



Tag Dependency Diagnostic Utility



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1 Pre-requisites

This application uses OSIsoft's 32-bit PI-SDK routines. The application is generally for use on client PCs running Windows 2000, XP or Windows 7 with OSIsoft's PI-SDK installed; in particular, this application will fail if it does not detect a valid definition for the environment variable "PIHOME". If a 64-bit version is required, please contact the author; see section 12.1

2 Purpose

The primary purpose of this utility is to present the performance equation tag dependencies diagrammatically. The application will examine the **ExDesc** and **sourcetag** attributes for classic tags and other attributes as necessary for **Alarm**, **Base SQC_Alarm** and **Totalizer** tags, and display these in an explorer style view. It is ideal as a diagnostic tool for identifying points of failure in performance equation calculations. It is a valuable addition to a PI system administrator's toolset in his goal of providing a properly configured set of PI tags.

Versions 6.4 and later supports all the PI tag types (**Alarm**, **Base**, **Classic**, **SQC_Alarm** and **Totalizer**) without distinction; some attributes that can be displayed are not available for all tag types, and a suitable configurable text message (see Figure 12, Selecting Tag Attributes, Values and Formats) is displayed in these circumstances.

This utility does not support PI ACE calculations.

3 Installation

3.1 Step 1 setup.exe

This application will install into the user's local profile, so every user on the machine will need to do their own installation. To install the application double-click on setup.exe to see the window below. Click **Install** to proceed.

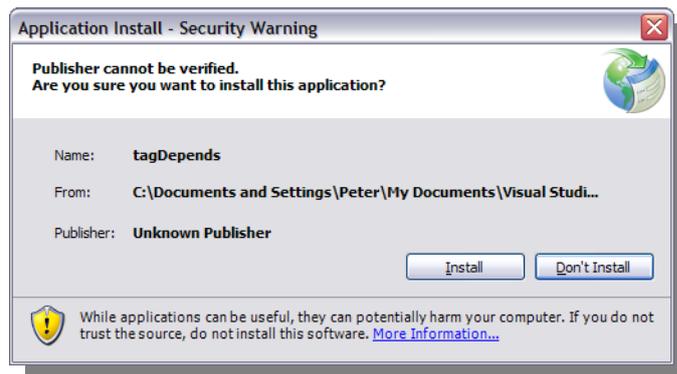


Figure 1, setup

Within a short time, the application will have installed and will immediately execute.

4 Instantiation

After successful authentication, the main window is presented. This window is split very much like the Windows File Explorer screen; the left panel is a treeview display, while the right panel is a list type display. The right-hand display format can be



changed by right-clicking in the panel and selecting from the popup menu. In combination with the Tag Attributes menu and the Detail display, a large amount of tag detail can be viewed (the default displays only the tag name, timestamp and snapshot).

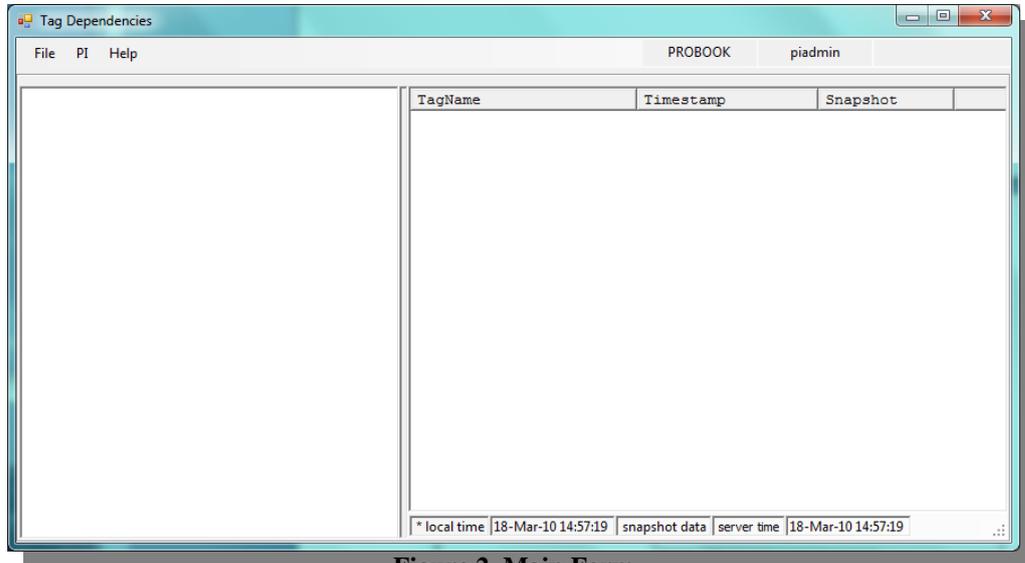


Figure 2, Main Form

4.1 Connections

The first step is to connect to **PI**. This can be achieved from the **PI** menu and clicking the **connections** menu; alternatively, right-click in the main treeview panel of the application, and then selecting **PIconnections** from the pop-up menu.

Select the appropriate server. Click the **Close** button when ready. This application will only work with a single PI connection, so if more than one server is selected a message explaining this will be displayed.

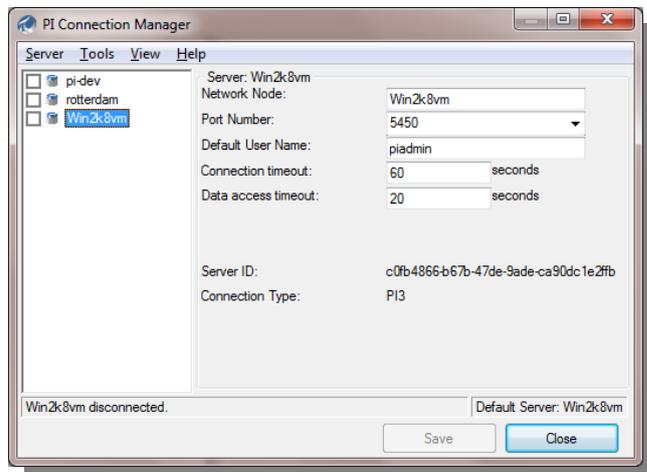


Figure 3, PI connections dialog



4.2 Tag timestamps

Before retrieving any tags from PI, it may be desirable to set the preferences for the snapshot data and timestamp format. By right-clicking in the treeview object display, select **PI>timestamps** to change the preferences. Click the **OK** button to close the window and return to the main display.

