TrendWorX

smar - FIRST IN FIELDBUS

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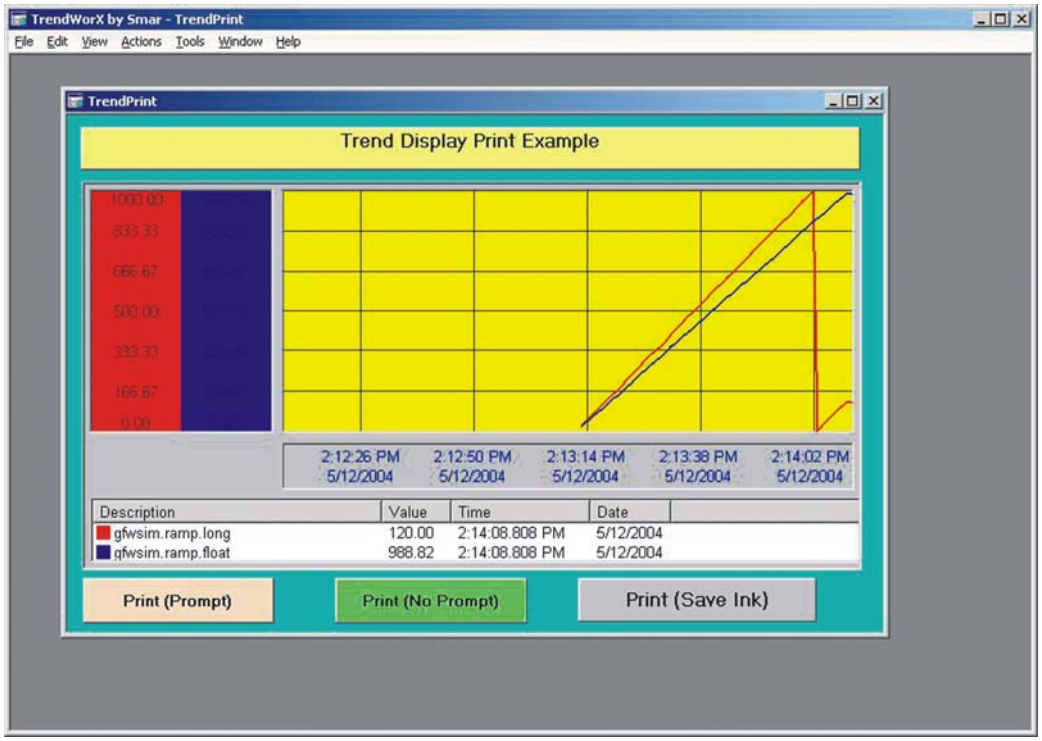
TrendWorX

VERSION 7.1

FOUNDATION

USER´S GUIDE

TrendWorX



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web: www.smar.com

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Chapter 1

Main and Containers

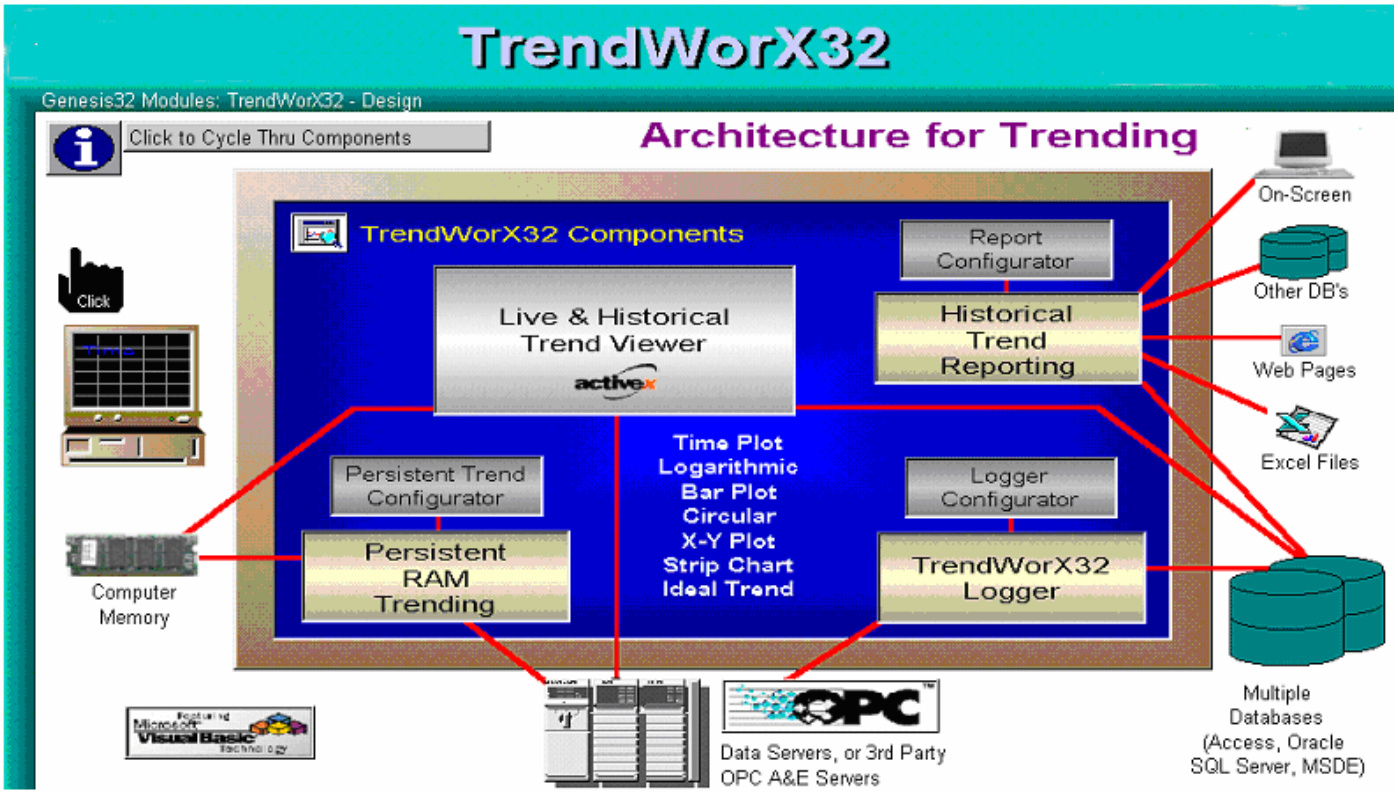
Introduction

TrendWorX™ is a powerful collection of real-time trending, historical data logging, reporting, and analysis tools that seamlessly integrates with enterprise-wide information systems. Based on the OPC Historical Data Access specification for creating Plug and Play historical data servers and clients, TrendWorx offers an open solution to applications requiring scalable and distributed real-time performance.

The powerful Microsoft based ADO/OLEDB data-logging provider is at the core of TrendWorx. OPC HDA provides the standard COM and OLE interface for Smar Trend ActiveX Viewer Control to display real-time and historical data, separately or simultaneously.

Several trend display types are supported, including time plots, XY plots, logarithmic plots, bar plots, the popular strip chart recorder, and even circular charts! Acquire thousands of data points and organize them into groups for very fast and efficient replay of historical and real-time information. You can use the built in Visual Basic Application to create reports, calculations, and data analysis.

TrendWorx integrates with Microsoft Access, Microsoft SQL 7.0, Microsoft SQL 2000, and Oracle using ADO and OLEDB database technologies. In addition, TrendWorx supports MSDE 7.0 and MSDE 2000.

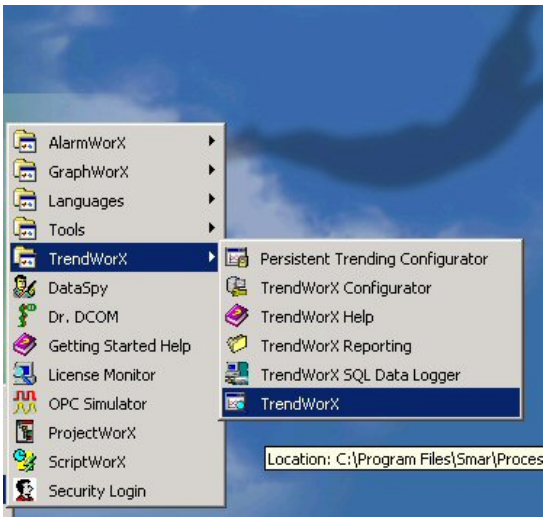


Starting TrendWorx

You can use TrendWorx Container as a stand-alone software tool connected directly to your third-party software application, or in conjunction with the Smar Control Series or Smar for Windows products available from Smar. This user's guide assumes that you are using TrendWorx as a stand-alone application accessed directly from your desktop.

