss		psig	psig	Mcf/d
6	2007/03/01	12:00:00		0.0	0.9	0.0
7	2007/03/01	12:00:01	Open well on 1/2 " (12.7 mm) prover plate			
8	2007/03/01	12:01:00			0.0	0.0
9	2007/03/01	12:05:00			598.4	3622.8
10	2007/03/01	12:10:00			564.6	3407.5
11	2007/03/01	12:15:00			575.1	3473.4
12	2007/03/01	12:30:00			617.0	3743.2
13	2007/03/01	12:45:00			528.3	3178.6
14	2007/03/01	13:00:00			526.5	3166.1
15	2007/03/01	13:30:00			149.3	910.8
16	2007/03/01	13:31:00			143.8	879.8
17	2007/03/01	14:00:00			103.3	649.7
18	2007/03/01	14:30:00			74.8	489.1
19	2007/03/01	15:00:00			56.9	388.7
20	2007/03/01	15:30:00			22.3	195.8
21	2007/03/01	16:00:00			19.7	181.1
22	2007/03/01	16:30:00			12.9	143.2
23	2007/03/01	17:00:00			11.5	135.5
24	2007/03/01	17:30:00			10.4	129.5

Preview with added header.

Once we have the custom export working. We should save it as a template so it can be loaded at a later time.



To save, use the save button on the main toolbar and give it a name in the save window.

The named template will now be available in the Template dropdown.

Example case 2:

Here we will modify the 'Example case 1' with the following additions:

1. Add a 3rd header row with a data type description of Date, Time, String and Number
2. Add a well UWI as the first data column.

Step 1, load the template and add the extra header row by using the properties button on the 'Table Data' toolbar. 

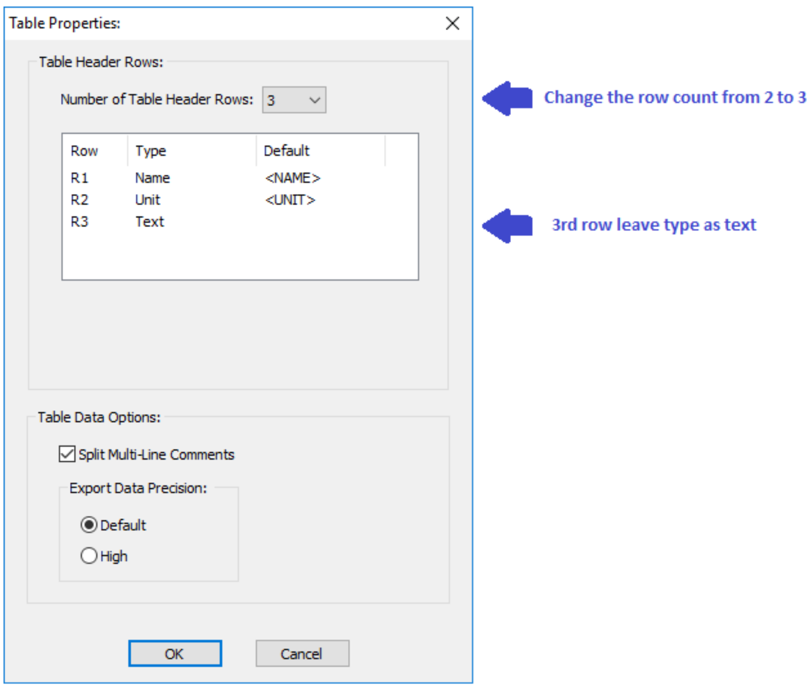
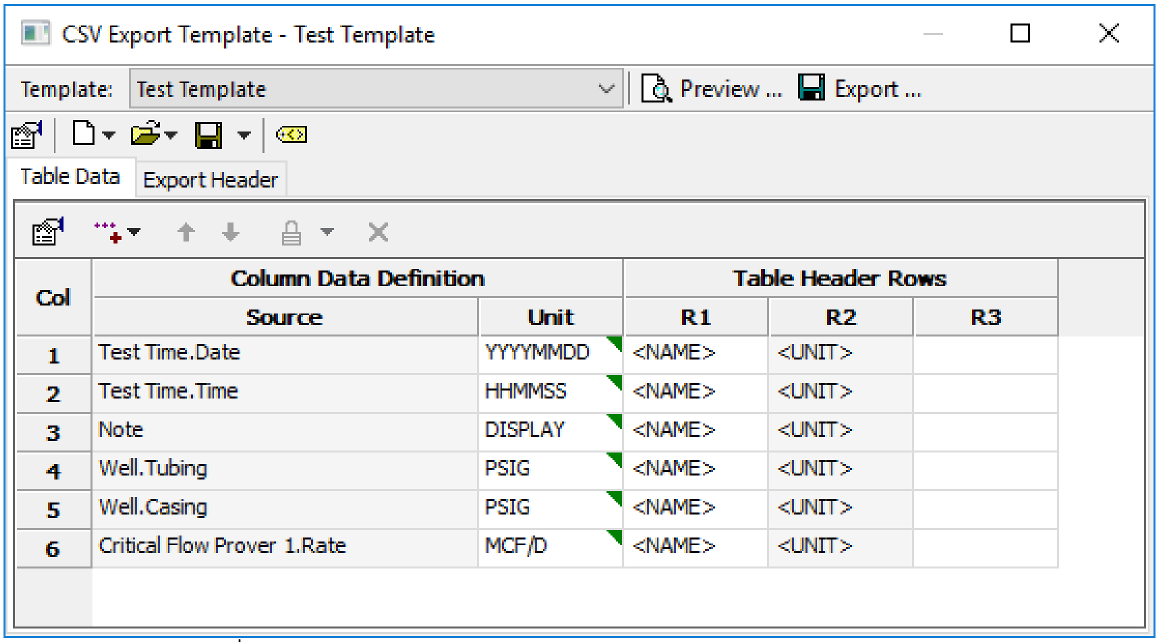


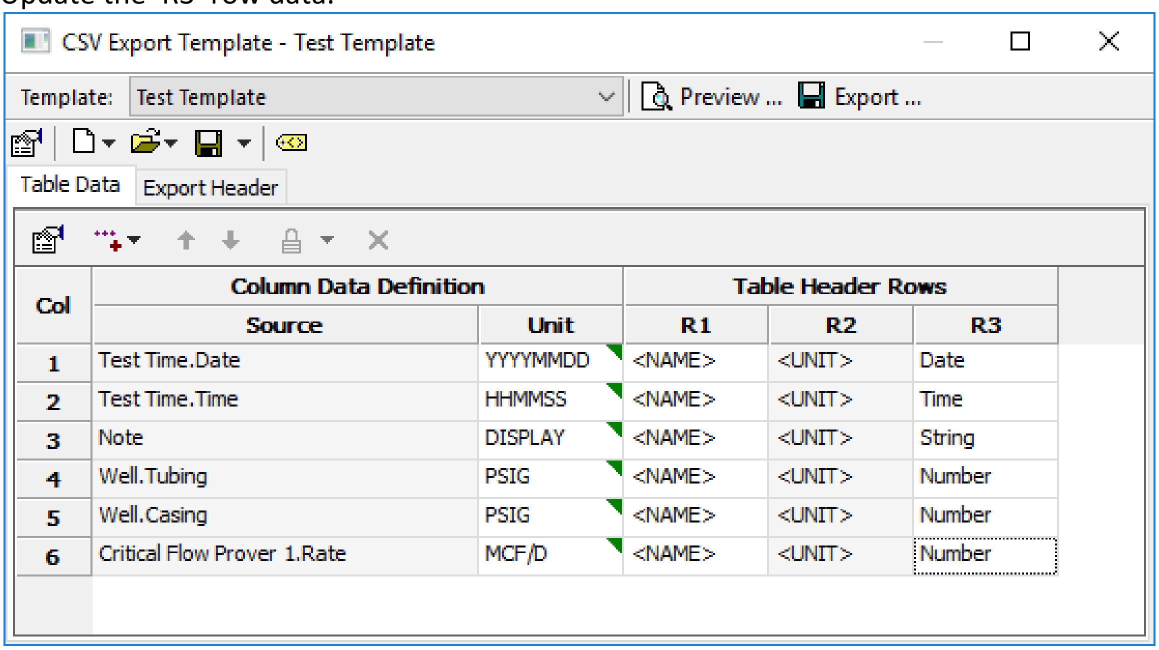
Table Properties window

In the 'Table Properties' window, change the row count to 3 and select OK.

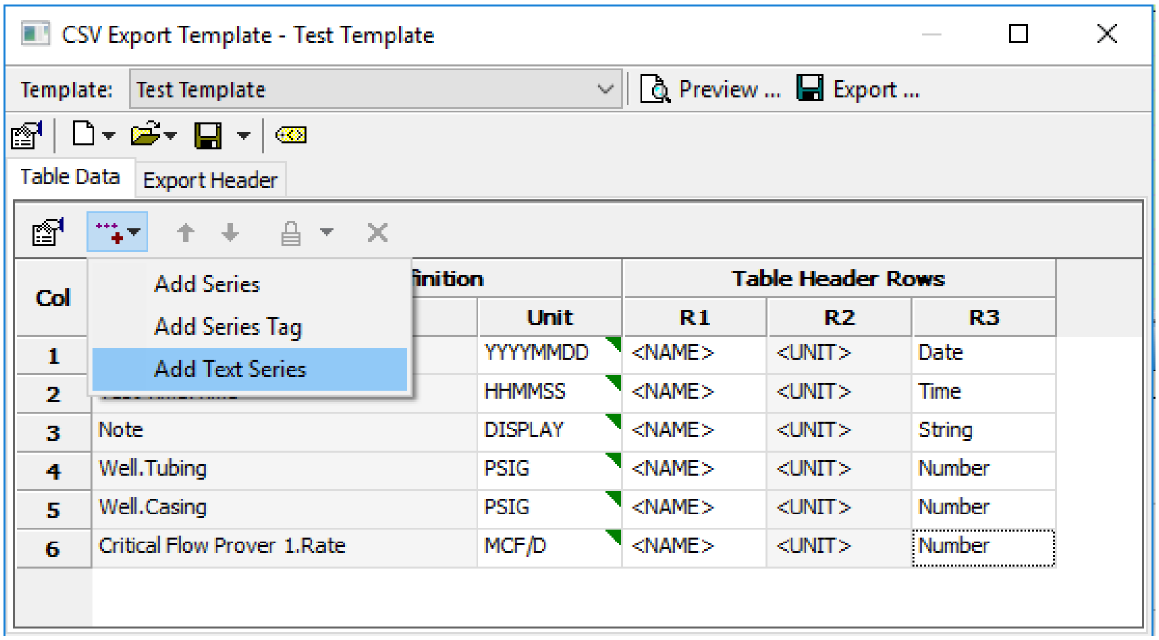


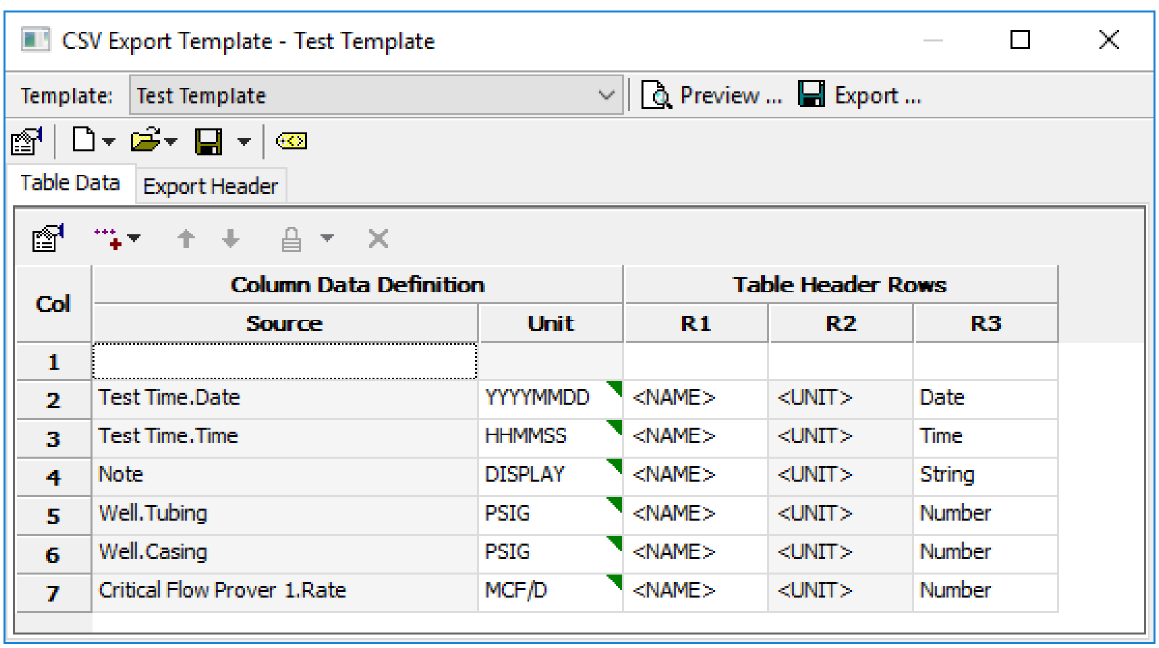
We now have a 3rd header row 'R3'

Update the 'R3' row data.