It is possible to choose a time at which the tag values should be read. The default is to use the snapshot. The timestamp field can be entered in either windows or PI time formats, so values such as "*", "*-3d", "today", "yesterday" are all valid responses ("now", however, which is valid in Excel, is not a valid string in this application); a blank will be taken as meaning current time. Changes to this item will automatically validate and update the display to show what the date will look like.

Figure 4, Setting Timestamp format

If the Archive values are chosen, and no value exists at the time specified, a substitute value method can be specified from the **Mode** drop-down list box. With the value shown in the example, if there is no value at the time specified, the most recent previous value will be used; the table below details the options and their meaning.

Placing a tick in **Use PI Server time Zone** box means that timestamps displayed for the tag values will be those of the PI server; this is useful if data is being pulled from a server in a different time zone from that of the client.

Once the options have been selected click the **OK** button to close the window and revert to the Exploration window. Settings made in this form will be reflected in the main window in the status bar.



4.2.1 Timestamp format characters

This table details the characters that can be used in the timestamp format string. The most common formats, however, are available from the drop-down list, but other formats can be entered manually.

Characters	Meaning
yy, yyyy	Year, 2 or 4 digits
M, MM	Month, short/long number
MMM, MMMM	Month, short/long name
d, dd	Day, short/long number
ddd, dddd	Weekday, short/long name
h, hh	Hour, short/long number
m, mm	Minute, short/long number
s, ss	Seconds, short/long number
0 - 000000	Fraction of second, show trailing zeros
# - #####	Fraction of second, no trailing zeros
z, zz	Time zone, short/long name
i[name]	Interval ordinal, short form
ii[name]	Interval ordinal, long form
iii[name]	Interval member name, short
iiii[name]	Interval member name, long
.	Local decimal separator
:	Local time separator
-	Local date separator
AP	Local AM/PM symbol
\	Next character is literal
other char	Itself

4.2.2 Mode meanings

At Or Before	Return a recorded value at the passed time or if no value exists at that time, the previous recorded value.
At Or After	Return a recorded value at the passed time or if no value exists at that time, the next recorded value.
Interpolated	Return an interpolated value for this time. Discrete points (step attribute = 1) will simply carry the previous value forward.
Auto	For a continuous point (step attribute = 0) treat as Interpolated For a discrete point (step attribute = 1) treat as At Or Before
Before	Return the first recorded value before the passed time.
After	Return the first recorded value after the passed time.
Compressed	Return a recorded value at the passed time or return an error if none exists.



5 Tag search

This is the only way to populate the main treeview display. Click the **tag search** from the **PI** menu, or from the popup menu. In the example below some particularly intensive calculation tags were selected. After highlighting the required selection, clicking the **OK** button will close this window, revert to the main treeview display, and populate it with the selected tags and their dependencies.

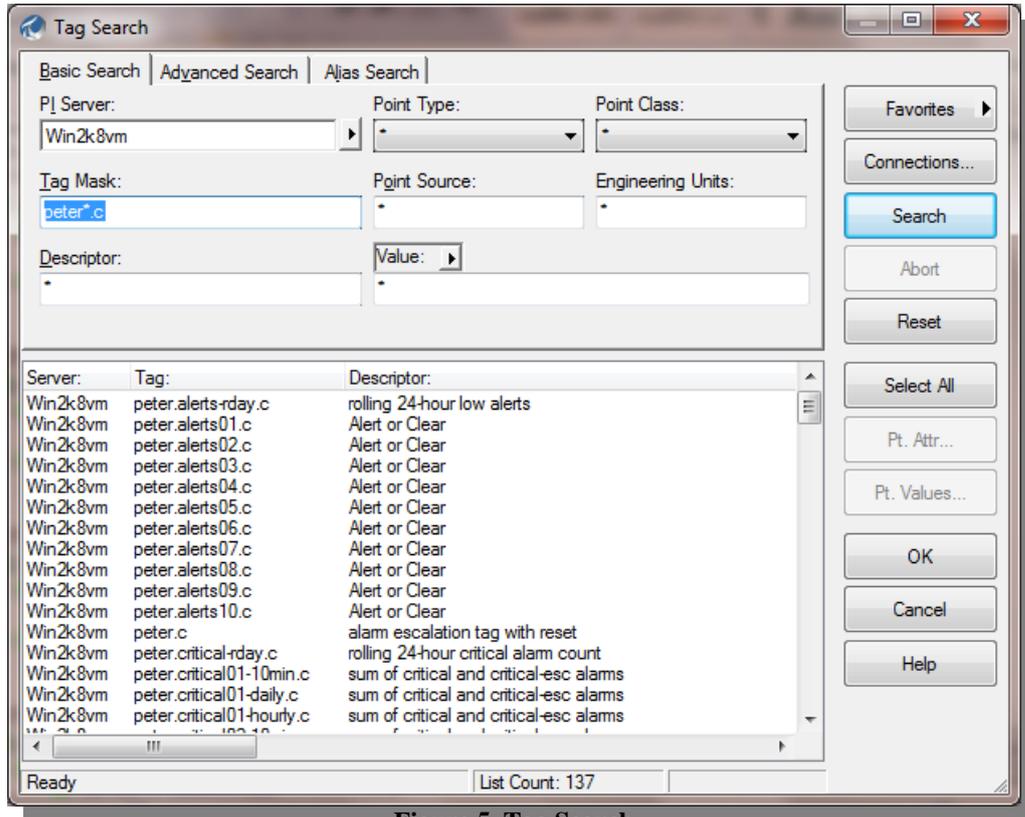


Figure 5, Tag Search



6 Population of Explorer Tree View Panel

This window can be re-sized at will to show more detail; the splitter in the centre of the window can be used to re-size the panels within the window. Clicking on any tag (or using the arrow keys to navigate round the tags) in the treeview panel will provide tag detail in the right-hand panel for the immediately dependent tags (if there are any). Clicking on the plus or minus sign in the explorer window will compress or expand the node detail (the left and right arrow keys can also be used to expand or compress the currently selected node detail). If a tag has a problem with the value at the time specified, the indicator will show red; in normal circumstances the indicator will show green (the colours are, however, configurable). The values in right-hand list view panel of the window will refresh as tags (nodes) in the tree view display are selected, so these values will show the latest values in PI as the tags are selected. If more detail is required in the right-hand panel, a popup menu will display by right-clicking in the right-hand panel, and selecting the **Tag Attributes** menu. Simply select any or all of the attributes you wish to see.

A selected node in the treeview can be copied to the clipboard by selecting the option from the popup menu; the content copied is dictated by the selection from the **Attributes and Values** dialog box, or as can be currently seen in the list view panel.