Starting TrendWorx Container

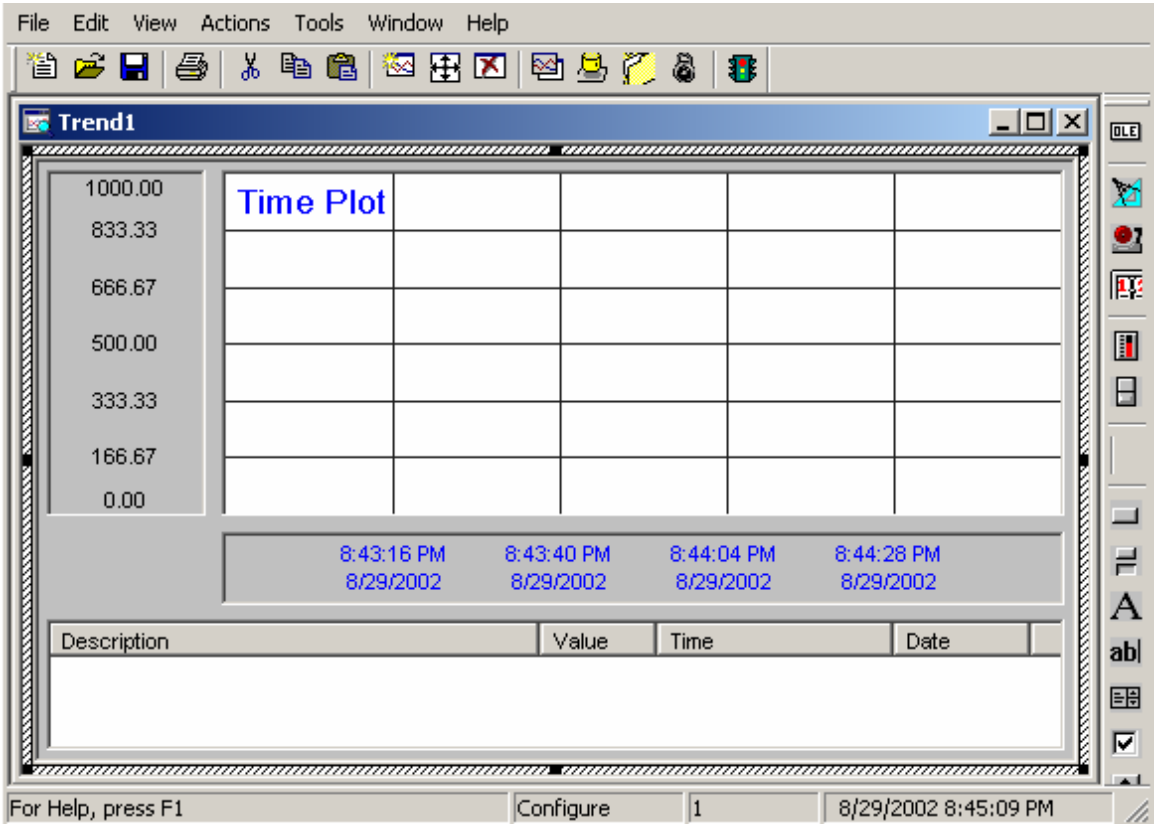
To start the TrendWorx Container from the Windows **Start** menu, select **Programs > Smar ProcessView > TrendWorx > TrendWorx,** as shown in the figure below.



Starting the TrendWorx Container

If you do not install an Smar Software License, you will only be able to run TrendWorx Container in a two hour Demo mode. If you have a software license and do not wish to run in Demo mode, make sure that the license is properly installed.

When you start TrendWorx, the TrendWorx Container screen will open and a **Trend** window will appear as shown in the figure below.



TrendWorx Container Screen and Trend Window

The table below lists the basic TrendWorx Container screen components and their functions. Refer to the **Screen Features** section for a complete description of the menu bar, toolbar, and status bar functions.

Component	Function
Title bar	Displays the name of the application and the name of the current screen displayed. To reposition the screen, click the title bar using the left mouse button and drag the screen to the desired location.
Control-menu box	Displays the Windows Control menu. Refer to your Windows documentation for more information about the control menu.
Minimize button	Reduces the window to an icon.
Maximize button	Enlarges the active application window to fill the entire screen.
Menu bar	Contains the various menus through which you can access TrendWorx Container features, such as printing and saving to a file.
Toolbar	Contains toolbar buttons for certain useful menu items.
Work area	Displays the various TrendWorx Container screens as you select them.
Status bar	Displays context-sensitive help, display mode, and the current time and date.

Using the Mouse and Keyboard

You can use both the mouse and the keyboard to control TrendWorx. This section explains how to use the mouse and lists keyboard shortcuts for TrendWorx Container.

Mouse Functions

In Windows, you use the mouse to move a pointer (usually an arrow) on the screen. The pointer shows you where you are on the screen and enables you to point to and select application items.

In the TrendWorx Container, you can use the mouse to:

- Select icons, buttons, and other screen objects.
- Resize TrendWorx Container screens.
- Reposition windows and dialog boxes.
- Scroll through list boxes.
- Display context-sensitive help in the status bar for screen objects, such as icons, command buttons, and parameter fields.

The table below lists various mouse functions and descriptions with which you need to be familiar.

Function	Description
Left-click	Position the mouse pointer over an object, such as an icon or a command button, and press the left mouse button once.
Right-click	Inside a **Trend** window, press the right mouse button once to view ActiveX properties.
Double-click	Position the mouse pointer over an object, and press the left button twice in quick succession.
Drag-and-drop	Click an object, and with the button still depressed, move the object to the desired location and release the button.
Select	Click an object once with the left mouse button, highlighting the object (enclosing the object in a rectangle with a dotted rule or in reverse color).
Move pointer over	Place the mouse pointer on top of an object, such as an icon or a command button, to display context-sensitive help for that object in the status bar.

Shortcut Keys

The keyboard is used to enter information into dialog boxes and to select menu options. The table below lists the available shortcut keys and their related functions (English version only).

Key	Function
ALT+F	Displays the **File** menu options available for the displayed screen
ALT+E	Displays the **Edit** menu options available for the displayed screen
ALT+V	Displays the **View** menu options available for the displayed screen
ALT+A	Displays the **Actions** menu options available for the displayed screen
ALT+SHIFT+T	Displays the **Tools** menu options available for the displayed screen
ALT+W	Displays the **Window** menu, which contains a list of available TrendWorx Container screens
ALT+H	Displays the available Help menu options
CTRL+N	Opens a new **Trend** window
CTRL+O	Opens an existing **Trend** window
CTRL+S	Saves the active **Trend** window
CTRL+P	Prints the current screen
CTRL+X	Cuts a selected item from the display
CTRL+C	Copies a selected item from the display

Key	Function
CTRL+V	Pastes a selected item from the display
CTRL+1	Adds a **Time Plot** to the display
CTRL+2	Adds an **XY Plot** to the display
CTRL+3	Adds a **Bar Plot** to the display
CTRL+4	Adds a **Log Plot** to the display
CTRL+5	Adds a **Strip Chart** to the display
CTRL+6	Adds a **Circular Chart** to the display
DEL	Deletes an object from the display
F12	Inserts a new object in the display
F4	Displays the properties of the active **Trend** window
F3	Shows the display preferences for the active **Trend** window
F2	Displays the application preferences
CTRL+T	Toggles all toolbars
CTRL+SHIFT+T	Displays the **Main** toolbar
CTRL+SHIFT+Y	Displays the **ActiveX** toolbar
CTRL+B	Displays the status bar
CTRL+F	Sizes an ActiveX object to the display
CTRL+G	Tiles all ActiveX objects in the display
CTRL+H	Cascades all ActiveX objects in the display
CTRL+SHIFT+G	Shows grids
CTRL+ALT+U	Displays language selections
CTRL+A	Animates the active **Trend** window in the display
CTRL+U	Activates runtime mode
CTRL+E	Activates persistent trend mode
CTRL+R	Activates reporting mode
CTRL+M	Activates logging mode
ALT+F8	Starts the Macros dialog
ALT+F11	Starts the Visual Basic editor
CTRL+W	Starts TrendWorx Configurator
SHIFT+L	Connects to TrendWorx SQL Data Logger
CTRL+K	Launches TrendWorx Persistent Trending
CTRL+Q	Launches TrendWorx History Reporting
F6	Launches security login in runtime mode
F7	Starts the Security Configurator
F8	Sets the PROCESSVIEW working directory
F1	Opens the **Help** topics file