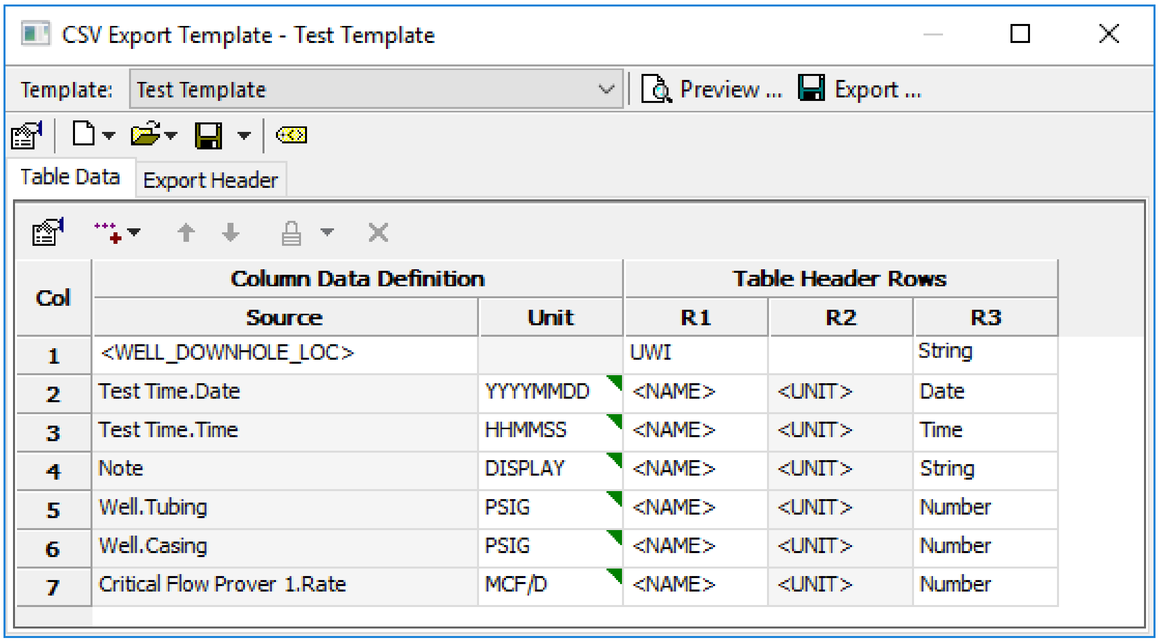
Add the UWI column:
The UWI is not available as a series in FlowTest however it is available via. a smart-tag from the ‘Test Information’ window. So in order to add it as a data column we need to add it as a ‘Text’ series in the export table (using the ‘Add Series’ button).





Add Text series and move to the front

For the ‘Source’ specify the smart-tag for the well bottom location.
Units are not specified
R1 is “UWI”
R2 we will leave empty
R3 is “String”



Col	Column Data Definition		Table Header Rows		
	Source	Unit	R1	R2	R3
1	<WELL_DOWNHOLE_LOC>		UWI		String
2	Test Time.Date	YYYYMMDD	<NAME>	<UNIT>	Date
3	Test Time.Time	HHMMSS	<NAME>	<UNIT>	Time
4	Note	DISPLAY	<NAME>	<UNIT>	String
5	Well.Tubing	PSIG	<NAME>	<UNIT>	Number
6	Well.Casing	PSIG	<NAME>	<UNIT>	Number
7	Critical Flow Prover 1.Rate	MCF/D	<NAME>	<UNIT>	Number

Save and Preview

CSV Export Viewer - Test Template

Save CSV ... | Fixed Font

	A	B	C	D	E	F	G
1	Operator: ABC Petroleum Co.						
2	Well Name: Generic Well/Lease						
3	Bottom Location: 100/00-00-000-00W5/0						
4	UWI	Date	Time	Note	Tubing	Casing	Rate
5		yyyy/mm/dd	hh:mm:ss		psig	psig	Mcf/d
6	String	Date	Time	String	Number	Number	Number
7	100/00-00-000	2007/03/01	12:00:00		0.0	0.9	0.0
8	100/00-00-000	2007/03/01	12:00:01	Open well on 1/2 " (12.7 mm) prover plate			
9	100/00-00-000	2007/03/01	12:01:00			0.0	0.0
10	100/00-00-000	2007/03/01	12:05:00			598.4	3622.8
11	100/00-00-000	2007/03/01	12:10:00			564.6	3407.5
12	100/00-00-000	2007/03/01	12:15:00			575.1	3473.4
13	100/00-00-000	2007/03/01	12:30:00			617.0	3743.2
14	100/00-00-000	2007/03/01	12:45:00			528.3	3178.6
15	100/00-00-000	2007/03/01	13:00:00			526.5	3166.1
16	100/00-00-000	2007/03/01	13:30:00			149.3	910.8
17	100/00-00-000	2007/03/01	13:31:00			143.8	879.8
18	100/00-00-000	2007/03/01	14:00:00			103.3	649.7
19	100/00-00-000	2007/03/01	14:30:00			74.8	489.1
20	100/00-00-000	2007/03/01	15:00:00			56.9	388.7

Export 'Text' series are a useful for adding non-series data to the export they can be anything including any FlowTest smart-tag moniker. As another example; if you wanted a single date-time column you could define it using a 'Text' series with a formatted smart-tag: ***<DATETIME{'%A %B %#d %Y %#I:%M:%S %p'}>*** *resulting in a date-time column with data in the format: Friday March 2 2017 1:32:00 PM.*

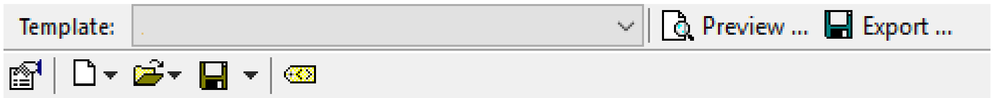
ISO 8601 Date and Time Format

Additionally, when importing the resulting CSV file into a spreadsheet, an ISO 8601 format is often used to disambiguate the "date-part" formatting as follows: ***<DATETIME{'%Y-%m-%dT%H:%M:%S'}>*** *resulting in a date-time data in the ISO 8601 format: 2017-03-02T13:32:00.*

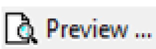
For a full description of the date time format options see:
Smart Tag Format specifiers for <DATETIME{'…'}> tag in Appendix B

CSV Template Export Reference

Main Toolbar buttons:



The Template drop list displays all saved templates and FlowTest Tables. Selecting an item will load the template or (if a FlowTest data table) create a template definition based on the selected table.



Opens the CSV preview window displaying the generated CSV file

Generates and saves the CSV file.

Displays the general properties window. The General properties window allows you to manage the saved templates (rename/delete).

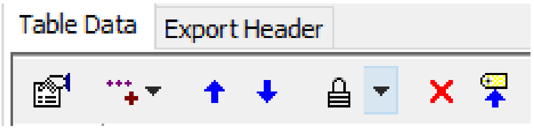
The New Template button clears the current template. Via the drop arrow options are available to create a new template bases on a FlowTest table.

The Open Template button displays a list of saved templates to be loaded.

The Save Template button saved the current template definition. Save-As functionality is available via the drop arrow.

The Smart-Tag reference button displays the Smart-Tag reference window.

Table Data Toolbar buttons:



Displays the Table Data properties window. The Table Data properties window allows you to specify the number (and type) of table header rows and other table export properties.

The Add Series button adds a new export column as either a FlowTest series or a Text series.

The Move Up button moves the selected series up one row.

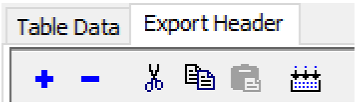
The Move Down button moves the selected series down one row.

The lock columns button locks the selected columns such that their position cannot be changed or properties edited. Unlock functionality is available via the drop arrow.

The Delete columns button removes the selected columns.

Convert FlowTest series types to ‘Tag name’ references. Converts all export series to be referenced by their user tag names. This makes the CSV export definition usable in different FlowTest files.

Table Header Toolbar Buttons:



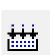

The Add Row button adds a row to the export header.

The Remove Row button removes the last row from the export header.


Cut the selection


Copy the selection

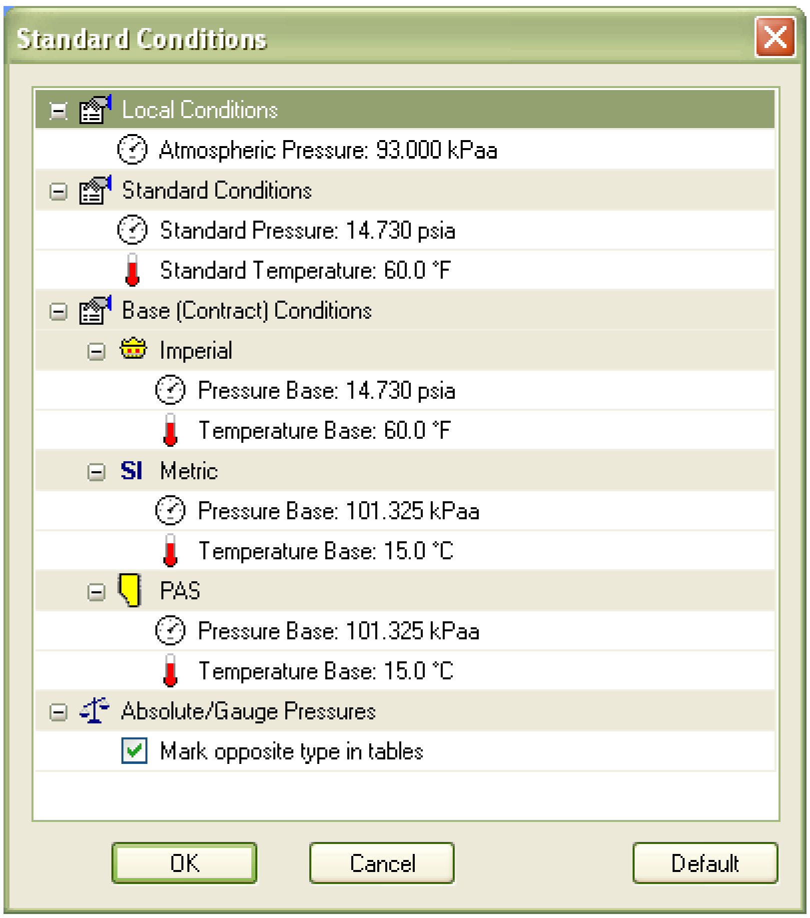

Past the selection


The Build Custom Header button opens a window to quickly build a customized header.
Options include ‘Test Information’ Smart-Tags and ‘Data Summary’ report options.