The screenshot shows the 'Tag Dependencies' application window. The left pane is a treeview showing a hierarchy of tags under 'peter.alerts-rday.c'. The right pane is a listview with columns for TagName, Timestamp, and Snapshot. The status bar at the bottom shows local time, snapshot data, and server time.

TagName	Timestamp	Snapshot
PETER.ALERTS01-HOURLY.TOT	25-Oct-11 12:00:01	2
PETER.ALERTS02-HOURLY.TOT	25-Oct-11 12:00:01	2
PETER.ALERTS03-HOURLY.TOT	25-Oct-11 12:00:01	0
PETER.ALERTS04-HOURLY.TOT	25-Oct-11 12:00:01	4
PETER.ALERTS05-HOURLY.TOT	25-Oct-11 12:00:01	4
PETER.ALERTS06-HOURLY.TOT	25-Oct-11 12:00:01	2
PETER.ALERTS07-HOURLY.TOT	25-Oct-11 12:00:01	2
PETER.ALERTS08-HOURLY.TOT	25-Oct-11 12:00:01	4
PETER.ALERTS09-HOURLY.TOT	25-Oct-11 12:00:01	4
PETER.ALERTS10-HOURLY.TOT	25-Oct-11 12:00:01	2

Figure 6, Populated Form

Treeview

The asterisk will identify which of the times is being used

The status bar shows the timestamp and data retrieval settings

Current PI account

Currently connected PI server name

Listview. The columns in this panel can be selected and/or sorted.



6.1 Treeview popup menu

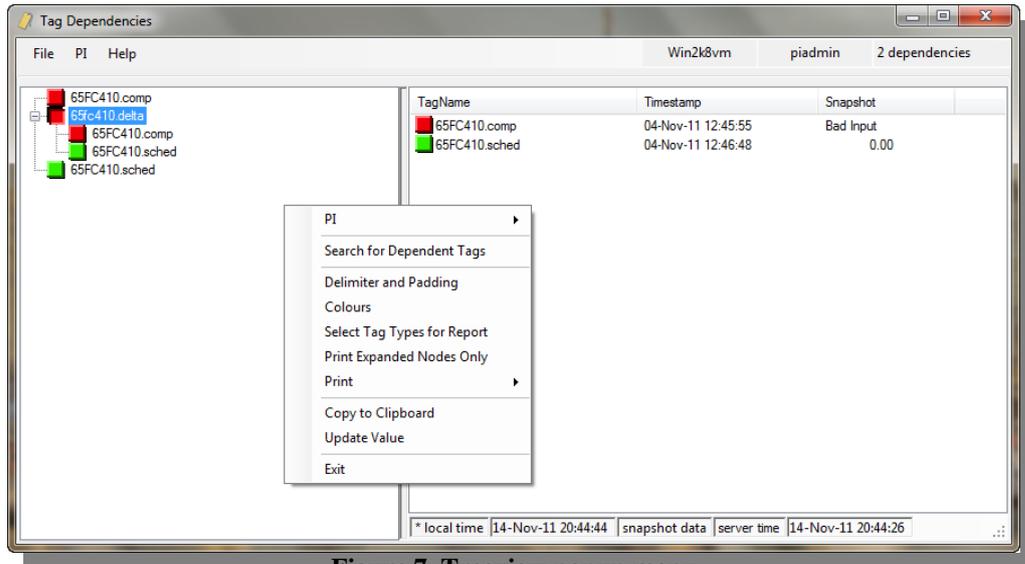


Figure 7, Treeview popup menu

6.1.1 Search for Dependent Tags

This window will list all the tags in PI that have the selected tag in the main tree view window in its calculation (and also extend the search to include the found tags in the search list recursively).

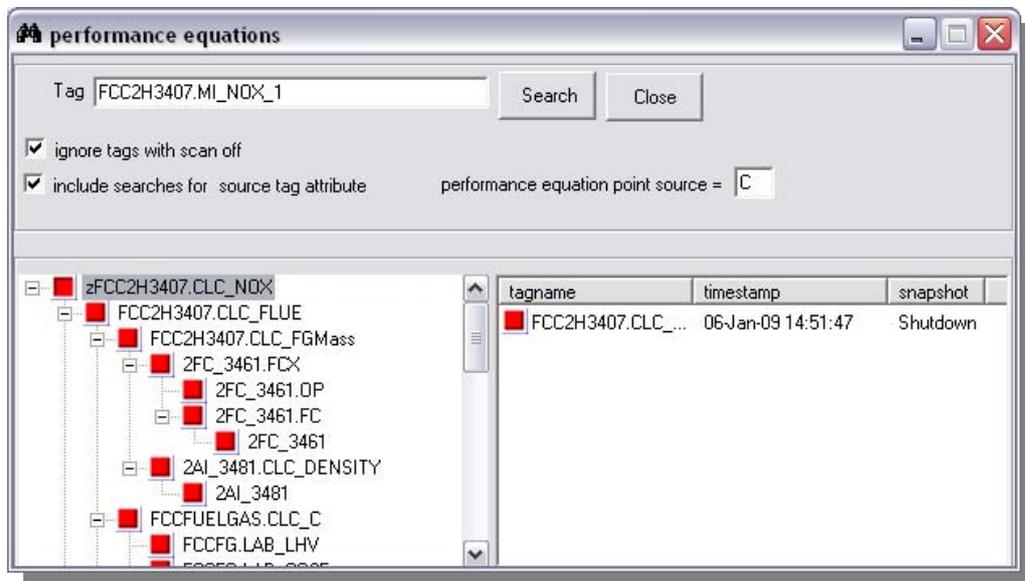


Figure 8, Performance Equation Tags

It is not necessary to have first populated the main treeview window in order to use this search, as the tag search pattern can be directly entered here before clicking **Search**.

The contents of the list view panel are determined by the attributes selected.

Right-clicking on the main tag explorer section will pop up a menu to allow printing of the display the print content can be modified by using the delimiter menu and the tag attribute menu on the main display.

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You may also change the search criteria by changing the performance equation point source (leaving it blank or placing a wild card in here will have the same effect and return all tags that meet the criteria) and/or deselecting the check boxes if desired.