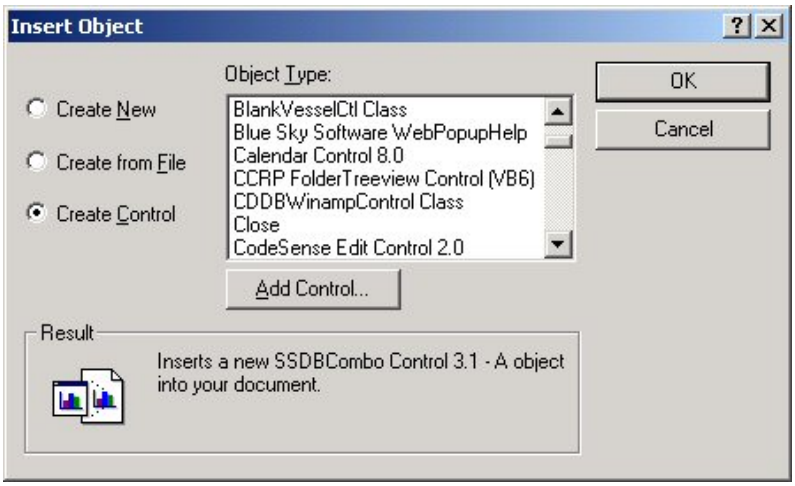
New Features in the TrendWorx Container

TrendWorx includes many new features that not only add functionality to the product but also make it easier to use. The TrendWorx Container now has Unicode support and enhanced international language support, as well as global aliasing support. The TrendWorx Container also includes VBA 6.3 integration. For a list of the new features for each application within TrendWorx, see the documentation for that application.

About the TrendWorx Container

The TrendWorx Container is a fully VBA-enabled application, which allows for a high degree of customization and functionality. A container is an application that supports embedding of ActiveX objects, which are available from the **Edit** menu and the **ActiveX** toolbar**.**

To insert an ActiveX object from the **Edit** menu, choose **Insert New Object,** or press the shortcut key **F12.** This opens the **Insert Object** dialog box, which is shown in the figure below. You can select an existing ActiveX object from the list, or you can create a new ActiveX object. You can also open the **Insert Object** dialog box by clicking the **OLE** button on the **ActiveX** toolbar. You can also insert an ActiveX object by choosing from the **Add Trend** submenu in the **Edit** menu.



Insert Object Dialog Box

Menus

This section explains the various features available from the menu bar, toolbar, and status bar that allow you to manage your database records and use TrendWorx easily and efficiently.

The menus in the TrendWorx Container enable you to change the default settings for many elements of the container. You can also use the menus to add new trends and open different elements of the TrendWorx application.

- File menu
- Edit menu
- View menu
- Actions menu
- Tools menu
- Window menu
- Help menu

Note
The **File** menu functions vary according to the screen that is displayed. (This is documented where appropriate.)

File Menu

The **File** menu commands are listed in the table below.

Note
If a **Trend** window is not open, the **Close, Save,** and **Print** commands are disabled.

File Menu Commands

Command	Shortcut Keys	Function
New	CTRL+N	Creates a new trend display.
Open	CTRL+O	Opens an existing trend display.
Close		Closes the current trend display.
Save	CTRL+S	Saves the current display file.
Save As		Saves current display file with a new name or file extension.
Print	CTRL+P	Prints the current trend display.
Print Preview		Displays a preview of the screen before printing.
Print Setup		Configures printer settings.
Recent File		Lists the last four files opened in TrendWorx.
Exit		Closes the application.

Edit Menu

The **Edit** menu commands are listed in the table below.

Edit Menu Commands

Command	Shortcut Keys	Function
Cut	CTRL+X	Cuts the selected object from the current view and places it on the clipboard.
Copy	CTRL+C	Copies the selected object to the clipboard.
Paste	CTRL+V	Pastes the last object placed on the clipboard.
Paste Special		Pastes the last object placed on the clipboard (with special options).
Add Trend		Provides a selection of supported Trend ActiveX Viewer styles that you can insert directly into the **Trend** window.
Time Plot	CTRL+1	Adds a time plot to the display.
XY Plot	CTRL+2	Adds an XY plot to the display.
Bar Plot	CTRL+3	Adds a bar plot to the display.
Log Plot	CTRL+4	Adds a log plot to the display.
Strip Chart	CTRL+5	Adds a strip chart to the display.
Circular Chart	CTRL+6	Adds a circular chart to the display.
Delete Object	DEL	Deletes the selected object from the Trend window.
Insert New Object	F12	Opens the **Insert Object** dialog box, which allows you to embed an ActiveX control in the Trend window.
Links		Edits linked objects.
Properties		Opens the **ActiveX Properties** dialog box.

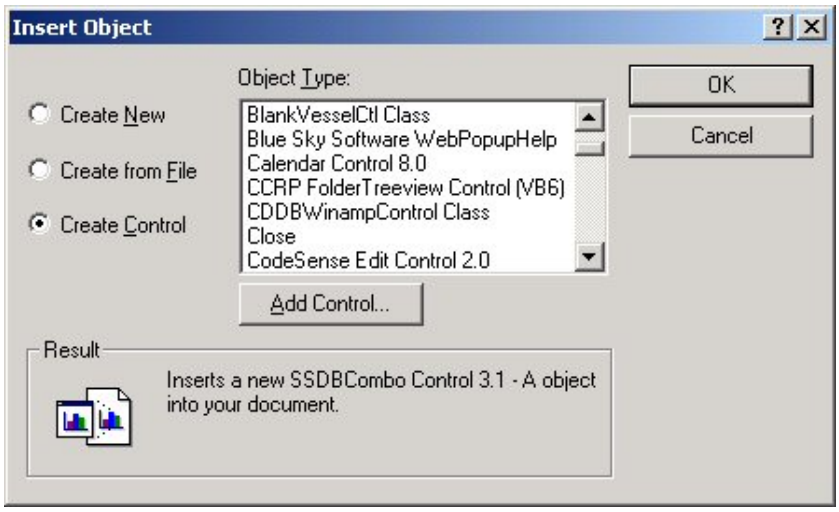
The **Cut, Copy, Delete Object,** and **Properties** commands affect the currently selected ActiveX object in the **Trend** window. The **Add Trend** submenu provides a selection of supported Trend ActiveX Viewer styles that you can insert directly into the **Trend** window. The **Paste** and **Paste Special** commands paste ActiveX objects into the **Trend** window. The **Properties** command opens the **TWXView32 ActiveX Properties** dialog box. The **Properties** dialog box is described in detail in the **TrendWorx Viewer** section.

Inserting Objects

Selecting **Insert Object** from the **Edit** menu opens the **Insert Object** dialog box, shown in the figure below, which allows you to embed an ActiveX control in the container window. Alternatively, integrated ActiveX Controls can be inserted by selecting the corresponding button on the **ActiveX** toolbar. To configure the properties for an object, either double-click on that object or right-click and select the **Properties** from the pop-up menu.

The following options are available in the Insert Object dialog box:

- **Create New:** Inserts the selected object into the container. Selecting this tab brings up the following dialog, which offers a list of object types to choose from as shown below:
- **Create From File:** Inserts a user-specified object into the container that is created from an existing file. Click the **Browse** button to select a file.
- **Create Control:** Adds an ActiveX control to the **Object Type** list. Click the **Add Control** button to browse for a file.



Inserting an Object Into the Container

View Menu

The **View** menu commands are listed in the table below.

View Menu Commands

Command	Shortcut Keys	Function
Properties Window	F4	Opens the **Properties** window, which shows alphabetical and categorical properties for the currently selected ActiveX object.
Display Preferences	F3	Opens the **Display Preferences** dialog.
Application Preferences	F2	Opens the **Application Preferences** dialog.
Toggle Toolbars	CTRL+T	Switches between the TrendWorx **Main** toolbar and the **ActiveX** toolbar.
Main Toolbar	CTRL+SHIFT+T	Toggles the TrendWorx Main toolbar.
ActiveX Toolbar	CTRL+SHIFT+Y	Toggles the ActiveX toolbar.
Status Bar	CTRL+B	Toggles the status bar, which indicates the status of the container, which mode you are in (configuration or runtime), and the date and time. When navigating through the menu items, whichever item the mouse is over will be displayed in the status bar.
Object Layout		Controls the positioning of currently selected ActiveX objects.
Size to Display	CTRL+F	Maximizes the size of the currently selected ActiveX object within the open Trend window.
Tile to Display	CTRL+G	Changes the size of all ActiveX objects to fit

Command	Shortcut Keys	Function
		them evenly into the Trend window.
Cascade	CTRL+H	Overlaps all of the open ActiveX objects.
Grid	CTRL+SHIFT+G	Toggles the grids available in configuration mode.
Select Language	CTRL+ALT+U	Specifies the language to be used in the from the **Select Language** dialog box. Select the language you wish to use for your system and click **OK.** For navigation purposes, use the radio buttons and check boxes in the **List** section.