Standard Conditions Dialog

The Standard Conditions Dialog displays the base conditions that gas rates and volumes are referenced to as well as the local atmospheric pressure for the test.

Standard Conditions is accessed via the Preferences button on the main toolbar.



- Atmospheric Pressure is the local atmospheric pressure for the test. It is used when converting gauge pressures to absolute pressures (and vise versa).
- Standard Conditions are fixed (non editable values) representing the standards the meter calculations are rigorously calculated to.
- Base (Contract Conditions) represent base conditions for each of the Unit modes (Metric and Imperial) as well as the base conditions for PAS submissions.
  PAS base conditions are fixed at 101.325 kPa absolute and 15.0 °C and cannot be changed.

The current unit mode is set via the Units button on the main toolbar.


Metric and Imperial bases can be changed but PAS base conditions are fixed (non Editable)

Rates and Volumes are converted from standard to base conditions via the following formula:

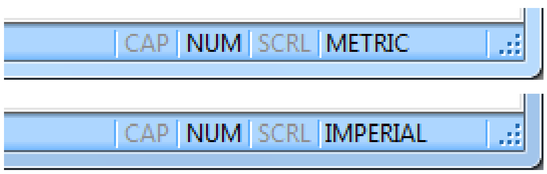
Vb = Vs(Ps/Pb)(Tb/Ts)(Zs/Zb) where Zb = Zs = 1 (non rigorous calculation excludes Z, assuming ideal gas behavior, in the conversion)

- Absolute/Gauge Pressures ‘Mark opposite type in tables’ will give an indication that the displayed unit type (either absolute or gauge) differs from the type set when the data was originally entered, by coloring the respective values green. *See section titled “Absolute / Gauge Conversions” for more information.*

Units (Metric/Imperial)

FlowTest provides a rich set of units for entry and display of the test data. Units are categorized into two working modes (Metric and Imperial) providing the appropriate oilfield units.
The current unit mode is set via the Units button on the main toolbar. Pressing the unit button effectively toggles between the metric and imperial modes.

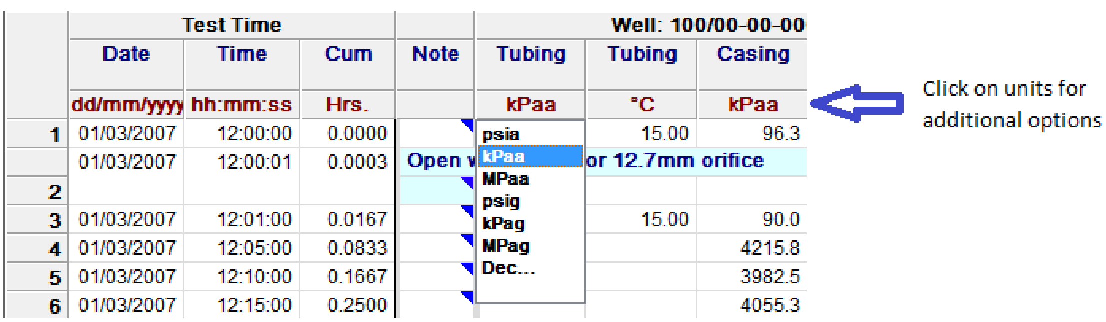
The active unit mode is displayed in the status bar at the bottom of the program window.



Status bar displays active unit mode

The metric and imperial unit modes have independent pressure and temperature bases for reporting standard gas rates and cums (see: Standard Conditions Dialog).

In addition to the metric and imperial modes the units for any column in the data table can be further customized to override the default units.



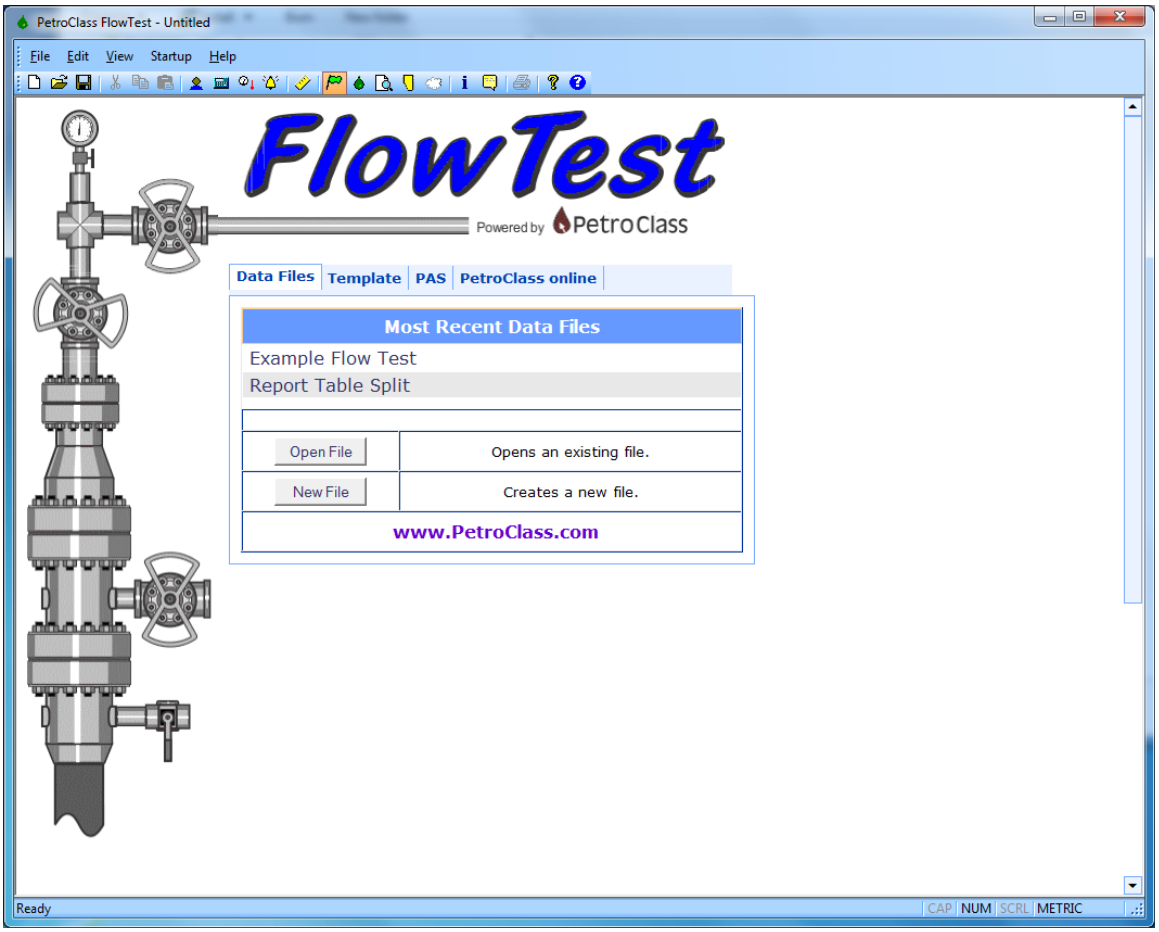
For more information see: 'Change Units' in the 'Data Entry' data table section.

The default unit mode (for new files) can be set in the User Preferences window, see: User Preferences and Defaults section.

Start-Up View

The start-up view is displayed is the initial view displayed when FlowTest is started. The Start-up view provides a convenient means of opening recent files and templates.

The Start-up view can be accessed at any time through the “Start Page” button on the main toolbar.



Data File Templates

Data file templates are a convenient means of defining default UI and meter configurations for various test types. Any file can be saved as a template by selecting “Save Template …” from the File menu. A Template contains only UI and meter configuration any specific data is removed from the template. A dialog displaying the current templates is displayed whenever an “new" file is created.

Backup File Recovery

FlowTest will create backups of the currently edited file at 15 minute intervals. Six such backups are maintained and overwritten in a round-robin fashion.

To view or recover a backup file, select the “Backup File Recovery..” option from the “File” menu.

Absolute / Gauge Conversions

FlowTest treats absolute and gauge pressure readings as distinct types where:

Absolute pressure = Gauge pressure + Atmospheric pressure
Gauge pressure = Absolute pressure - Atmospheric pressure

In order to maintain Data integrity, FlowTest stores an absolute/gauge indicator with each reading.

In addition, the Atmospheric pressure is defined (in FlowTest) to be constant throughout the test.

Meter calculations require a static pressure in absolute readings. If the static meter pressure inputs contain gauge pressures they are converted to absolute pressure for the meter calculation. If the (Global) Atmospheric pressure is changed, meters with gauge static pressure inputs will be forced to recalculate whereas meters with static inputs defined as absolute pressure need not recalculate. Series can contain both absolute and gauge types, and, the type can be changed on the fly. If a series contains a mixture of absolute and gauge readings, those reading that are not of the selected unit type are displayed in "green". To illustrate this, consider the following series of actions (as demonstrated below):

Tubing	Tubing	Tubing	Tubing	Tubing	Tubing
psia	psig	psig	psia	psia	psig
500.0	487.0	500.0	513.0	514.0	500.0
1000.0	987.0	1000.0	1013.0	1014.0	1000.0
1000.0	987.0	1000.0	1013.0	1014.0	1000.0
1200.0	1187.0	1187.0	1200.0	1200.0	1186.0
1200.0	1187.0	1187.0	1200.0	1200.0	1186.0
1300.0	1287.0	1287.0	1300.0	1300.0	1286.0
1350.0	1337.0	1337.0	1350.0	1350.0	1336.0
2502.0	2489.0	2489.0	2502.0	2502.0	2488.0
2205.0	2192.0	2192.0	2205.0	2205.0	2191.0
2400.0	2387.0	2387.0	2400.0	2400.0	2386.0
2300.0	2287.0	2287.0	2300.0	2300.0	2286.0
2560.0	2547.0	2547.0	2560.0	2560.0	2546.0

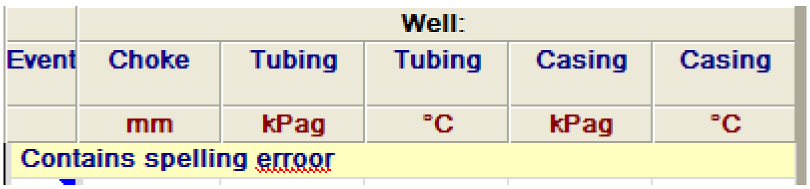
- In the first diagram all readings were entered in absolute mode and are all displayed in black.
- The second diagram shows the readings as "green" after the units are changed to gauge mode (indicating the readings are actually entered as absolute).
- In the third diagram the first three readings are modified (while in gauge mode) changing the first three reading to gauge, but leaving the remaining readings as absolute.
- In the fourth column the units are changed back to absolute.
- The fifth and sixth columns display the result of changing the global atmospheric pressure form 13.0 psia to 14.0 psia, for both absolute and gauge units.