6.1.2 Delimiter and Padding

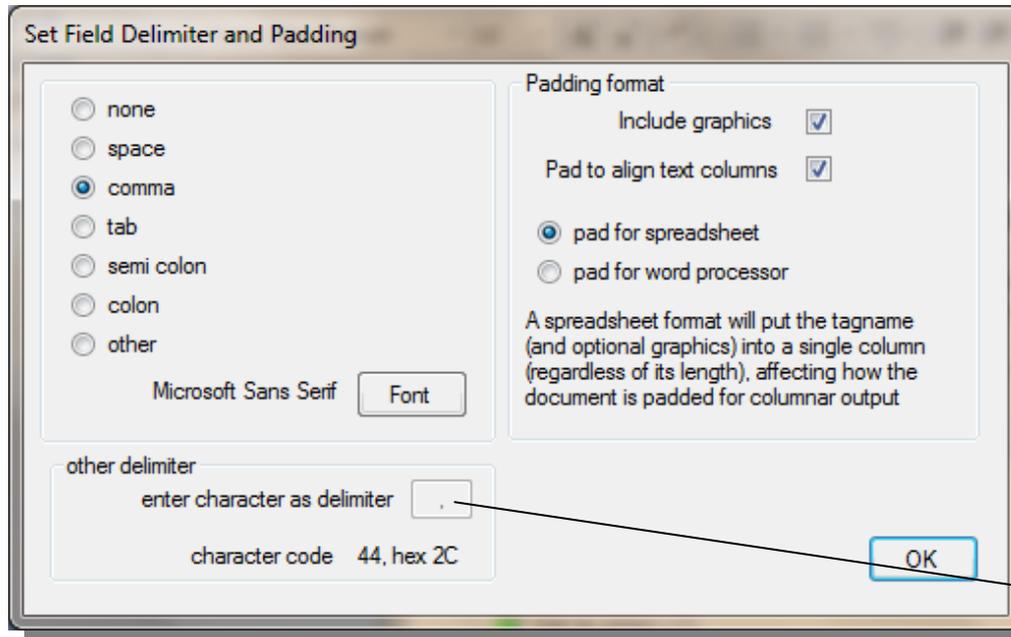


Figure 9, Setting Delimiters and Padding

This value can be changed by using the arrow keys or the mouse wheel. This box is enabled only when "other" is selected.

By changing the field delimiter character, it is possible to produce a format that can be easily imported into applications such as a spreadsheet or a database table. If the chosen option is **none**, the only field to be printed will be the tag name. The default value is **comma**.

6.1.2.1 Include graphics

By removing the tick from the **Include graphics** check box the graphics that are included to give the diagram a tree-like appearance can also be removed, allowing a text-only output.

6.1.2.2 Pad to align text columns

Ticking the **Pad to align columns** check box, will place extra delimiter characters between the tag name and the remaining attributes when printing the treeview, so that the attributes will appear in a column. It will also enable the buttons to choose the output style.

- **Pad for spreadsheet** will place the tag name (and optionally the graphics) into a single delimited column, with a single delimiter between the tag name and the rest of the attributes
- **Pad for word processor** will place sufficient delimiter characters between the tag name (and optionally the graphics) and the rest of the attributes to align the attributes into a column. The remaining attributes will not necessarily be aligned into columns.



6.1.3 Colours

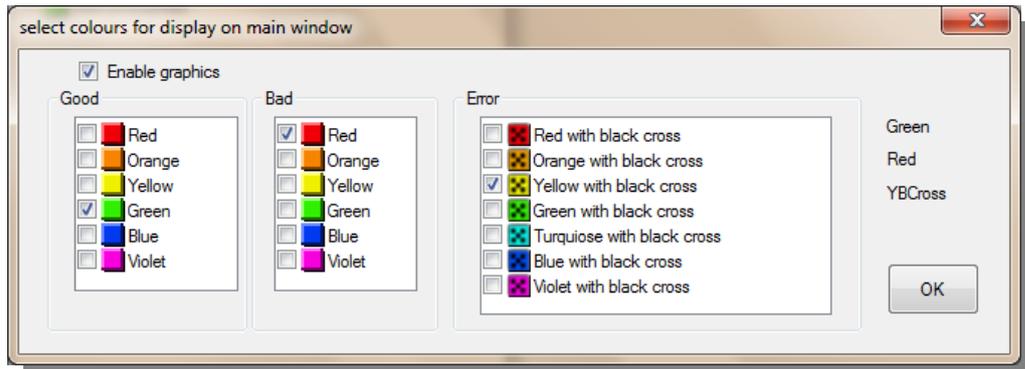


Figure 10, Colour display menu

With version 6.6 comes the ability to change the colours of the icons that are used in the treeview and listview displays. This may be useful for users with colour difficulties or even just a personal preference. If the colours are changed, it will be necessary to update the treeview display by using the tag search facility; there is no automatic refresh.

6.2 Listview popup menu

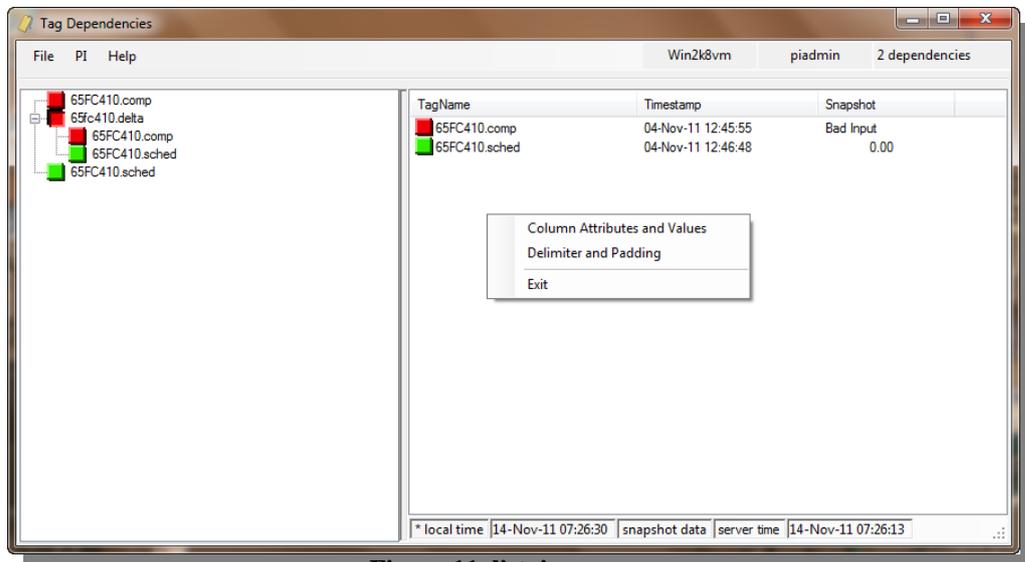


Figure 11, listview popup

The popup menu in the listview panel differs from that of the treeview panel. Perhaps the only item worth considering is the top-most item, **Column Attributes and Values**. This actually covers rather more than just attributes and values but also some formatting features such as choice of font, which is used on both the treeview and listview panels, and also by the printing feature.