The **Properties Window** command opens the **Properties** dialog box for the currently selected ActiveX object. The **Display Preferences** and **Application Preferences** commands open the dialog boxes for configuring the TrendWorx display and application-level preferences. The **Toggle Toolbars** command toggles both the TrendWorx **Main** toolbar and the **ActiveX** toolbar. The **Main Toolbar** and the **ActiveX Toolbar** commands toggle each toolbar individually. The **Status Bar** command toggles the status bar.

The **Object Layout** submenu controls the positioning of currently selected ActiveX objects. The **Size to Display** command maximizes the size of the currently selected ActiveX object within the open **Trend** window. This command is not available if an object is not selected. The **Tile to Display** command changes the size of all ActiveX objects to fit them evenly into the **Trend** window. This is helpful if you want to compare the data in different objects or move between objects. The **Cascade** command overlaps all of the open ActiveX objects.

The **Grid** command toggles the grids available in Design mode. The **Select Language** command opens a dialog box that enables you to select the user language. If a language resource .dll is present in the TrendWorx Bin directory, TrendWorx will automatically load the language and switch the menus and dialog boxes to the chosen language. It will also start up in that language.

Actions Menu

The **Actions** menu commands are listed in the table below.

Actions Menu Commands

Command	Shortcut Keys	Function
Animation Mode	CTRL+A	Animates or deanimates the active Trend window in the display.
Runtime Mode	CTRL+U	Activates runtime mode for all Trend windows.
Persistent Trend Mode	CTRL+E	Toggles runtime mode for the TrendWorx Persistent Trending application, if it is loaded.
Reporting Mode	CTRL+R	Toggles runtime mode for the TrendWorx Reporting application, if it is loaded.
Logging Mode	CTRL+M	Toggles data-logging mode for the TrendWorx SQL Data Logger application, if TrendWorx Container is already connected to it.

Note
You can also toggle between configuration mode and runtime mode by using the **Traffic Light** button on the **Main** toolbar. When the light is showing Red, the application is in configuration mode. When the light is showing Green, the application is in runtime mode.

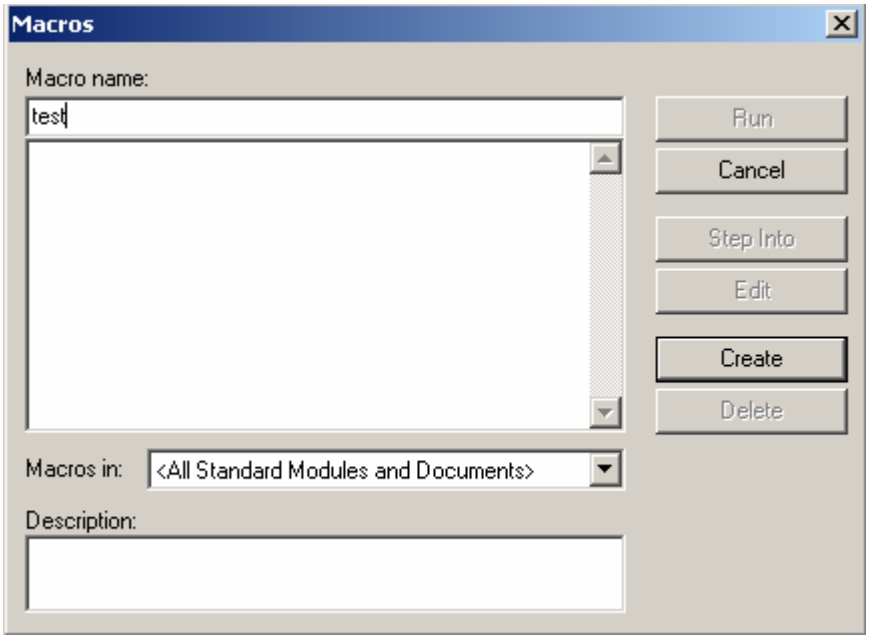
Tools Menu

The **Tools** menu commands are listed in the table below.

Tools Menu Commands

Command	Shortcut Keys	Function
Macros	ALT+F8	Runs a macro using the **Macros** dialog box.
Visual Basic Editor	ALT+F11	Opens the Visual Basic for Applications (VBA) IDE environment for developing customized VBA modules.
TrendWorx Configurator	CTRL+W	Starts the TrendWorx Configurator application, which has all the tools required for configuring data logging and provides a comprehensive set of tools for data logging monitoring and troubleshooting.
Connect to Logger	SHIFT+L	Starts the TrendWorx SQL Data Logger and establishes a connection to it. Note that, in this case, the TrendWorx SQL Data Logger will run in the background and will not be visible.
Persistent Trending	CTRL+K	Launches the TrendWorx Persistent Trending application.
Reporting	CTRL+Q	Launches the TrendWorx Reporting application.
Security Login	F6	Opens the security login screen for logging into the Security Server (runtime mode only).
Security Configuration	F7	Launches the Security Server Configurator (configuration mode only).
Set Working Directory	F8	Specifies a custom directory in which all application configuration files will be stored and retrieved.
Publish to HTML		Launches the Web Publishing Wizard, which allows you to export (generate) an HTML file based on your TrendWorx display file and/or publish the HTML file to a Web server. For more information, please see the Web Publishing Wizard Help documentation.
Configure for Windows CE		Starts TrendWorXCE configuration mode.
Windows CE Preferences		Configures settings for downloading the configuration to a Pocket PC or CE device.

Selecting **Macros > Macros** from the **Tools** menu opens the **Macros** dialog box, as shown in the figure below. Type a name for the macro and then click the **Create** button. This opens the Microsoft Visual Basic Editor, where you can create a new macro. You can run an existing macro by entering the name of the macro in the **Macro Name** field and clicking the **Run** button.



Creating and Running Macros

The **TrendWorx Configurator** command starts the TrendWorx Configurator application. The TrendWorx Configurator has all the tools required for configuring data logging, and it provides a comprehensive set of tools for data logging monitoring and troubleshooting.

The **Security** submenu allows for the configuration of the Smar Security Server, if the TrendWorx application is currently in configuration mode, or for login to the Smar Security Server, if the TrendWorx application is currently in runtime mode.

The **Windows CE** submenu refers to the capability of configuring Pocket TrendWorx displays to be downloaded to the CE device. To start TrendWorXCE configuration mode, choose **Configure for Windows CE** from the **Windows CE** submenu. The Windows CE options are not available if Pocket TrendWorX is not installed on your PC. The CE features are further explained in the Pocket TrendWorX documentation.

IMPORTANT NOTE: The TrendWorx Container has support for starting the TrendWorx Configurator, which enables TrendWorx data-logging configuration and administration. Although the Smar Security Server protects this menu action, the TrendWorx Configurator itself has not been interfaced with the Smar Security Server. It is recommended that floor operators do not have access to the TrendWorx Configurator, since they can accidentally delete data-logging configurations and/or stop data logging.

Window Menu

The **Window** menu commands are listed in the table below.

Window Menu Commands

Command	Shortcut Keys	Function
Close		Closes the active Trend window.
Close All		Closes all open Trend windows.
Cascade		Overlaps all open Trend windows.
Tile		Changes the size of all open **Trend** windows to fit them evenly into the Container screen as non-overlapping tiles. This is helpful if you want to compare the data in different Trend windows or move between Trend windows.
Arrange Icons		Arranges icons at the bottom of the window.

The **Window** menu also contains a list of all open **Trend** windows. In this list, the active window is indicated by a check mark. You can display a window by selecting it from this list.

Help Menu

The **Help** menu commands are listed in the table below.

Help Menu Commands

Command	Shortcut Keys	Function
Help Topics	F1	Launches the online help for TrendWorx.
About Application		Launches the **About Box,** which contains information about the product version number, copyright, and available disk space. It also contains information about how to contact Smar.