Although *it would be highly unusual for a single series to contain a mixture of reading types, FlowTest always preserves the data as entered, and provides an obvious visual indication. At the very least it is an indicator that something unusual has happened.*

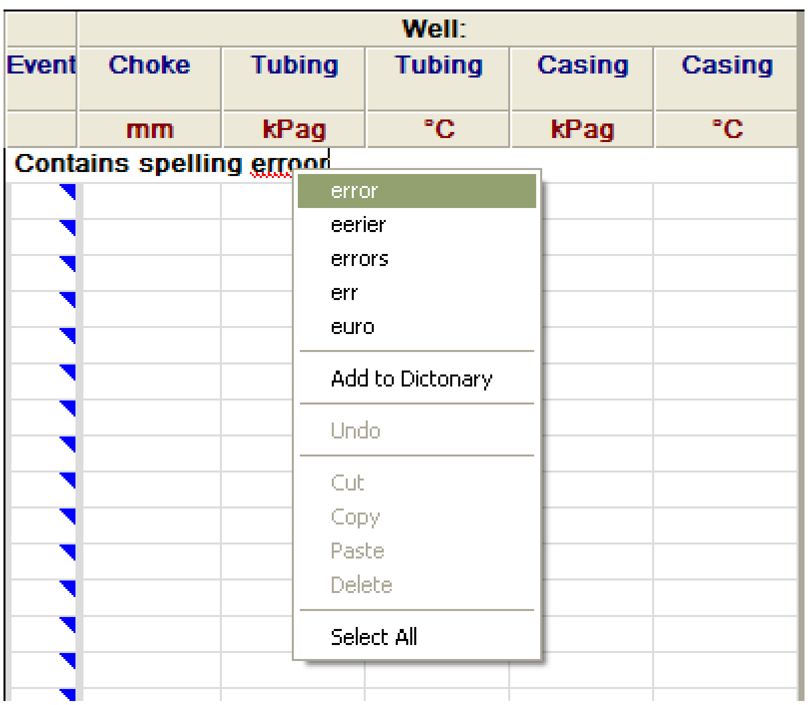
Spell Checker

The spell checker module is a separate installer package called ‘PetroWordSetup’ and is available on the FlowTest download page. In order to get the spell check functionality described below, this package must be installed in addition to the FlowTest upgrade. (The order of the install is not important i.e. you can install the FlowTest upgrade first, then run PetroWordSetup or vice versa. just restart FlowTest after both packages have been installed.

Spell checker additions:



Comment with spelling error.



To correct the error:

- Double click the comment (to enter the edit mode)
- Right click the word in error
- From the context menu select one of the suggested replacement words or ‘Add to Dictionary’.

- *Spelling errors are displayed throughout the table but can only be corrected when the individual comment is in edit mode (double click comment to enter edit mode).*
- *The red squiggly lines under error words will not print on the reports.*

The spell checker can be turned on or off via. the ‘Spell Check’ toolbar button.

The spell checker contains a custom petroleum terms dictionary along with Alberta formation names and places. If you find any words that you think should be in the base dictionary, please send them to me and I will add them to future revisions.

APPENDIX A: Custom Excel Exports

There is often a requirement to export data in predefined fixed format in order to either be imported into a database or for use by other applications.

FlowTest can generate custom tailored Excel data files through the use of user defined Excel templates. Custom Excel templates offer several advantages over the standard Excel, or CSV, export modes including:

- The ability to format data (headers, columns …) as a fixed format irrespective of any table layouts within the FlowTest data file.
- The ability to specify unit types and precision within the template regardless of the configuration within the FlowTest data file (at the time of the export).
- Include value-added calculations within Excel.
- Automatically create charts and graphs from the exported data.
- Custom CSV export files can be created by simply saving the generated Excel sheet as type CSV.

Excel export templates for the examples below can be found in the 'Examples' folder of in the Excel export dialog box.

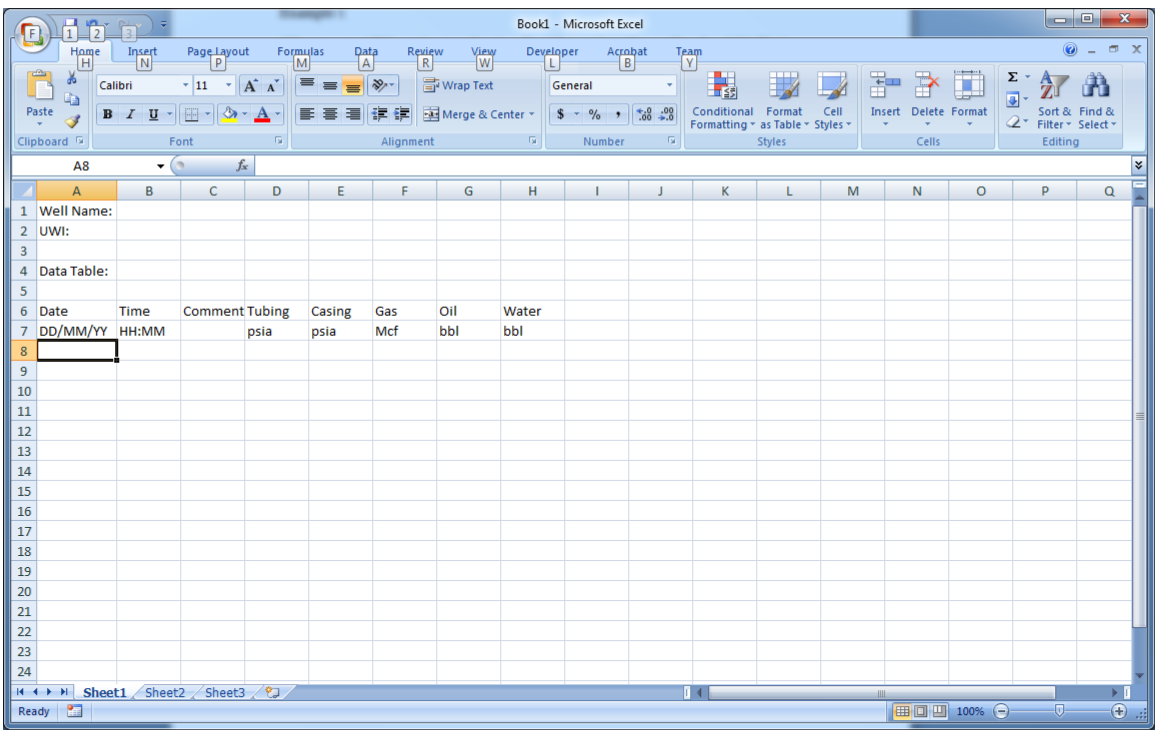
Example 1

Oil company ABC requires test data in a fixed format (as either an Excel or CSV file) in order to be imported into a company database. The format required is as follows:

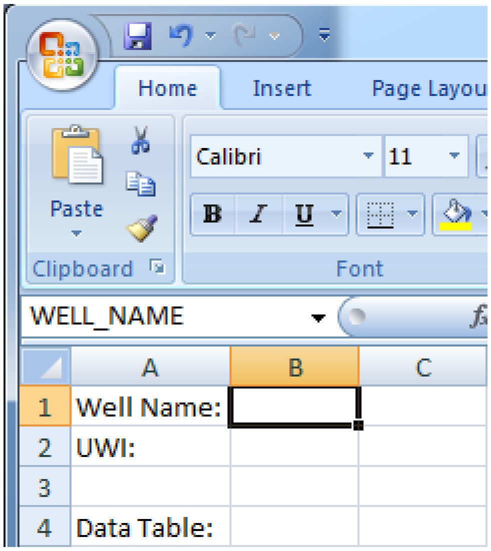
Well Name:		*Name of Well*					
UWI:		*UWI of Well*					
Data Table:							
Date	Time	Comment	Tubing	Casing	Gas	Oil	Water
DD/MM/YY	HH:MM		psia	psia	Mcf	bbl	bbl
Data	*Data*	*Data*	*Data*	*Data*	*Data*	*Data*	*Data*
Data…	*Data…*	*Data…*	*Data…*	*Data…*	*Data…*	*Data…*	*Data…*

The item names in black specify the fixed format required with the blue items being actual data.

Step 1 Create a new Excel work book and enter in the fixed format items.



Step 2 Define the data items.
Template data items are defined using Excel 'Named Ranges' as shown below. The named ranges (or named cells) allow FlowTest to link the cells to actual test data. The actual name can be any valid Excel name.



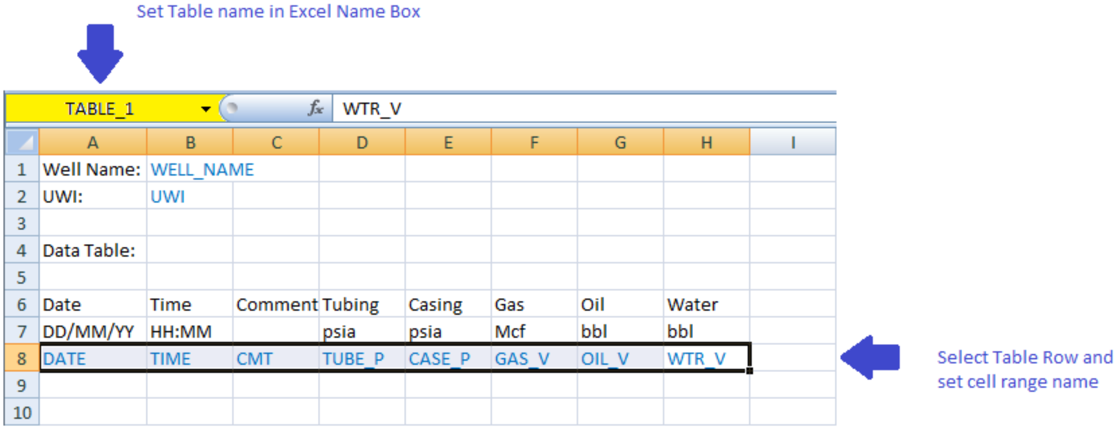
Name Data cells B1 as WELL_NAME

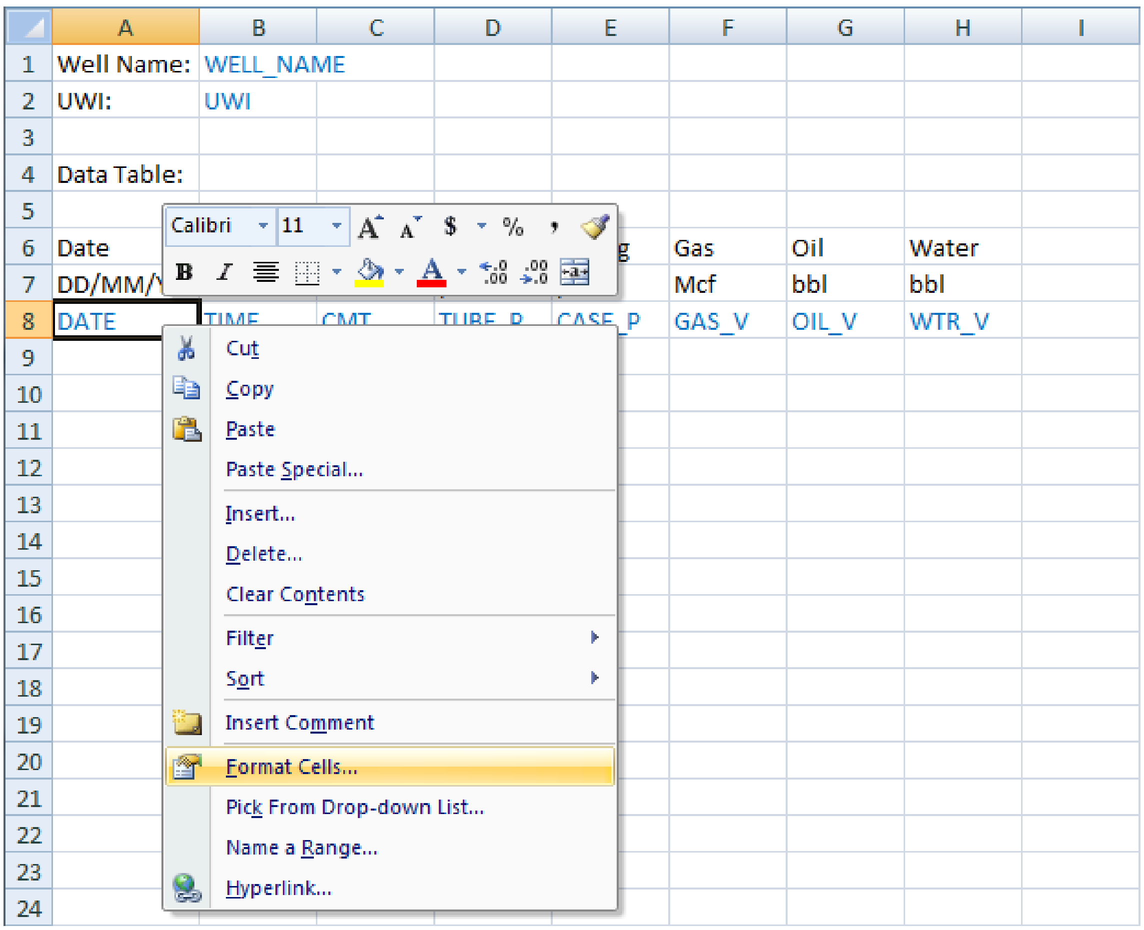
	A	B	C	D	E	F	G	H
1	Well Name:	WELL_NAME						
2	UWI:	UWI						
3								
4	Data Table:							
5								
6	Date	Time	Comment	Tubing	Casing	Gas	Oil	Water
7	DD/MM/YY	HH:MM		psia	psia	Mcf	bbl	bbl
8	DATE	TIME	CMT	TUBE_P	CASE_P	GAS_V	OIL_V	WTR_V
9								

Excel names indicated in blue.