6.2.1 Column Attributes and Values

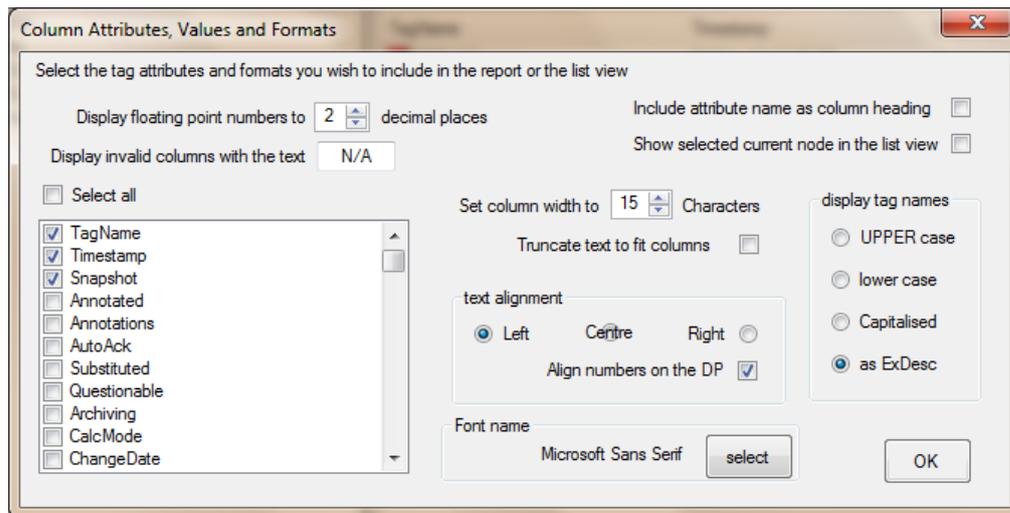


Figure 12, Selecting Tag Attributes, Values and Formats

In conjunction with the **Delimiter and Padding** menu options, a wide variety of report formats can be produced. Options are available to print more than just the tag name; all of the tag attributes are available, along with timestamp and snapshot values. Additional attributes that can be displayed include annotations and the substituted and questionable flags. The timestamp and snapshot fields are those chosen from the timestamp dialog box, so that an archive value or a snapshot can be selected.

By ticking the box **include attribute name as a column heading**, the detail will be added to the report which is a useful addition in Excel. The information could later be used, for example, in PI-SMT.

The same information selected here is used to display information in the list view panel of the main screen and optionally to include the current node in the list view. Normally the list view only display the immediate dependent tags, which would mean that the current node would not be visible in the list view (since only its dependents are listed). Checking **Show selected current node in the list view** will make these details visible in the list view. Some fields may be exceptionally long; in particular the **ExDesc** field, which can contain a long calculation formula. By checking the box **Truncate text to fit columns**, this field will be limited to the specified column width.

The other option meanings should be obvious, with perhaps the exception of the **Align numbers on the DP**. This will attempt to keep numeric fields aligned on the decimal point (so there may be some padding to make this happen); once this is aligned, then the values will be aligned in the column to meet the selected option. This may mean that centred text may be slightly skewed, but the number should still be aligned on the decimal point. Any fields that are determined to contain timestamps will have their width determined by the format of the date field in the timestamp menu option.

6.3 Problem Tag and Data Representation

Occasionally, due to tag security in PI, it may not be possible for the user to view the tag details. In which case, the tag name will be displayed with a tilde (~) prefix to the name (suggesting a problem) and the graphic symbol will be a black cross on a yellow background, and no further information will be retrieved. Another reason this may happen, of course, is if there is an error in the **ExDesc**, and the tag doesn't exist in PI at all. This application will have no way of determining which of these two conditions is causing the problem. Reasons for this display include: -



1. The user has insufficient privilege in PI to view the details
2. The **ExDesc** of the parent tag has a typing error in it
3. The tag does not exist in PI

There may be other times when the list view panel fails to display all the attributes requested; the data in this panel fall into two categories: -

1. Data (timestamp and snapshot) and
2. Attributes

The data may be absent and the rest visible; if this is the case, suspect that the data access security in PI prevents access. Likewise it may be possible to see the data but not the attributes; in which case suspect the PI point access security prevents access (this will also prevent the tag itself from being visible). Solutions to these problems lie with the PI administrator, or by using a correctly privileged account.

tagname	timestamp	snapshot
SRUA.CLC_SO2F_0	06-Jan-09 14:51:47	Shutdown
ZZS_34116A	06-Jan-09 14:51:45	Shutdown
2FC_3403A	06-Jan-09 14:51:45	Shutdown
~SRUA.CLC_SO2F_1		

Figure 13, Displaying Errors

6.4 Population of List View Panel

This will be automatically populated with the immediate dependent tags from that selected in the tree view panel; this may take a little time if there are many tags to display and the display involves sorting.

The columns available in the list view panel can be selected by right-clicking in the list view panel, and selecting **Attributes and Values** from the popup menu. Clicking the column header in the list view panel will sort the rows in either ascending or descending order, alternating with each click of the column heading. Initially, no sorting is done, but once invoked, all rows in the display will be sorted; the more columns and the more rows, the longer this will take to sort, though there is usually only a short delay. From version 4.3 on, the columns in the list view may be sorted as required; there is no requirement for the tag name to be in the first column.

Rows may be multiply selected and by right-clicking, the text in the selected rows can be copied to the clipboard for use in other applications by pasting.

The look of the list view can also be changed if the user wishes by selecting the option from the popup menu, but the recommendation is to use the detailed view.

6.5 Printing the display

Printing the treeview display is a two-stage process. Once print is selected, this treeview is drawn in a separate window using a text font to represent the graphics. The printing of the treeview is best done using a fixed-width font (such as MS LineDraw or Courier New, because spaces are used to pad between lines, and with a



proportional font this will affect the layout of the text). Once the window is displayed, this can be considered a “print pre-view”, but can also be edited before the final print. The format of the display is highly configurable, and can form the basis of a text report, displaying selected tag attributes, and optionally disabling the graphics representation.

6.6 Print expanded nodes only

This item dictates how much of the tree diagram displayed in the current view is printed. The option to print only expanded nodes is toggled on and off by clicking this menu item. By default the entire tree is printed, regardless of whether or not any of the nodes are visible (expanded) in the current view. Nodes may be compressed by selecting them and then using left arrow key to hide any child nodes; nodes may be expanded by selecting them and using the right arrow key.