Printing

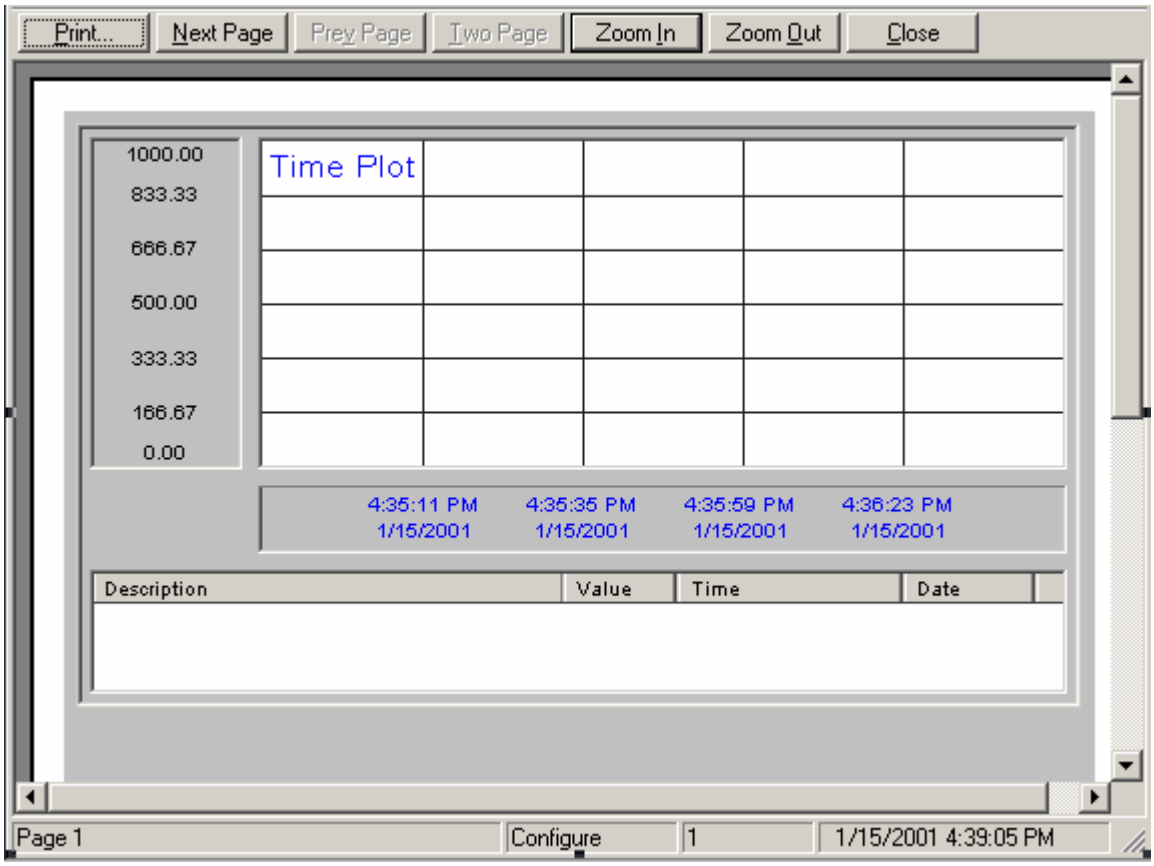
Using TrendWorx, you can perform any of the following printer functions:

- Print the current window.
- Preview the screen information before printing. Refer to the **Print Preview** section for more information.
- Print only the **Help** instructions for the currently selected trend.

To configure a printer, you need to define the appropriate parameters in the Microsoft Windows Control Panel. Refer to your Windows documentation for complete information.

Print Preview

To preview the screen information before printing, choose **Print Preview** from the **File** menu. The **Print Preview** screen will appear as shown below. The figure below shows a print preview of the **Trend** window for a time plot. The title bar indicates the file that is currently displayed.



Print Preview Screen

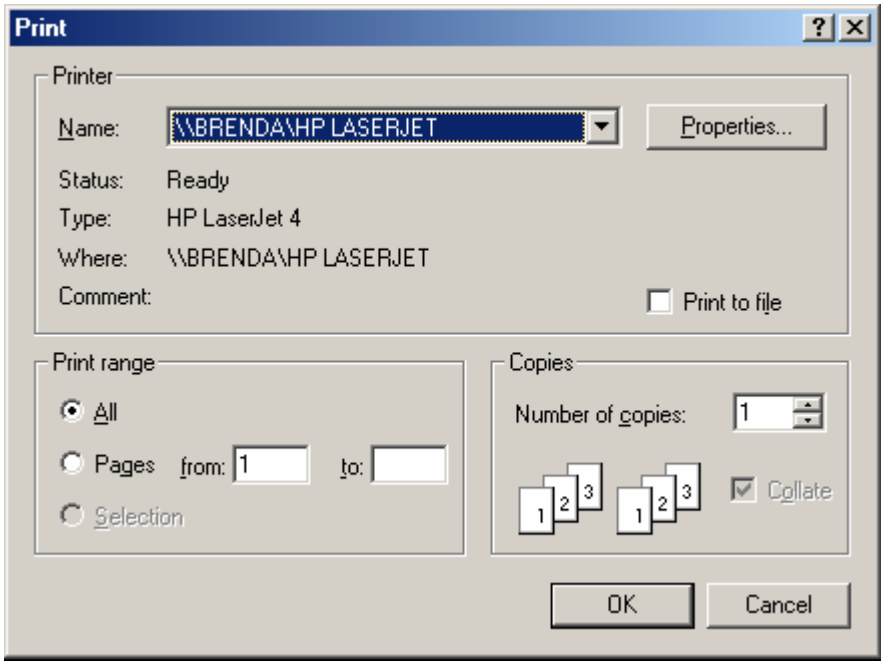
The table below lists the command buttons found in the **Print Preview** screen and their functions. These buttons enable you to view the print preview information before you print.

Button	Function
Print	Displays the **Print** dialog box
Next Page	Displays the next page in a multiple-page print preview
Previous Page	Displays the page that immediately precedes the current page in a multiple-page print preview
Two Page	Displays two pages simultaneously in a multiple-page print preview
Zoom In	Enlarges the view of the **Print Preview** screen from normal view
Zoom Out	Decreases the view of the **Print Preview** screen to a full-page view, enabling you to see how the entire printed page will look
Close	Exits the **Print Preview** screen and returns to the normal view

To print the document, click **Print** to display the **Print** dialog box. For more information on printing, refer to the **Printing Screen Information** section. If you decide not to print, click **Close** to exit the Print Preview screen.

Printing Screen Information

To print the information on the screen, choose **Print** from the **File** menu, or press the shortcut keys **CTRL+P.** The **Print** dialog box will appear on the screen as shown below. When you are ready to print, click **OK.** TrendWorx prints all records contained within the scroll window on the screen. \



Print Dialog Box

When the information is sent to the print queue, the **Printing Status** dialog box appears on the screen. The **Printing Status** dialog box indicates the number of records printed and the page that is printing.

The **Print** dialog box indicates the configured printer to which this information prints. Refer to your Windows and printer documentation for complete information about how to configure a printer.

Cancel Printing

To cancel printing, click Cancel in the Printing Status dialog box. This immediately halts printing, and the print job is removed from the print queue.

Status Bar and Toolbars

The status bar and toolbar are objects in the TrendWorx Container screen. The information contained in the status bar varies depending upon the current screen displayed and the current system configuration and activity. The toolbars provide a convenient way to choose commands that are also available in the menu bar.

Status Bar

The status bar, shown in the figure below, is located at the bottom of the TrendWorx screen. To display or hide the status bar, choose the **Status Bar** command in the **View** menu, or press the shortcut keys **CTRL+B.** The left side of the status bar describes the functions of menu commands as you navigate through each menu. This side also describes the functions of toolbar buttons. When you move the mouse pointer over a toolbar button, the function of the button is displayed in the status bar. The status bar also indicates the display mode (runtime or configure), the number of open ActiveX objects, the current time, and the current date.

Status Bar

Toolbars

The **Main** toolbar is located below the menu bar. As shown in the figure below, the **Main** toolbar contains buttons for different functions available in TrendWorx.

New: Creates a new trend display.

Open: Opens an existing trend display.

Save: Saves the current display file.

Print: Prints the current trend display.

Cut: Deletes current selection, sending it to the clipboard.

Copy: Copies the current selection to the clipboard.

Paste: Pastes the current contents of the clipboard.

Add Trend: Inserts a Trend Viewer ActiveX in the display.

Tile Objects: Fit all open windows into the container screen as non-overlapping tiles.

Delete: Deletes the selected object from the Trend window.

Persistent Trending: Launches the TrendWorx Persistent Trending application.

Configurator: Starts the TrendWorx Configurator application.

Reports: Launches the TrendWorx Reporting application.

Security: Launches the Security Server Configurator.

Runtime: Activates runtime mode for all Trend windows.

The **ActiveX** toolbar enables you to select Active X objects. For more information, refer to the **ActiveX Toolbar** section.

Creating New Trend Displays

You must create a new **Trend ActiveX Viewer** before adding and editing pens. Refer to the **Pens** section for more information about selecting pens. From the **Add Trend** submenu in the **Edit** menu, choose one of the following Trend ActiveX Viewer types:

- Time plot
- XY plot
- Bar plot
- Log plot
- Strip chart
- Circular chart

When you select a Trend ActiveX Viewer, it is inserted into the **Trend** window. The object type is displayed in the upper left-hand corner.