The names in blue on the Excel work sheet are for illustration only; the important thing here is that each cell name is set via the Excel name box.

Step 3 Name and format the table data.
Select the entire data row (from DATE to WTR_V) and assign the name TABLE_1 via the Excel name box.



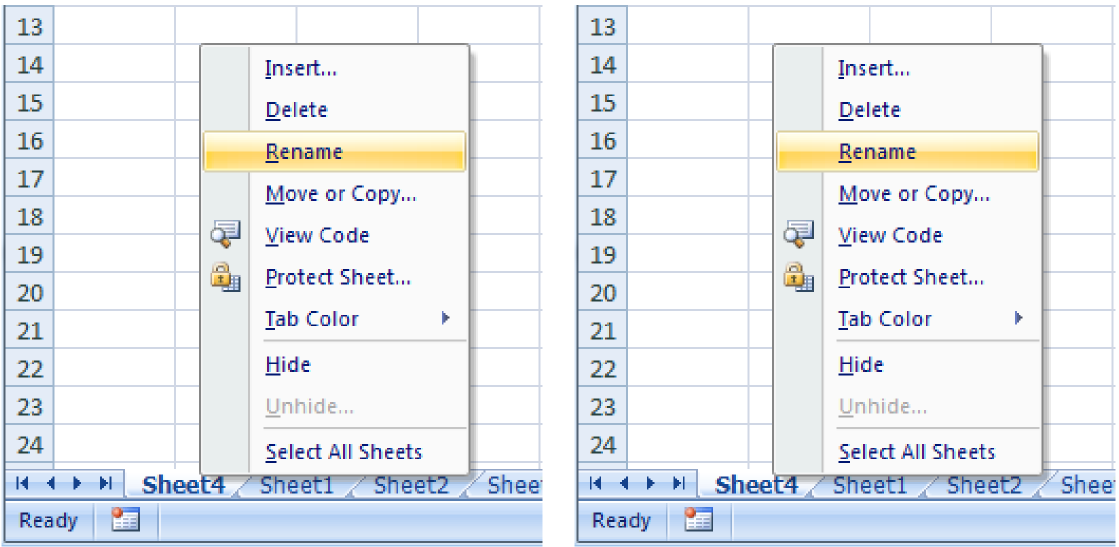


Format Data Cells

Set the Date, Time and data column format as required.

At this point we have defined the basic structure for the data template. Now we need to link the Excel names to FlowTest this is done by creating a special sheet in Excel called ‘FlowTest Manifest’.

Step 4 Create the Manifest
Insert a new sheet into the Excel workbook and re-name it to FlowTest Manifest



Insert new sheet called FlowTest Manifest

Step 5 Define the manifest

The manifest is structured sections with each section containing items and values in a column format where:

- Column A	Section tag / Item name
- Column B	Item value

The manifest begins with a <BEGIN_MANIFEST section tag and ends with an END_MANIFEST> tag anything outside these tags are ignored by the FlowTest manifest processor. Additionally any row within the manifest tags that begins with // is ignored and can be used to add comments to the manifest.
Within the <BEGIN_MANIFEST and END_MANIFEST> there are two mandatory sections <MANIFEST and <GLOBAL additionally we will be defining additional sections: <MONIKER, <DATA_TABLE and <SERIES in implementing the manifest for our Excel template. For a full description of the manifest directives see Manifest Reference below.

Start the manifest by adding the required sections as shown below. The export format is in imperial units so we will use IMPERIAL and STD for the manifest global section items.

	A	B
1	<BEGIN_MANIFEST	
2	<MANIFEST	
3	Type	PetroClass FlowTest
4	Version	1.0
5	MANIFEST>	
6	<GLOBAL	
7	UnitBase	IMPERIAL
8	PTBase	STD
9	GLOBAL>	
10	END_MANIFEST>	
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		

FlowTest Manifest | Sheet1 | Sheet2 | Sheet3

Step 6 Add manifest entries for the well name and UWI items. The well name and UWI items will be described in the manifest as <MONIKER sections these sections will relate the Excel names (as specified in step 2 above), for the respective items, to the appropriate FlowTest smart tags as follows:

Item	Excel Named Range	FlowTest smart tag
Well Name	WELL_NAME	<WELL_NAME>
UWI	UWI	<WELL_DOWNHOLE_LOC>

	A	B
1	<BEGIN_MANIFEST	
2	<MANIFEST	
3	Type	PetroClass FlowTest
4	Version	1.0
5	MANIFEST>	
6	<GLOBAL	
7	UnitBase	IMPERIAL
8	PTBase	STD
9	GLOBAL>	
10	<MONIKER	
11	Name	WELL_NAME
12	Tag	<WELL_NAME>
13	MONIKER>	
14	<MONIKER	
15	Name	UWI
16	Tag	<WELL_DOWNHOLE_LOC>
17	MONIKER>	
18	END_MANIFEST>	
19		
20		
21		
22		
23		
24		

FlowTest Manifest | Sheet1 | Sheet2 | Sheet3

Well Name and UWI items

For a complete list of available moniker tags see: Smart Tag Reference of Appendix B.

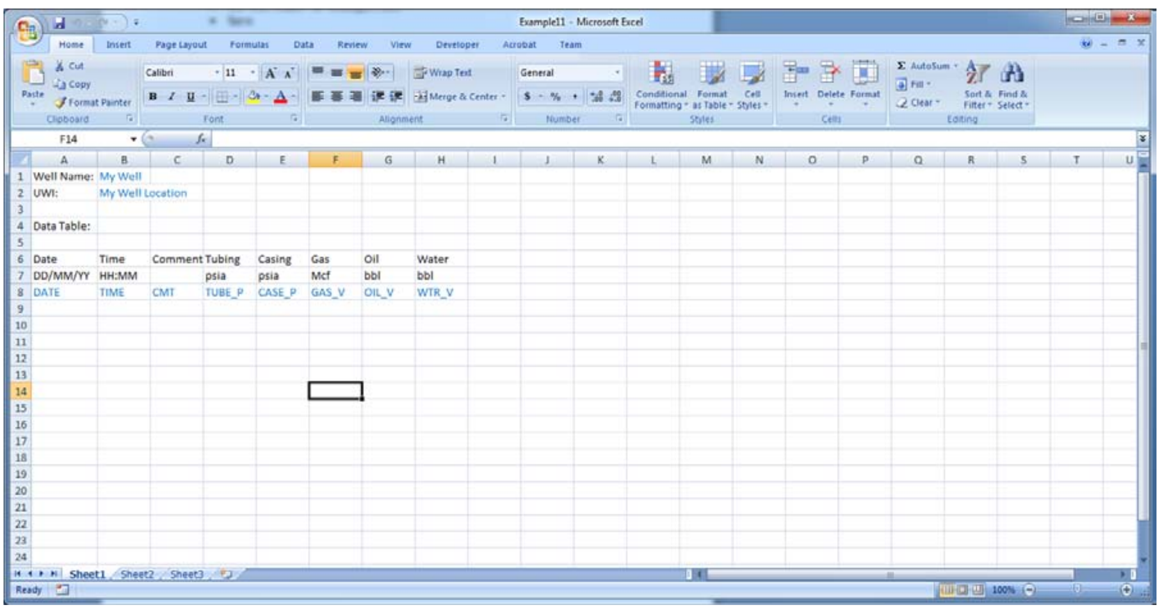
Step 7 Test the excel template

At this point we have a valid manifest that will actually do something, so we can test it by saving the excel file as a .xltx (Excel Template).

- In Excel, select ‘Save As’
- Set ‘Save As Type:’ to ‘Excel Template (*.xlxt)’
- Set ‘File Name:’ to ‘Example1.xltx’
- Save

Open a blank FlowTest File

- In the ‘Test Information’
    - Set Well Name to ‘My Well’
    - Set UWI Bottom Location to “My Well Location’
- Select “Excel Export” from the File menu
- In the Export window, select our Example1.xltx as the export template



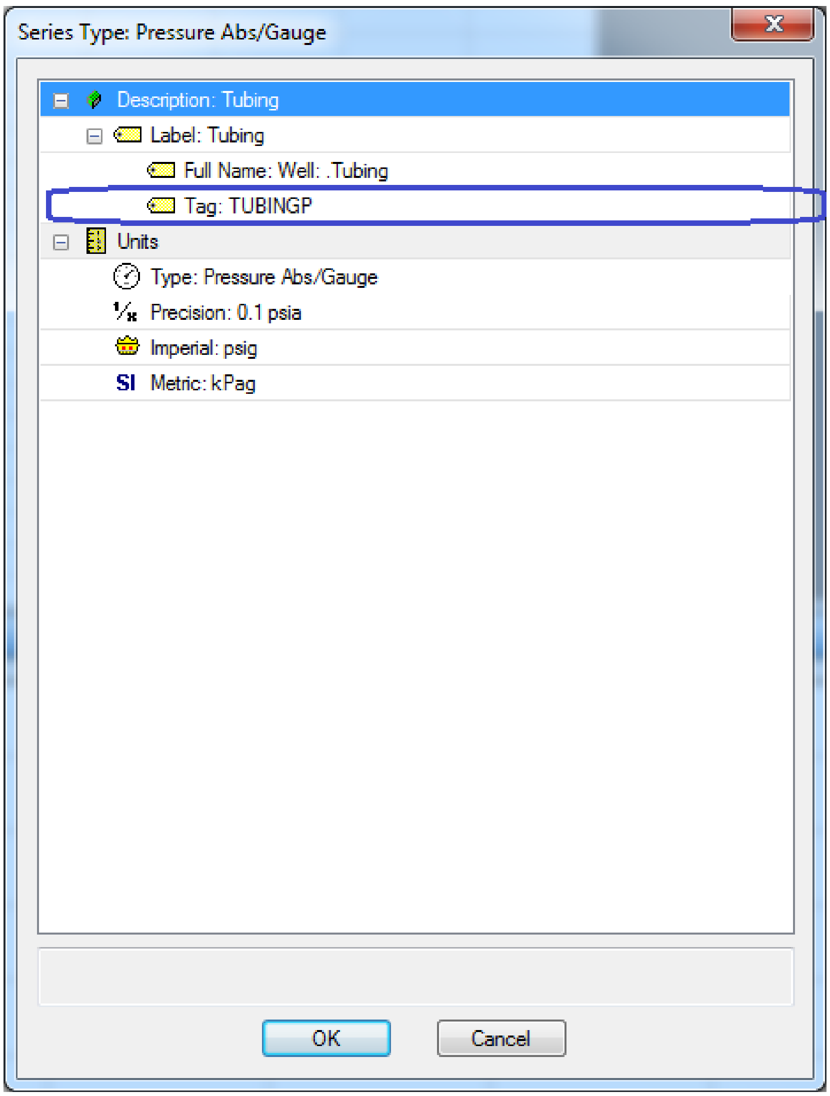
FlowTest generates a new excel file based on the Example1.xlxt template with the manifest sheet removed and the items ‘My Well’ and ‘My Well Location’ populated in the appropriate locations.