6.7 Print entire tree

Clicking on **print entire tree** will copy everything in the explorer window to a separate window, taking into account the print expanded nodes option (see section 6.6).

There are some basic facilities offered in the window to allow change of font, etc. The text can then be printed or copy-and-pasted into another application of choice. It is possible also to further select within the window as with any other word processing document.

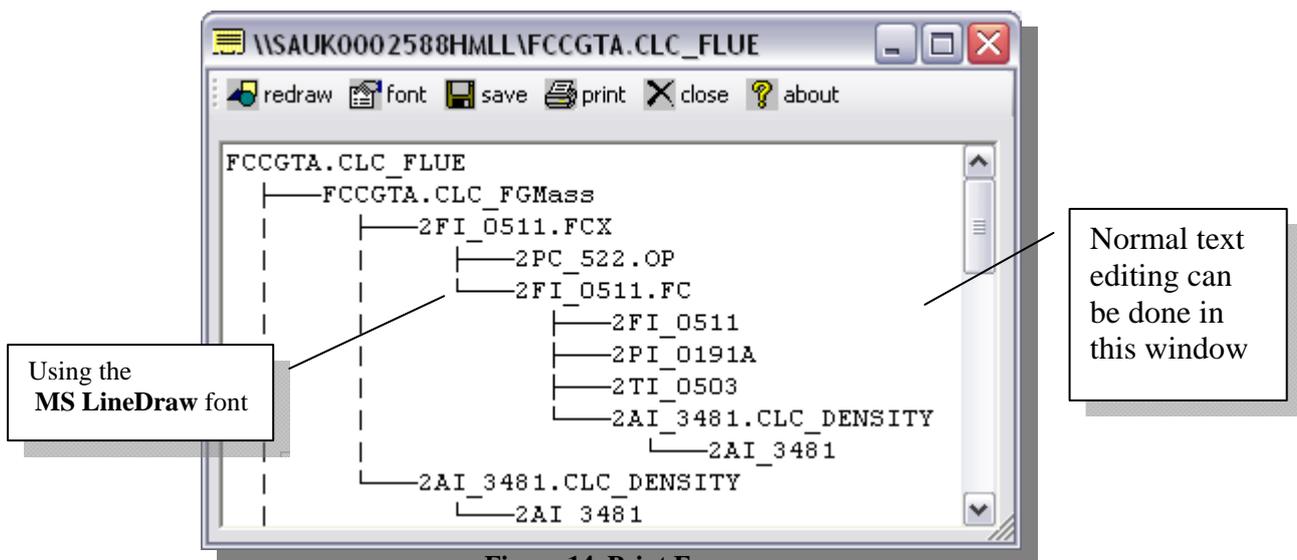


Figure 14, Print Form

- The **redraw** button will redraw the currently selected node (could be useful in restoring the diagram if any edits have been over-zealous). If the font selected is the **MS LineDraw** font then the diagram will include line graphics otherwise it uses the unicode box drawing character set.
- The **font** button allows a choice of installed fonts. Mono-space fonts (such as MS LineDraw, Courier or Consolas) work better than proportional fonts (such as Arial).
- The **save** button allow the diagram to be saved to a file in either rich text format (.rtf) or in text format (.txt).
- The **print** button will send the diagram to the selected printer (or to a file).
- The **close** button closes only this window – not the application.
- The **about** button will display version information about this utility.



6.8 Print selected node

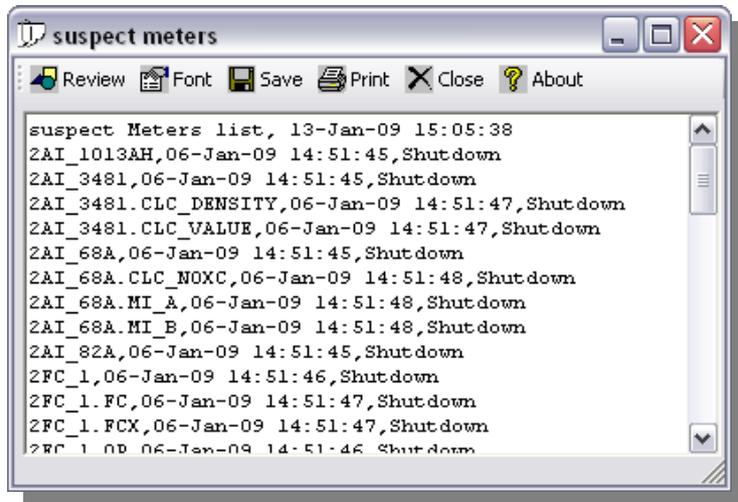
Clicking on **print selected node** will copy this node (and all its child nodes) into another text window. The editing features and toolbar functions described in section 6.7 apply.

7 Calculation tags and tuning

Using this application, it is comparatively easy to consider how any calculations should be performed. Child tags should ideally be calculated before the parent tags. The performance equation calculator should be configured with sufficient scan classes to handle the tag structure. Configuring the PI database for this exercise is a matter for the PI administrator and is not considered part of this application.

8 Print suspect meter list

This report is not necessarily a complete list of all the suspect meters in PI. To print off the list of suspect meters that exists in the explorer window, right-click any of the nodes and click **print suspect meter list** from the popup menu. This will then populate another window with the details, which can then either be printed, or copied to another application using standard windows features. The list of “suspect” meters is actually a list of any tags from the main display that show



failed; some of these may be calculation tags which rely on under-lying instrument data for the calculation. The delimiter between fields is dictated by [set delimiter](#) menu item, which has a default value of comma; if a value of none is specified the only item printed will be the instrument name.

8.1 Select tag types for report

Tags may optionally be included in the suspect meters list by ticking the boxes in the displayed window before running the suspect meters list.