You can also click the **Add Trend** button on the **Main** toolbar to create a new **Time Plot.**

Trend ActiveX Viewer Types

TrendWorx offers the following Trend ActiveX Viewer types:

Time plot. This is a variable-versus-time plot. This is the default setting for new **Trend** windows.

XY plot. This is a variable-versus-variable plot. You can select any pen to be the *x*-axis (horizontal axis) pen.

Bar plot. This is a variable plot in bar form.

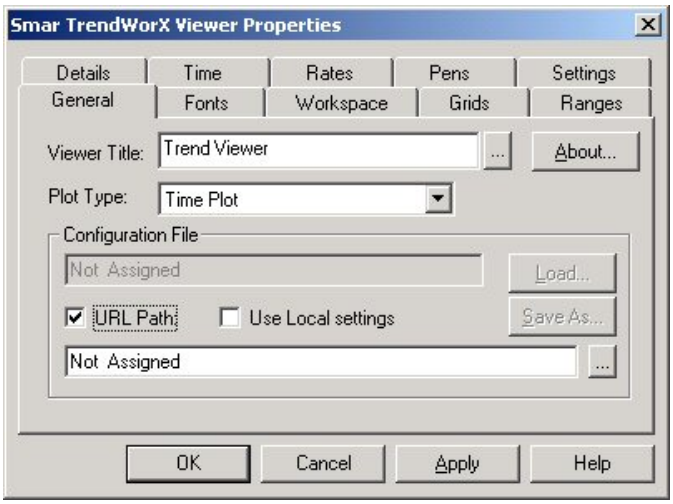
Logarithmic plot. This is a plot that uses a logarithmic scale. The ranges set in the first pen used always determine the logarithmic axis. TrendWorx determines the nearest factor of 10 and scales all grids accordingly. Any negative values are clamped to 0.10. All values in the details field at the bottom of the Trend ActiveX are displayed in decimal form, while all curves are drawn in logarithmic scale.

Strip chart. Like the time plot Trend Viewer, this is a variable-versus-time plot. However, in a strip chart the time data are plotted on the *y*-axis (vertical axis).

Circular chart. This is a plot of signal values in a circular field.

Editing Trend Windows

You can display the properties of a selected TrendWorx Viewer ActiveX by double-clicking the ActiveX object. This opens the **TrendWorx Viewer ActiveX Properties** dialog box, which is shown in the figure below. You can also open this dialog box by choosing **Properties** from the **Edit** menu. Alternatively, you can right-click using the right mouse button and select **Properties.**



Trend Viewer ActiveX Properties Dialog Box

As you can see, the **TrendWorx Viewer ActiveX Properties** dialog box contains the following tabs:

- General
- Fonts
- Workspace
- Grids
- Ranges
- Details
- Time
- Rates

- Pens
- Settings

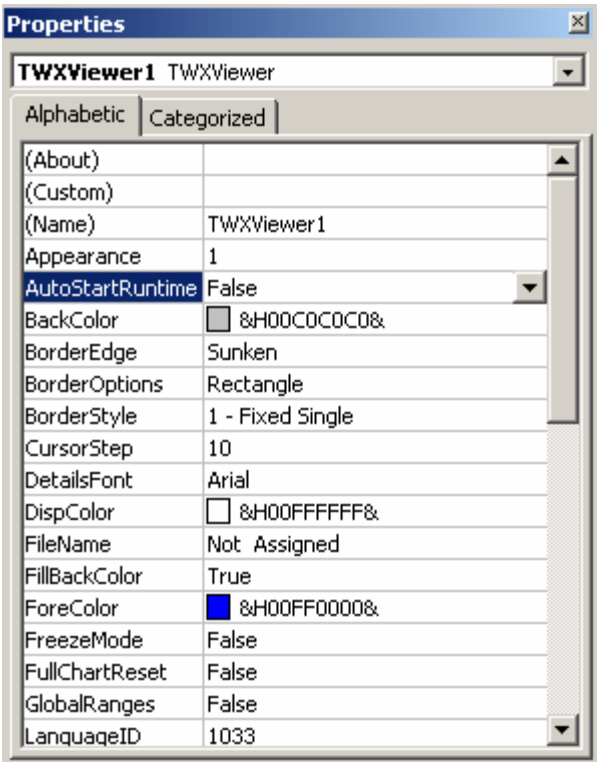
You can use these tabs to edit or modify the properties of the selected ActiveX object.

For a complete description of each of these tabs, see the **TrendWorx Viewer** documentation.

Properties Window

To view the ActiveX object properties, choose **Properties Window** from the **View** menu, or press the shortcut key **F4.** Alternatively, you can right-click using the right mouse button and select **Show Property Window** from the menu. Each of these commands opens the **Properties** window, which is shown in the figure below.

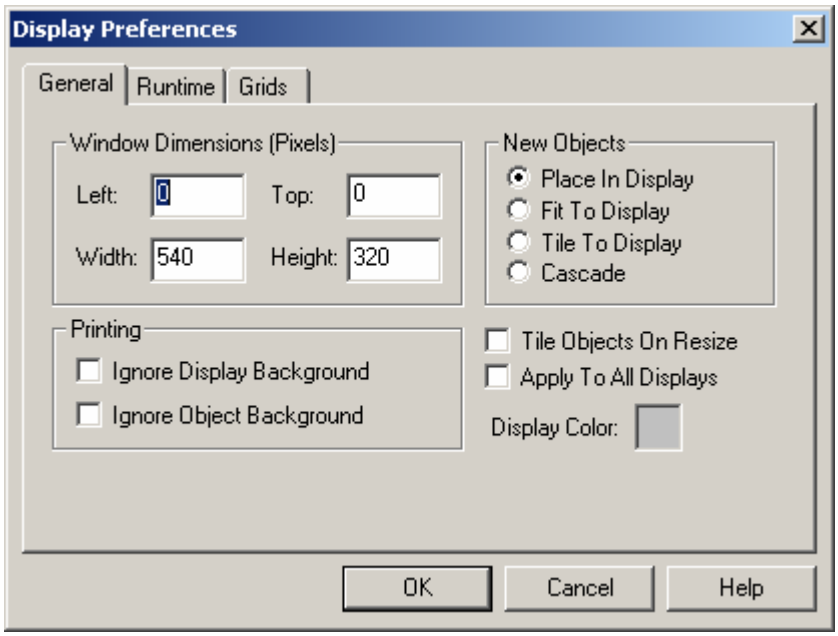
The **Properties** window contains all configurable options for the selected ActiveX object or the entire display. You can switch between ActiveX objects by choosing them from the drop-down list at the top of the **Properties** window. To modify a property, click the field for that property. You can either use the available options or simply type in your changes.



Properties Window

Display Properties

To configure the display properties, choose **Display Preferences** from the **View** menu, or press the shortcut key **F3.** This opens the **Display Preferences** dialog box, shown in the figure below.



Display Preferences Dialog Box

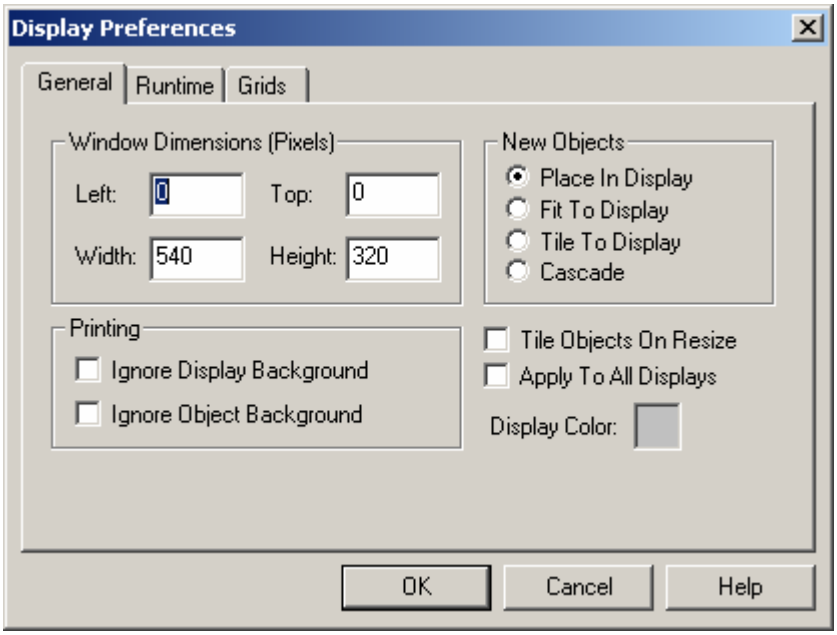
As you can see, the **Display Preferences** dialog box contains the following tabs, which enable you to modify the display:

- General tab
- Runtime tab
- Grids tab

General Tab

The **General** tab in the **Display Preferences** dialog box, shown in the figure below, enables you to:

- Set the size of the **Trend** window.
- Choose how to arrange open Trend ActiveX Viewers and/or other ActiveX objects.
- Change the display background color.
- Configure the display for printing. This last option has been implemented to save ink while printing Trend displays.