Step 8 Add the data table items to the manifest.
For the manifest data table we need to define and map the following:

- Map FlowTest series to Excel column names
- Define which Excel column names make up the table

In steps 2 and 3we assigned excel names for the data columns and also gave the entire table row a name. In the manifest the data columns are defined using the <SERIES section(s) and the table is defined using a single <DATA_TABLE section.

Series within FlowTest are identified using the series tag name. Within FlowTest, the series tag name can be viewed or modified in the series property window as shown below:



Tubing Pressure Series
Tag Name

Series tag names in FlowTest

Note: Series in the Time, Well and Data Summary groups are assigned default tag names, generic series and series in other meters are blank by default and must be assigned before they can be used in Excel templates.

Manifest Series Definitions:

<SERIES
Name DATE
Tag DATETIME
SERIES>
<SERIES
Name TIME
Tag DATETIME
SERIES>
<SERIES
Name CMT
Tag EVENT
SERIES>
<SERIES
Name TUBE_P
Tag TUBINGP
Unit PSIA
SERIES>
<SERIES
Name CASE_P
Tag CASINGP
Unit PSIA
SERIES>
<SERIES
Name GAS_V
Tag GAS_ALL
Unit MCF
SERIES>
<SERIES
Name OIL_V
Tag OIL_ALL
Unit BBL
SERIES>
<SERIES
Name WTR_V
Tag WTR_ALL
Unit BBL
SERIES>

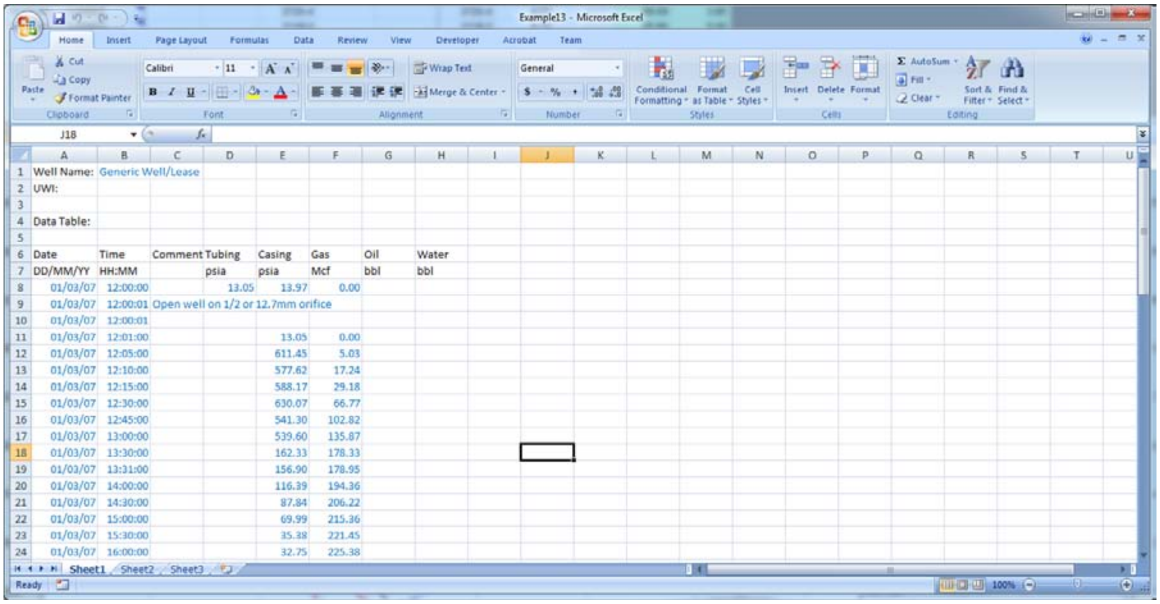
In addition to the manifest <SERIES definitions we need to define the <DATA_TABLE as follows:

```
<DATA_TABLE
Name            TABLE_1
DATA_TABLE>
```

<BEGIN_MANIFEST	
<MANIFEST	
Type	PetroClass FlowTest
Version	1.0
MANIFEST>	
<GLOBAL	
UnitBase	IMPERIAL
PTBase	STD
GLOBAL>	
<MONIKER	
Name	WELL_NAME
Tag	<WELL_NAME>
MONIKER>	
<MONIKER	
Name	UWI
Tag	<WELL_DOWNHOLE_LOC>
MONIKER>	
<SERIES	
Name	DATE
Tag	DATETIME
SERIES>	
<SERIES	
Name	TIME
Tag	DATETIME
SERIES>	
<SERIES	
Name	CMT
Tag	EVENT
SERIES>	
<SERIES	
Name	TUBE_P
Tag	TUBINGP
Unit	PSIA
SERIES>	
<SERIES	
Name	CASE_P
Tag	CASINGP
Unit	PSIA
SERIES>	
<SERIES	
Name	GAS_V
Tag	GAS_ALL
Unit	MCF
SERIES>	
<SERIES	
Name	OIL_V
Tag	OIL_ALL
Unit	BBL
SERIES>	
<SERIES	
Name	WTR_V
Tag	WTR_ALL
Unit	BBL
SERIES>	
<DATA_TABLE	
Name	TABLE_1
DATA_TABLE>	
END_MANIFEST>	

Entire manifest for Example 1

Step 9 Test the completed template.
This completes the Excel template of Example 1. The template can be tested by loading a data file in FlowTest and exporting using the Example 1 template (as done in step 7 above).



Excel export of ‘Example FlowTest.flowtest’ using ‘Example1.xltx’ template.

Some noteworthy points on the generated export:

- The Oil and Water columns are absent due to the fact that there are no liquids produced in the FlowTest example file.
- Data units are as defined in the manifest, irrespective of the units selected in the data file, or order (if at all) in which they appear in any data table(s).
- Because the data table names are specified as part of the template definition, re-naming series in the FlowTest data file does not affect the template output.
- When the data table rows are expanded all cell formatting is expanded as well (i.e. all the data is formatted in blue) this behavior includes advanced Excel formatting functions such as conditional formatting.
- Additional calculated columns may also be included in the data table by simply ensuring they are contained within the table named range (TABLE_1 in this case).
- When you examine the generated export, you will notice that the Excel names defined in the template remain in the exported file of particular interest are the data table names which now span the entire data column. This powerful feature, of the exports, allows you to include charts and graphs as part of the template by using the column names to represent the data series.
- A CSV file, of the export, is easily created by simply doing a save-as ‘CSV’ within Excel.

Advanced Exporting Features

In Example 1 above, the data table column name and units were specified as part of the template; optionally, these items can be obtained as part of the manifest export operation.
The manifest <SERIES section 'Name' property specifies the Excel named range of the column data additionally the manifest will resolve two additional names in the form:
Name_UNIT and Name_LABEL with the series units and name respectively.
As an example, given the manifest definition of Tubing pressure for example 1:

```
<SERIES
Name        TUBE_P
Tag         TUBINGP
Unit        PSIA
SERIES>
```

The Excel data name is: TUBE_P
The series unit name is: TUBE_P_UNIT
The series label name is: TUBE_P_LABEL
The Excel template can be modified replacing the 'Tubing' and 'psia' table header cells with the names TUBE_P_UNIT and TUBE_P_LABEL respectively (as a result, the column name will then change to reflect the series name in the FlowTest data file).
Effectively there are two implied (read-only) properties for the <SERIES section given as:

```
<SERIES
Name        TUBE_P
UnitName    TUBE_P_UNIT
LabelName   TUBE_P_LABEL
Tag         TUBINGP
Unit        PSIA
SERIES>
```

The main advantage of doing this is that it moves more of the definitions to the manifest.

The manifest <MONIKER section has a similar functionality (to the <SERIES section described above) where if the FlowTest smart tag, specified in the moniker section, has associated units, then an implied (read-only) UnitName property for the <MONIKER section is given in the form: Name_UNIT.

A manifest moniker for Tubing ID
<MONIKER
Name TUBE_SZ
Tag <WELL_TUBING_SZ>
Unit MM
MONIKER>

<MONIKER
Name TUBE_SZ
UnitName TUBE_SZ_UNIT (Implied Unit name)
Tag <WELL_TUBING_SZ>
Unit MM
MONIKER>

Template Definition

	A	B	C	D
1	Tubing ID			
2				

Cell B1 Name = TUBE_SZ
Cell C1 Name = TUBE_SZ_UNIT

Export

	A	B	C	D
1	Tubing ID	101.6	mm	
2				

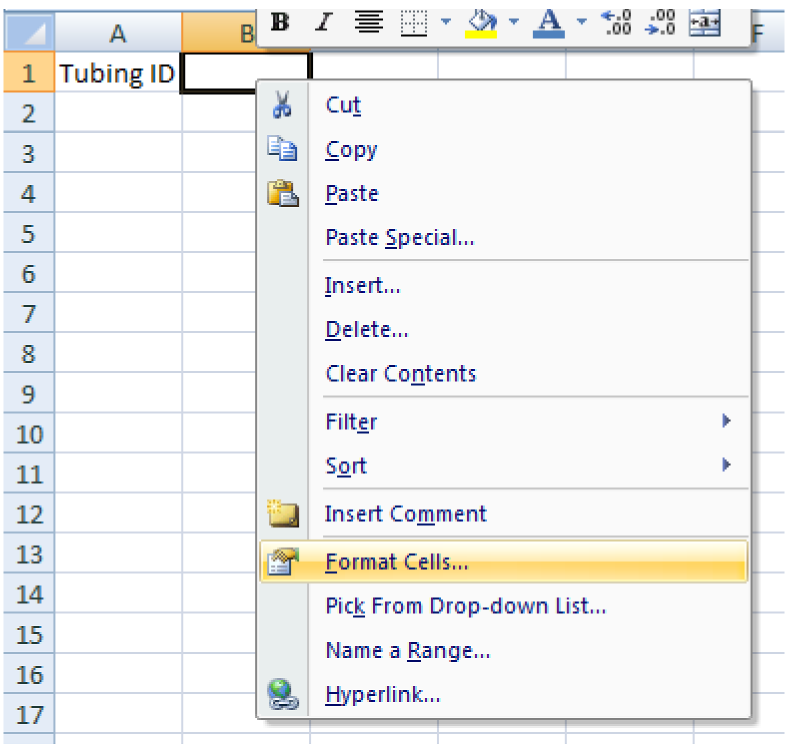
Export result for a 4” tubing ID (in metric units)

Moniker value and units can also be combines into a single cell by specifying a custom cell format. In the TUBE_SZ (cell B1) a custom format can be contain the text <UNIT> where the manifest will replace <UNIT> with the unit text.