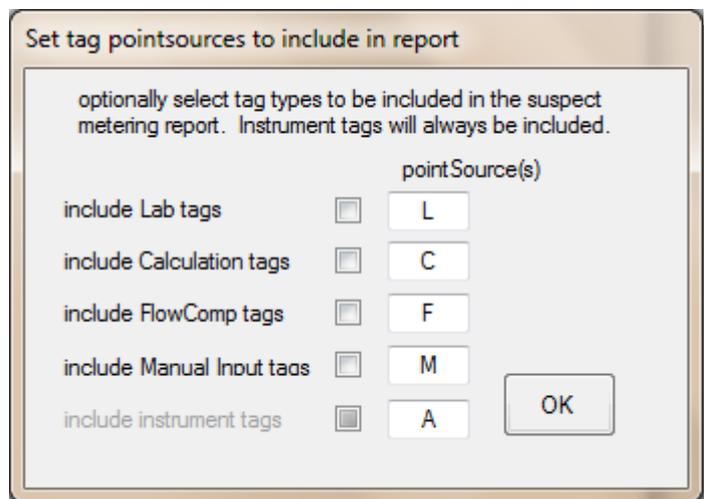


Figure 15, Defining Tags for Suspect Metering



9 Appendix

TagDepends has the ability to make limited controlled updates to performance equation tag values. If the user is granted **update** ability to TagDepends, under certain conditions extra options become available on the treeview popup menu.

1. **Update Value**, which will allow a single value update
2. **Recalculate**, which is only available if the selected treeview tag is a calculation tag (a flow-compensated tag or a performance equation tag).

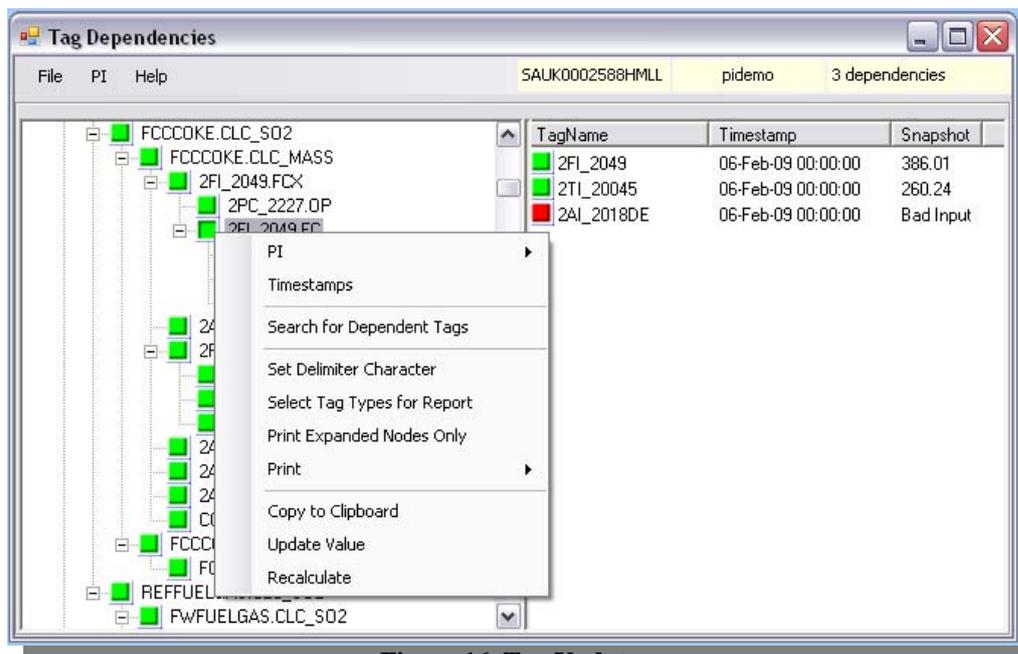


Figure 16, Tag Updates



9.1 Edit selected tag values

If a tag shows bad, the display will indicate this by showing a red marker. Occasionally, due to program or machine error, the value may be erroneous and will therefore cause knock-on failures throughout a calculation. If the user of this application has sufficient privilege in PI, this may easily be corrected in this application.

To edit a value, first select a tag in the left-hand panel, then right-click in the panel; a popup menu will display an “update value” option. Click the **update value** item to open a tag update window. The option to update a value may not always be allowed, so therefore may not be displayed.

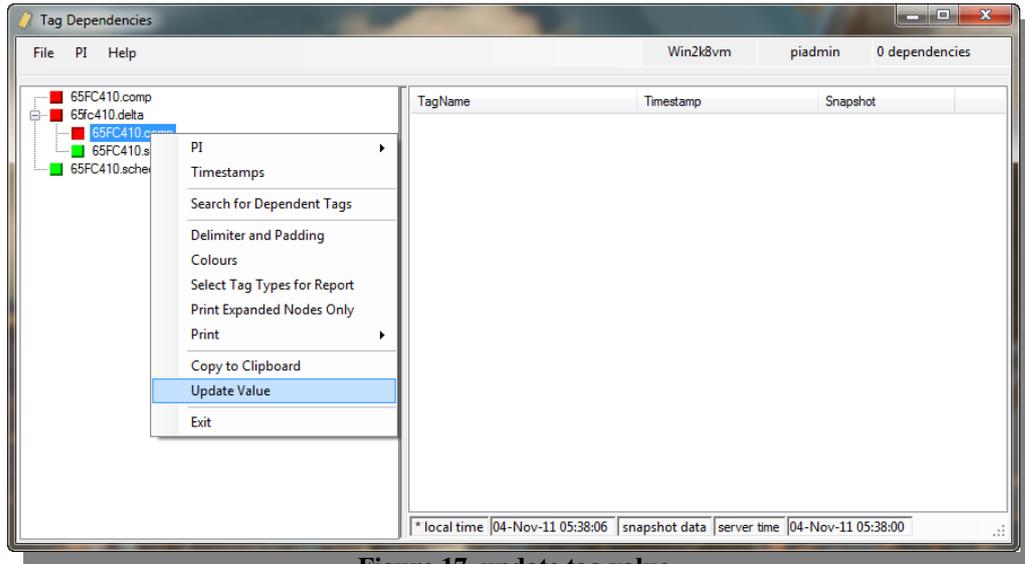


Figure 17, update tag value



9.2 Tag value update

This window will allow the edit of a single value and/or timestamp for the selected tag.

The options available are: -

1. **Replace** a value
2. **Insert** a value
3. **Delete** a value

The window will display the selected tag, its current value and timestamp, along with other useful detail such as the engineering units, and its minimum and maximum values so that a reasonable decision can be taken regarding its replacement value. Any changes made to the tag in this form will be logged in the PI message log against the current windows account. The **reason for change** field is mandatory and will be added to the audit record.

First select the appropriate tab, which will then allow the appropriate edits before clicking the appropriate button. Any status messages will be shown in the status bar at the bottom of the window.

Once this window is closed the display in the main window will automatically update to reflect the recent change.

Close this window using the cross in the top right corner.

Close this window using the cross in the top right corner.

9.2.1 Replace a value

A value can only be replaced if the timestamp between the existing value and the new value is the same.