Display Preferences: General Tab

Window Dimensions
The **Window Dimensions** field specifies dimensions (in pixels) from the left and the top of the window, as well as the width and the height of the window.

New Objects
The **New Objects** section positions the object with respect to the display. You can place the object in the display, size the object to the display, tile the object to the display, or arrange the object in the cascade mode.

Printing Options
If **Ignore Display Background** is checked upon printing a display, the background color of the entire display will be temporarily changed to white. The original display background color will be restored immediately after printing.

If **Ignore Object Background** is checked upon printing a display, all background colors of each individual area within a Trend ActiveX Viewer will be temporarily changed to white. The original colors will be restored immediately after printing.

Apply to All Displays
If checked, the parameters defined in the **General** tab of the **Display Preferences** dialog box will be applied to all displays.

Tile Objects on Resize
If checked, objects in the display are automatically tiled when the display is resized.

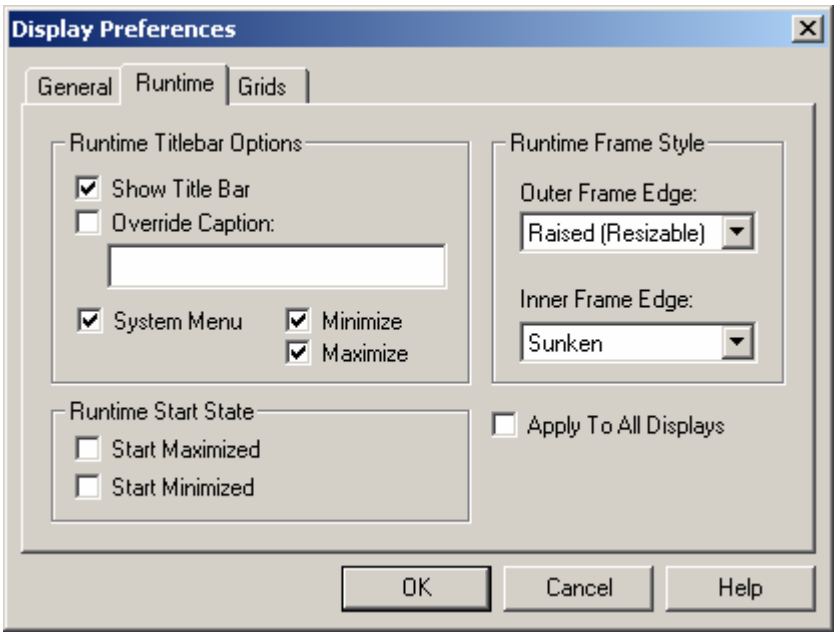
Display Color
The **Display Color** field allows you to choose a color for the display. Click the color box to open the Color Palette.

Runtime Tab

The **Runtime** tab in the **Display Preferences** dialog box, shown in the figure below, configures the way the **Trend** window will appear in runtime mode. As you can see, the **Runtime** tab contains the following features:

- Runtime title bar options
- Runtime frame style
- Runtime start state

Note
Checking the **Apply To All Displays** check box applies the settings to all currently open displays.



Display Preferences: Runtime Tab

Runtime Title Bar Options

If the **Show Title Bar** box is checked, the title bar of the **Trend** window will be displayed during runtime mode. Similarly, if the **Override Caption** box is checked, you may enter a caption that you would like to appear in the title bar during runtime.

The **System Menu, Minimize,** and **Maximize** options all refer to buttons that may appear in the title bar during runtime. When all of these boxes are checked, all of the indicated buttons show up in the title bar. If you do not want a button to appear in the title bar, simply click the box that applies to that button to remove the check mark. Hiding these buttons helps to ensure the functionality of the **Trend** window during runtime mode because the operator can neither close nor change the size of the window.

Runtime Frame Style

The **Outer Frame Edge** drop-down list enables you to choose from the following three frame styles:

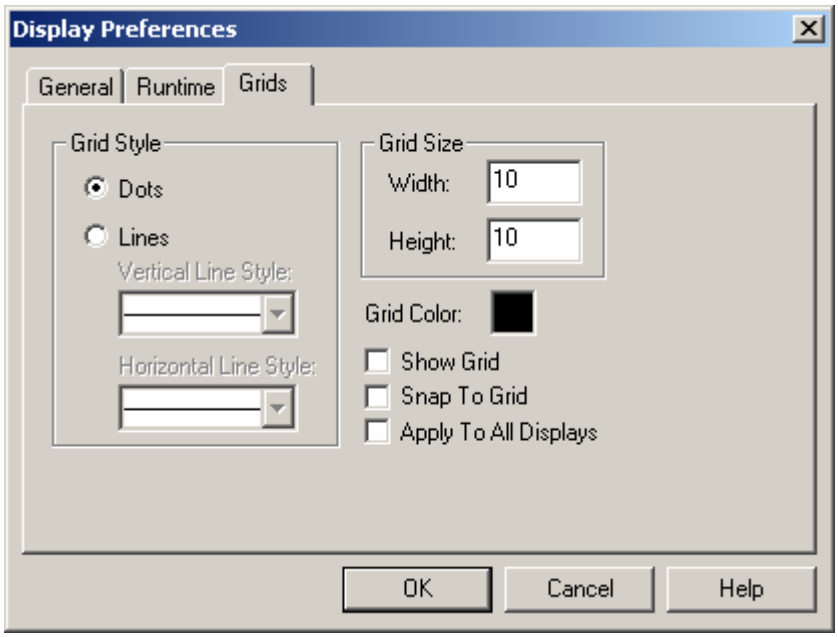
- None
- Raised (resizable)
- Raised (fixed size)

Selecting the **Raised (Fixed Size)** option helps to maintain the functionality of the **Trend** window in runtime mode because the operator is not allowed to change the configured display.
The **Inner Frame Edge** drop-down list gives you the option to have a sunken inner frame edge.

Runtime Start State
The **Runtime Start State** feature enables you to choose how the **Trend** window will appear during runtime mode. Check the appropriate box to minimize or maximize the **Trend** window.

Grids Tab

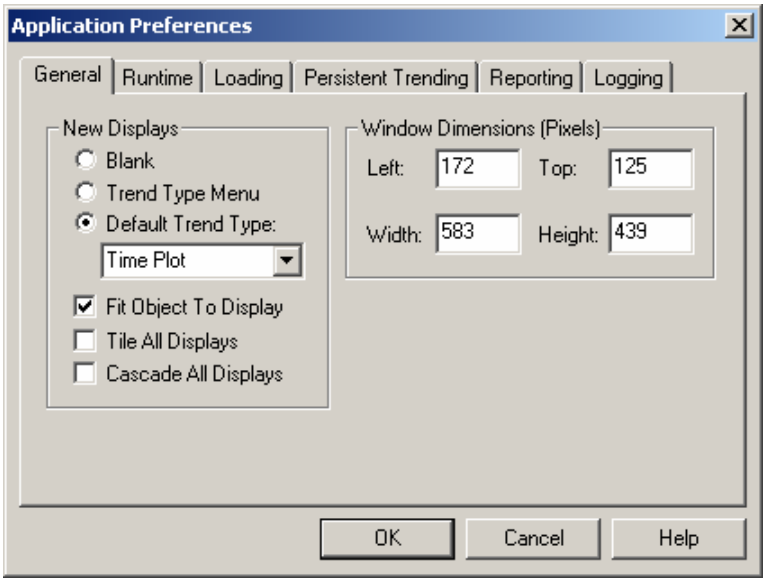
The **Grids** tab, shown in the figure below, configures the type, style, size, and color of the display grid. Selecting **Show Grid** makes the grid visible. Selecting **Snap To Grid** makes all borders of the display objects align with the grid lines when they are moved across the display area. The grids are not available when the display is in animation mode.



Display Preferences: Grids Tab

Application Preferences

To configure or change the application preferences, select **Application Preferences** from the **View** menu, or press the shortcut key **F2.** This opens the **Application Preferences** dialog box, as shown in the figure below.