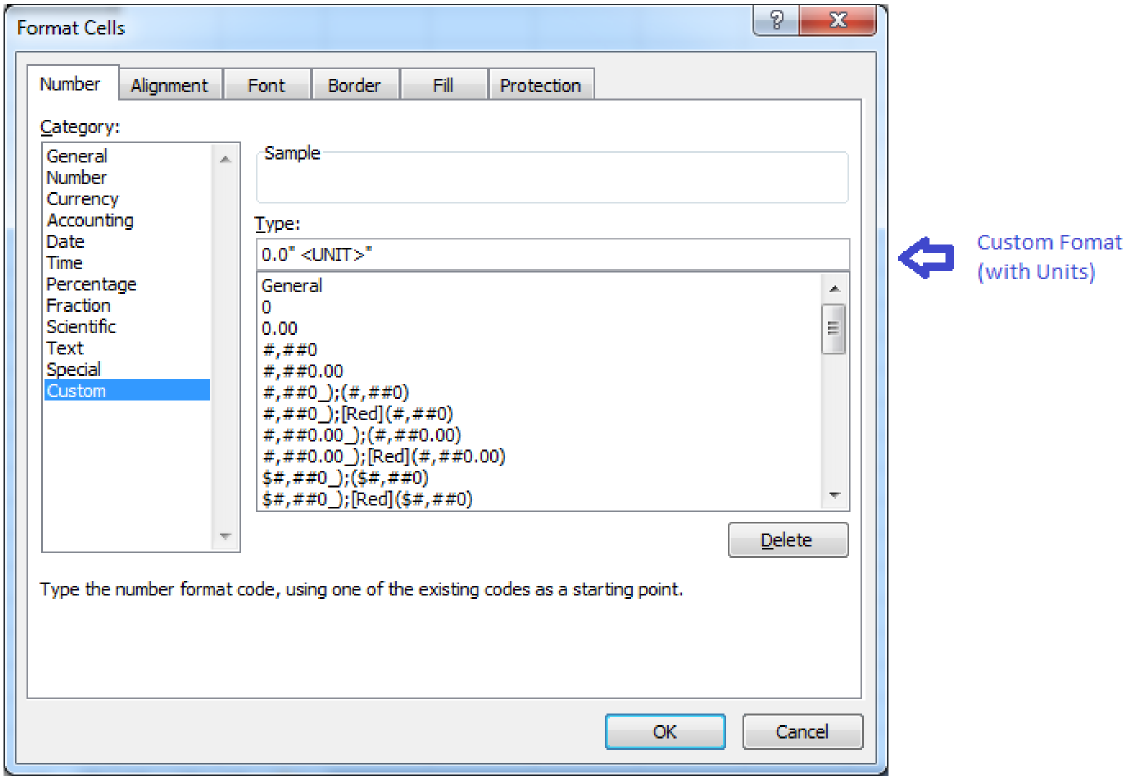
Template Definition

	A	B	C	D
1	Tubing ID			
2				

Cell B1 Name = TUBE_SZ



Set custom formatting for the TUBE_SZ cell.



0.0" <UNIT>" specified as the custom format will yield the value formatted to 1 decimal point followed by the units.

Export

	A	B	C
1	Tubing ID	101.6 mm	
2			

Export result for a 4" tubing ID (in metric units)

The Example 1 template is relatively simple, when templates become more advanced one quickly finds many manifest series definitions contain a common set of properties. The <SERIES_DEF section can be used to abstract common properties into a single definition.

Given the manifest Tubing and Casing definitions of Example1, we can refractor the manifest using a common <SERIES_DEF section as shown below.

<u>Original Example1 Definition</u>

```
<SERIES
Name        TUBE_P
Tag         TUBINGP
Unit        PSIA
SERIES>
<SERIES
Name        CASE_P
Tag         CASINGP
Unit        PSIA
SERIES>
```

<u>Refactored Definition</u>

```
<SERIES_DEF
Name        Pressure
Unit        PSIA
SERIES_DEF>


<SERIES
Name        TUBE_P
Tag         TUBINGP
Inherit     Pressure
SERIES>
<SERIES
Name        CASE_P
Tag         CASINGP
Inherit     Pressure
SERIES>
```

Manifest Reference

Column A	**Column B**	
Section / Item	**Value**	**Description**
<BEGIN_MANIFEST		Required beginning section tag
<MANIFEST		Required section
Type		Required: must be PetroClass FlowTest
Version		Required: must be 1.0
Remove		Optional: TRUE/FALSE removes the manifest sheet in the final output Default = TRUE
MANIFEST>		
<GLOBAL		Required section
UnitBase		Required: default units can be either METRIC or IMPERIAL
PTBase		Required: pressure/temperature base for rates and cums can be either STD or PAS STD = 14.73 psia, 60 °F PAS = 101.325 kPaa, 15 °C
GLOBAL>		
<MONIKER		
Name		Required: Excel named range
Tag		Required: FlowTest smart tag Form: <TAG> no additional tag formatting supported
Unit		Optional: Units for the smart tag Can be any valid unit tag
MONIKER>		

<DATA_TABLE		
Name		Required: Excel named range
ShowInterpValues		Optional: TRUE/FALSE Display interpolated values in the data table Default = FALSE
ExcludeCommentRows		Optional: TRUE/FALSE Remove comment data rows Default = FALSE
SeparateDataComments		Optional: TRUE/FALSE Separates data/comment rows Default = TRUE
BreakMultiLineComments		Optional: TRUE/FALSE Multi-line comments are separated to individual rows Default = TRUE
MergeCommentRows		Optional: TRUE/FALSE Default = FALSE *Cell wrapping can be used in conjunction with MergeCommentRows when multi line comments are to be displayed in a single row. In which case the row height will automatically adjust to display multiple text rows.*
DATA_TABLE>		
<SERIES_DEF		
Name		Required: Name for the series def
Inherit		Optional: name of <SERIES_DEF to inherit
Unit		Optional: any valid FlowTest unit tag
SERIES_DEF>		
<SERIES		
Name		Required: Excel named range
Inherit		Optional: name of <SERIES or <SERIES_DEF to inherit
Tag		Required: FlowTest series tag name
Unit		Required/Inheritable: Valid unit tag for the series
Required		Optional: TRUE/FALSE Issues an error if the series does not exist in the data file Default = TRUE
SERIES>		
END_MANIFEST>		Required ending section tag

Unit Tag Reference

Type	Tag	Unit
Pressure (Differential)	KPA	kPa
	PSI	Psi
	MPA	MPa
	HW	inH2O
Pressure (Absolute)	KPAA	kPaa
	PSIA	Psia
	MPAA	MPaa
Pressure (Gauge)	KPAG	kPag
	PSIG	Psig
	MPAG	MPag
Temperature	DEGC	°C
	DEGF	°F
	DEGR	R
	DEGK	K
Fraction	FRACTION	Fraction
	PERCENT	%
	PPM	ppm
	UNIT	Unit
Volume (Gas)	E3M3	10^3m^3
	MMCF	MMcf
	MCF	Mcf
	M3	m^3
	CF	f^3
Volume (Liquid)	M3	m^3
	BBL	bbl
	CF	f^3
	GAL	Gal(US)
	L	L
Volumetric Flow Rate (Gas)	E3M3/D	$10^3m^3/d$
	MMCF/D	MMcf/d
	MCF/D	Mcf/d
	M3/D	m^3/d
	CF/D	f^3/d
	M3/HR	m^3/hr
	CF/HR	f^3/hr
	M3/MIN	m^3/min
	CF/MIN	f^3/min

Volumetric Flow Rate (Liquid)	M3/D	m^3/d
	BBL/D	Bbl/d
	CF/D	f^3/d
	M3/HR	m^3/hr
	BBL/HR	Bbl/hr
	L/M	L/min
	GPM	gal/min
Length	M	m
	FT	ft.
	MM	mm
	IN	in.
	64	1/64
Ratio (Gas/Liquid)	SCF/SCF	scf/scf
	SCF/STB	scf/stb
	M3/M3	m^3/ m^3
	E3M3/M3	$10^3m^3/m^3$
	MMCF/STB	MMcf/stb
	MCF/STB	Mcf/stb
Ratio (Liquid/Gas)	SCF/SCF	scf/scf
	STB/SCF	stb/scf
	M3/M3	m^3/ m^3
	M3/E3M3	$m^3/ 10^3m^3$
	STB/MMCF	stb/MMcf
	STB/MCF	stb/Mcf
Ratio (Liquid/Liquid)	SCF/SCF	scf/scf
	M3/M3	m^3/ m^3
	STB/STB	stb/stb
Time (cumulative)	DEC_HOUR	Hrs.
	DEC_DAY	Days
	DEC_MIN	Min.
Oil Density	API	°API
	SG	SG
	LBS_CF	lbm/f^3
	KG_M3	kg/m^3

APPENDIX B: Smart Tag Reference

Category	Smart Tag	Description
Well	<WELL_NAME>	Well Name
	<WELL_SURFACE_LOC>	Surface UWI
	<WELL_DOWNHOLE_LOC>	Down hole UWI
	<WELL_LIC>	License
	<WELL_FORMATION>	Formation
	<WELL_FIELD>	Field
	<WELL_TYPE>	Type
	<WELL_GND_ELV>	Ground Elevation
	<WELL_KB_ELV>	Kelly Bushing Elevation
	<WELL_KB_GND_OFFSET>	Kelly Bushing, Ground Offset
	<WELL_DRILL_LEG>	Drill Leg
	<WELL_FLOW_PATH>	Flowing Path
	<WELL_FLUID_TYPE>	Fluid Type
	<WELL_TUBING_SZ>	Tubing Size
	<WELL_TUBING_WT>	Tubing Weight
	<WELL_CASING_SZ>	Casing Size
	<WELL_CASING_WT>	Casing Weight
Test Data	<TEST_TYPE>	Test Type
	<TEST_JOB>	Job Number
	<TEST_AFE>	AFE Number
	<TEST_UNIT>	Test Unit
	<TEST_TIME_START>	Test Start Time
	<TEST_TIME_END>	Test End Time
Contact (Operator)	<OPERATOR>	Well Operator
	<OPERATOR_CONTACT>	Contact
	<OPERATOR_STREET>	Street Address
	<OPERATOR_CITY>	City
	<OPERATOR_PROV>	Province/State
	<OPERATOR_POSTCODE>	Postal/Zip Code
	<OPERATOR_COUNTRY>	Country
	<OPERATOR_WEB>	Web Address
	<OPERATOR_TEL>	Telephone Number
	<OPERATOR_MOBILE>	Telephone Number
	<OPERATOR_FAX>	Telephone Number
	<OPERATOR_EMAIL>	Email Address

Contact (Service)	<SERCO>	Service Company
	<SERCO_CONTACT>	Contact
	<SERCO_SUPERVISOR_CONTACT>	Supervisor Contact
	<SERCO_FIELD_CONTACT>	Field Contact
	<SERCO_STREET>	Street Address
	<SERCO_CITY>	City
	<SERCO_PROV>	Province/State
	<SERCO_POSTCODE>	Postal/Zip Code
	<SERCO_COUNTRY>	Country
	<SERCO_WEB>	Web Address
	<SERCO_TEL>	Telephone Number
	<SERCO_MOBILE>	Telephone Number
	<SERCO_FAX>	Telephone Number
	<SERCO_EMAIL>	Email Address
	<SERCO_SUPERVISOR_TEL>	Telephone Number
	<SERCO_SUPERVISOR_MOBILE>	Telephone Number
	<SERCO_SUPERVISOR_FAX>	Telephone Number
	<SERCO_SUPERVISOR_EMAIL>	Email Address
	<SERCO_FIELD_TEL>	Telephone Number
	<SERCO_FIELD_MOBILE>	Telephone Number
	<SERCO_FIELD_FAX>	Telephone Number
	<SERCO_FIELD_EMAIL>	Email Address
Contact (Report)	<REPORTCO>	Reporting Company
	<REPORTCO_CONTACT>	Contact
	<REPORTCO_STREET>	Street Address
	<REPORTCO_CITY>	City
	<REPORTCO_PROV>	Province/State
	<REPORTCO_POSTCODE>	Postal/Zip Code
	<REPORTCO_COUNTRY>	Country
	<REPORTCO_WEB>	Web Address
	<REPORTCO_TEL>	Telephone Number
	<REPORTCO_MOBILE>	Telephone Number
	<REPORTCO_FAX>	Telephone Number
	<REPORTCO_EMAIL>	Email Address

Smart Tag Format specifiers for <DATETIME{'…'}> tag:
Where … is a combination of the following codes to format the date-time.