9.2.2 Insert a value

A value can only be inserted if the timestamp differs from the existing timestamp; the value may or may not be the same as that shown for the selected tag.

9.2.3 Delete a value

The value to be deleted must have the same timestamp as that in the main display window.



10 Performance Equation Recalculation

By clicking the **Recalculate** menu item, the following form is displayed. The tag name displayed at the top of the form is a reminder of the calculation tag that was selected. The tag name in bold (between the **Search** and **Close** buttons, shows which tag in the tree view has been selected, and also which tag the list view time stamps relate to.

By selecting appropriate **Start** and **End** times, then clicking the **Search** button, all the time stamped values that are in PI, either for the tag in question or any of its dependents are then displayed in the list view window, and any values available in PI at those times are then displayed, along with the recalculated values. This can then be used to determine if any of the values are in error. By selecting those values in the list view display, and provided a suitable reason is given, the option to **insert**, **delete** or **replace** them can be made from the popup menu.

Examining the treeview display will show which other tags can be affected by the selected tag; this application will not automatically update the parent nodes to match selected tag; this is left to the user to make that decision.

Of course ultimately, the ability to update values will depend upon the PI security.

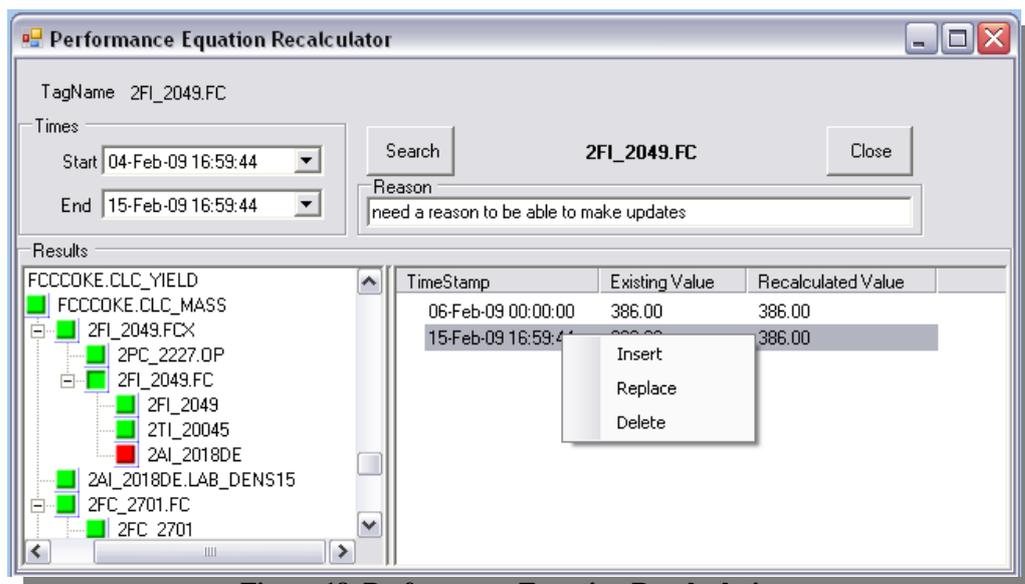


Figure 18, Performance Equation Recalculation



11 Application Configuration

This version of TagDepends has been written in VB.Net 2010. Configuration changes are saved between sessions. However, there are a couple of items that are not immediately configurable, such as: -

- Name of the audit tag that this application will update if it exists
- Forcing a login prompt to check the identity of the current user
- Allowing tag values to be updated

These options are available on the **Help About** screen by right-clicking on the Audit Tag area to display a popup menu from which these items may be modified. The login prompt will, of course, only happen when the application is restarted. Just because the option to edit tag values is enabled here does not guarantee that edits will be allowed; this will ultimately be decided by the PI administrator.

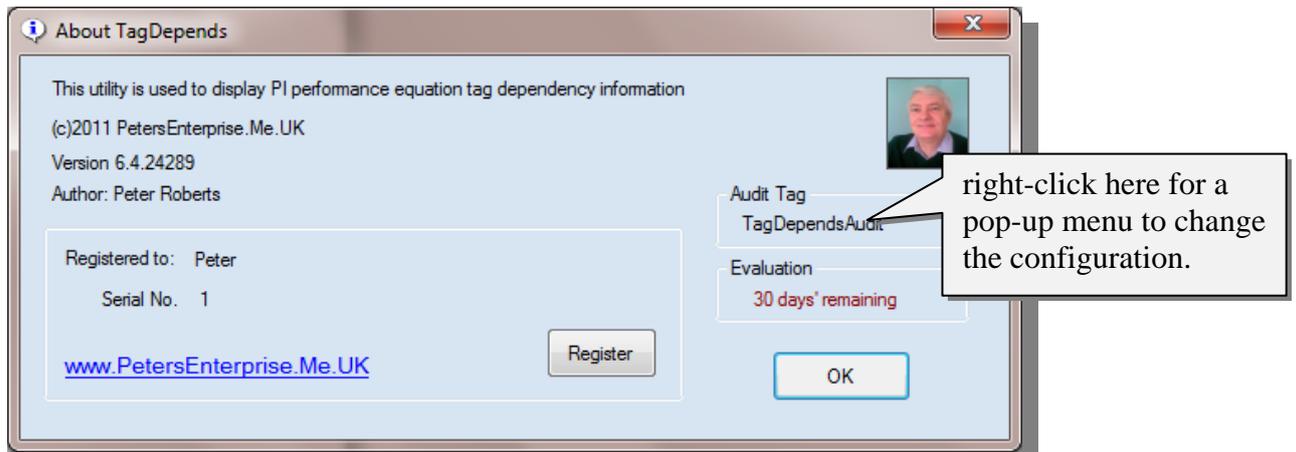


Figure 19, Help About and Registration Details



12 Product Registration

To obtain a serial number to register the product it is necessary to email the author of this application. The serial number will take the form xxxx-xxxx-xxxx-xxxx, and may be longer than the example shown.

A screenshot of a Windows-style dialog box titled "Enter the registration details". The dialog box has a light grey background and a dark grey border. Inside, there is a text area with the following text: "Enter your registration details as provided. You can email proberts@petersenterprise.me.uk who will provide the details on request." Below this text are two input fields. The first is labeled "Registered to:" and contains the text "Peter". The second is labeled "Serial No.:" and contains the number "1". To the right of the input fields are two buttons: "Register" (highlighted with a blue border) and "Cancel".

Figure 20, Product Registration

12.1 Contact details

The author may be contacted via email, proberts@petersenterprise.me.uk