Code	Replacement string
%a	Abbreviated weekday name in the locale
%A	Full weekday name in the locale
%b	Abbreviated month name in the locale
%B	Full month name in the locale
%c	Date and time representation appropriate for locale
%C	The year divided by 100 and truncated to an integer, as a decimal number (00−99)
%d	Day of month as a decimal number (01 - 31)
%D	Equivalent to **%m/%d/%y**
%e	Day of month as a decimal number (1 - 31), where single digits are preceded by a space
%F	Equivalent to **%Y-%m-%d**
%g	The last 2 digits of the ISO 8601 week-based year as a decimal number (00 - 99)
%G	The ISO 8601 week-based year as a decimal number
%h	Abbreviated month name (equivalent to **%b**)
%H	Hour in 24-hour format (00 - 23)
%I	Hour in 12-hour format (01 - 12)
%j	Day of the year as a decimal number (001 - 366)
%m	Month as a decimal number (01 - 12)
%M	Minute as a decimal number (00 - 59)

%n	A newline character (**\n**)
%p	The locale's A.M./P.M. indicator for 12-hour clock
%r	The locale's 12-hour clock time
%R	Equivalent to **%H:%M**
%S	Second as a decimal number (00 - 59)
%t	A horizontal tab character (**\t**)
%T	Equivalent to **%H:%M:%S**, the ISO 8601 time format
%u	ISO 8601 weekday as a decimal number (1 - 7; Monday is 1)
%U	Week number of the year as a decimal number (00 - 53), where the first Sunday is the first day of week 1
%V	ISO 8601 week number as a decimal number (00 - 53)
%w	Weekday as a decimal number (0 - 6; Sunday is 0)
%W	Week number of the year as a decimal number (00 - 53), where the first Monday is the first day of week 1
%x	Date representation for the locale
%X	Time representation for the locale
%y	Year without century, as decimal number (00 - 99)
%Y	Year with century, as decimal number
%z	The offset from UTC in ISO 8601 format; no characters if time zone is unknown
%Z	Either the locale's time-zone name or time zone abbreviation, depending on registry settings; no characters if time zone is unknown

APPENDIX C: Generic Series Expression Reference

Binary operators		
Operator	**Description**	**Priority**
+	addition	1
-	subtraction	1
*	multiplication	2
/	division	2
^	raise to power	3
()	parenthesis (operation precedence)	-1

Built-in functions		
Name	**Arguments**	**Description**
sin(x)	1	sine (argument x in radians)
cos(x)	1	cosine (argument x in radians)
tan(x)	1	tangent (argument x in radians)
asin(x)	1	arcsine
acos(x)	1	arccosine
atan(x)	1	arctangent
log2(x)	1	logarithm (base 2)
log10(x)	1	logarithm (base 10)
log(x)	1	logarithm (base 10)
ln(x)	1	logarithm (base e)
exp(x)	1	e raised to power x
sqrt(x)	1	square root
rint(x)	1	round to nearest integer
abs(x)	1	absolute value
min(…)	variable	minimum of arguments
max(…)	variable	maximum of arguments
sum(…)	variable	sum of arguments
avg(…)	variable	average of arguments

Name	Arguments	Description
SG60F(ro, t, hy)	3	Oil Relative Density @ 60°F
Syntax:	SG60F(SGobs , Tobs , Hyd)	
Output		Relative Density 60/60 °F
Input 1	SGobs	Measured Relative Density (ro/rw)
Input 2	Tobs	Measured Temperature (in °F)
Input 3	Hyd	Flag to correct for glass hydrometer
	0	No correction
	1	Apply glass hydrometer correction
Remarks:	Calculates the relative density for general crude oils based on inputs of observed relative density, observed temperature and an optional temperature correction for a glass hydrometer.	

Vasquez-Beggs Correlations for Fluid Physical Property Prediction		
Name	**Arguments**	**Description**
VB_Rs(Ygs, Yo, P, T, Pb)	5	Vasquez-Beggs Solution Gas-Oil Ratio (GOR)
Syntax:	VB_Rs(Ygs, Yo, P, T, Pb)	
Output		Dissolved GOR (in scf/STB)
Input 1	Ygs	Gas Gravity @ separator conditions of 100 psig
Input 2	Yo	Oil Gravity (in °API @ 60°F)
Input 3	P	Measured Pressure (in psia)
Input 4	T	Measured Temperature (in °F)
Input 5	Pb	Bubble-Point Pressure (in psia)
Remarks:	Calculates the solution gas oil ratio (Rs) as per Vasquez M., and Beggs, H. D. (SPE 6719) #Separator Oil Flash Factor	
Name	**Arguments**	**Description**
VB_Bo(Ygs, Yo, P, T, Pb)	5	Vasquez-Beggs Oil Formation Volume Factor (FVF)
Syntax:	VB_Bo(Ygs, Yo, P, T, Pb)	
Output		Oil FVF (in bbl/STB)
Input 1	Ygs	Gas Gravity @ separator conditions of 100 psig
Input 2	Yo	Oil Gravity (in °API @ 60°F)
Input 3	P	Measured Pressure (in psia)
Input 4	T	Measured Temperature (in °F)
Input 5	Pb	Bubble-Point Pressure (in psia)
Remarks:	Calculates the oil formation volume factor (Bo) as per Vasquez M., and Beggs, H. D. (SPE 6719) #Separator Oil Shrinkage Factor	
Name	**Arguments**	**Description**
VB_Ygs(Ygp, Yo, Ps, Ts)	4	Vasquez-Beggs Separator gas gravity converter Ygp to Ygs
Syntax:	VB_Ygs(Ygp, Yo, Ps, Ts)	
Output		Gas Gravity @ separator conditions of 100 psig
Input 1	Ygp	Gas Gravity @ separator conditions of Ps & Ts
Input 2	Yo	Oil Gravity (in °API @ 60°F)
Input 3	Ps	Actual Separator Pressure (in psia)
Input 4	Ts	Actual Separator Temperature (in °F)
Remarks:	Corrects a separator gas gravity measured at separator conditions of Ps & Ts to a gas gravity@100 psig as per Vasquez M., and Beggs, H. D. (SPE 6719)	

Example Reference Files:

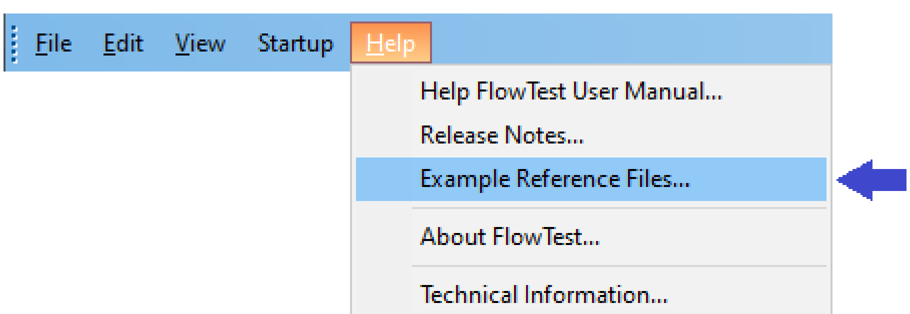
Several example files are included with the FlowTest distribution that illustrates using the custom functions in calculated generic series expressions:

- **Oil API 60F calculation**
  This file demonstrates the use of the function **SG60F()** to calculate an oil °API @ 60 °F from a field measurement.

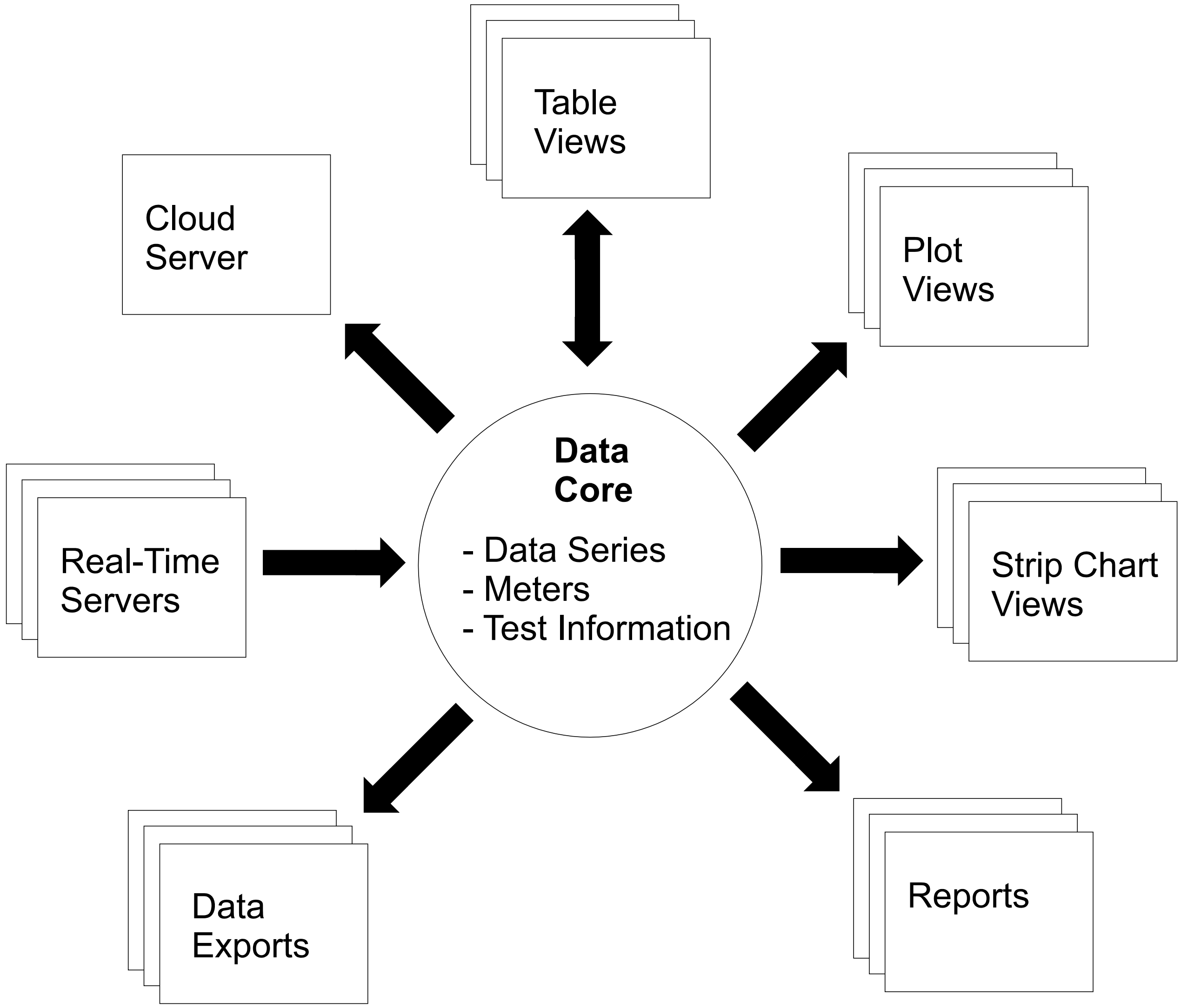
- **VBE Oil Shrinkage calculation**
  This file demonstrates the use of the **VB_Rs()** and **VB_Bo()** functions to calculate shrinkage and solution gas for an oil meter. Given a in-situ separator oil volume as an input it calculates the equivalent stock tank oil volume and liberated gas volume.

- **VBE Oil-Wtr Shrinkage with STATIC BSW**
  This file is an extension of "VBE Oil Shrinkage calculation" that further demonstrates shrinkage calculations when used in an oil/water meter with a BSW cut. The example shows how to convert a 'STATIC' BSW, measured at atmospheric conditions, to a 'DYNAMIC' BSW representative of the in-situ oil/water volumes. How the BSW cut was measured is an important consideration when applying shrinkage calculations!
  Basically if you are making BSW measurements on atmospheric (centrifuged) samples you need to do this extra conversion; as you need to know the ratio of oil to water in the separator, not at atmospheric conditions.

The example reference files can be a accessed from 'help' in the main menu.



APPENDIX D: FlowTest Block Diagram



FlowTest Block Diagram