Application Preferences Dialog Box

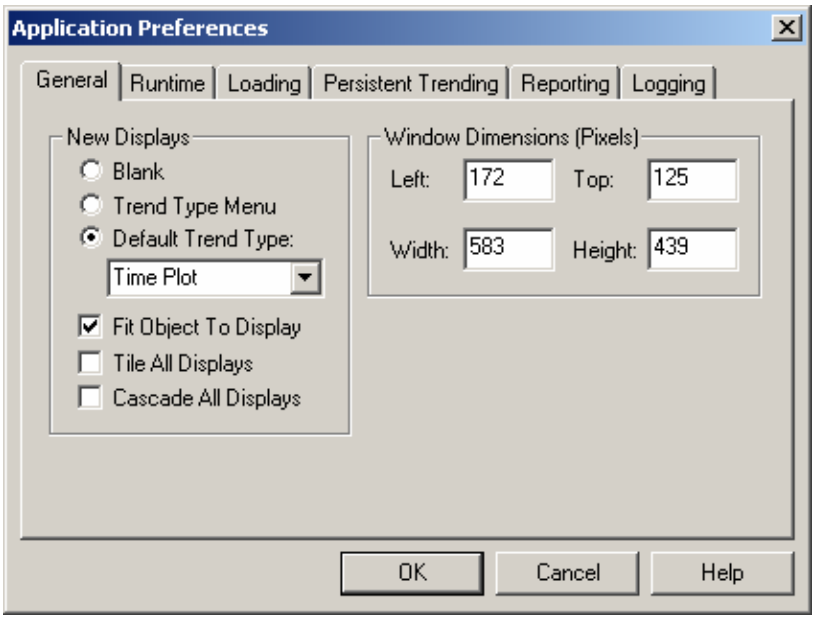
As you can see, the **Application Preferences** dialog box contains the following tabs, which enable you to modify the display:

- General tab
- Runtime tab
- Loading tab
- Persistent trending tab
- Reporting tab
- Logging tab

General Tab

The **General** tab in the **Application Preferences** dialog box, shown in the figure below, enables you to:

- Configure new displays.
- Select a default Trend type, such as a time plot or a bar plot.
- Define how a new Trend will be placed in the display.
- Define the size of the **Trend** window.



Application Preferences: General Tab

New Displays
You can choose to have the new display by default appear either as a **Blank** window or as a window with an embedded Trend Viewer.

Checking **Fit Object to Display** maximizes the size of the object in the container window.

Checking **Tile All Displays** changes the size of your objects to fit them into the evenly into the display window. This is helpful if you want to compare data in different objects or if you are moving back in forth from object to object.

Checking **Cascade All Displays** resizes all of the open objects and overlaps them so that you can see the top and left side of every open object window.

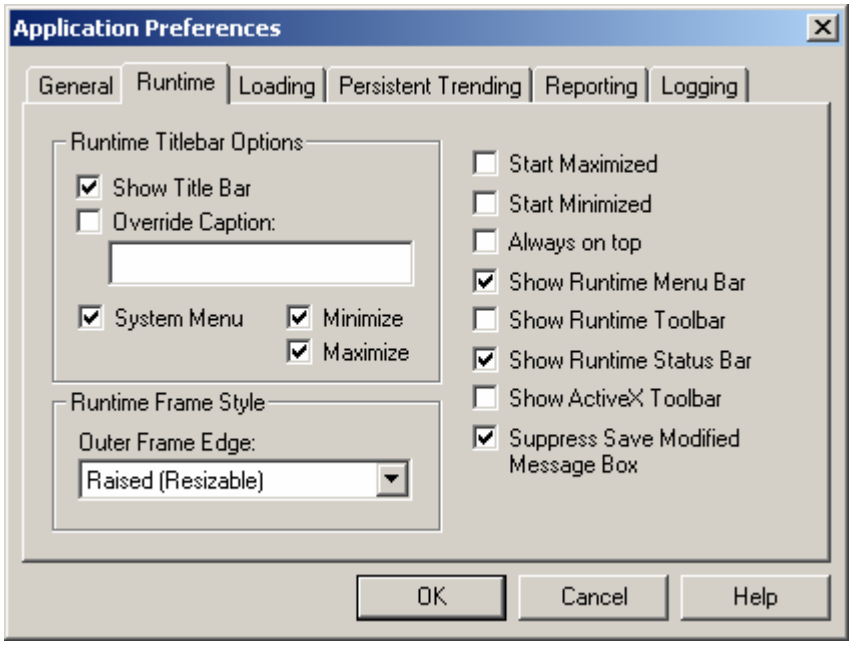
Window Dimensions
The **Window Dimensions** field specifies dimensions (in pixels) from the left and the top of the window, as well as the width and the height of the window.

Runtime Tab

The **Runtime** tab in the **Application Preferences** dialog box, shown in the figure below, configures runtime mode options for the entire TrendWorx application. As you can see, the **Runtime** tab contains the following features:

- Runtime title bar options
- Runtime frame style
- Runtime settings

The right side options allow you to decide how the application will start in runtime and how you want the application to appear in runtime mode. Additionally, the last two options let the you decide if you want to view the ActiveX Toolbar (described later) and if you want the save changes dialog to appear when you make changes in runtime and then exit the application. If the **Suppress Save Modified Message Box** check box is checked, you will not be warned to save all changes made to a display while in runtime mode, and these changes will be lost.



Application Preferences: Runtime Tab

Runtime Title Bar Options
If the **Show Title Bar** box is checked, the title bar of the TrendWorx Container screen will be displayed during runtime mode. Similarly, if the **Override Caption** box is checked, you may enter a caption that you would like to have appear in the title bar during runtime.

The **System Menu, Minimize,** and **Maximize** options all refer to buttons that may appear in the title bar of the TrendWorx Container screen during runtime. When all of these boxes are checked, all of the indicated buttons show up in the title bar. If you do not want a button to appear in the title bar, simply click the box that applies to that button to remove the check mark.

Runtime Frame Style
The **Outer Frame Edge** drop-down list enables you to choose from the following three frame styles for the TrendWorx Container screen:

- None
- Raised (resizable)
- Raised (fixed size)

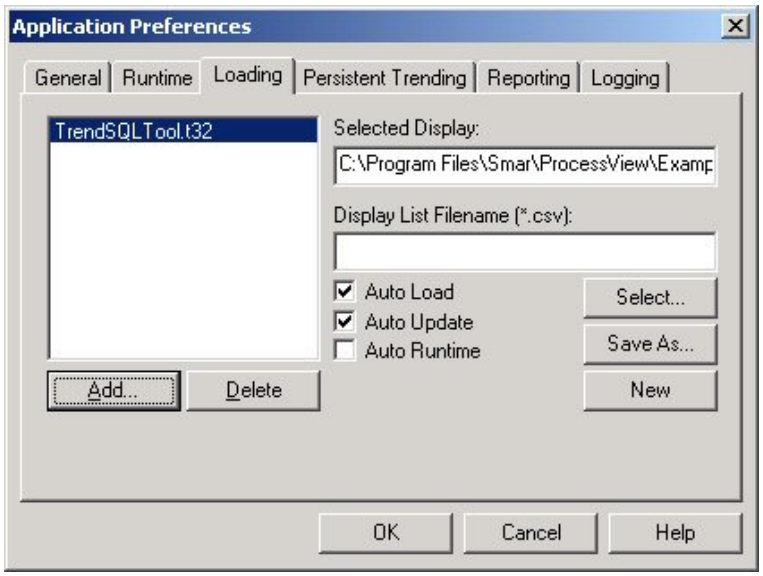
Runtime Settings
The runtime settings (listed along the right side of the **Runtime** tab) enable you to choose how the TrendWorx Container screen will appear during runtime mode. For example, check the appropriate box to minimize or maximize the TrendWorx Container screen. You can also choose whether to have menu bars, toolbars, or the status bar showing during runtime mode.

Loading Tab

The **Loading** tab, shown in the figure below, enables you to add or delete previously created Trend displays during startup. If **Auto Load** is checked, the selected displays will be loaded upon startup of TrendWorx. If **Auto Update** is checked, TrendWorx will automatically add the existing displays to the list of displays to be loaded during the next startup. If **Auto Runtime** is checked, the selected displays will automatically start in runtime mode upon startup.

You can also select displays to add to the display startup list by simply clicking **Add,** which will open a **Display** dialog box. Similarly, you can delete a display from the startup list by selecting it and then clicking **Delete.** For this feature to go into effect, the user must first save the display startup list as a .csv file. You can do this by clicking **Save As** to choose a directory for the .csv file that contains all the names of the TrendWorx displays to be loaded at startup. In addition, the user can click **Select** to select a previously saved .csv file with the names of displays to be loaded the next time

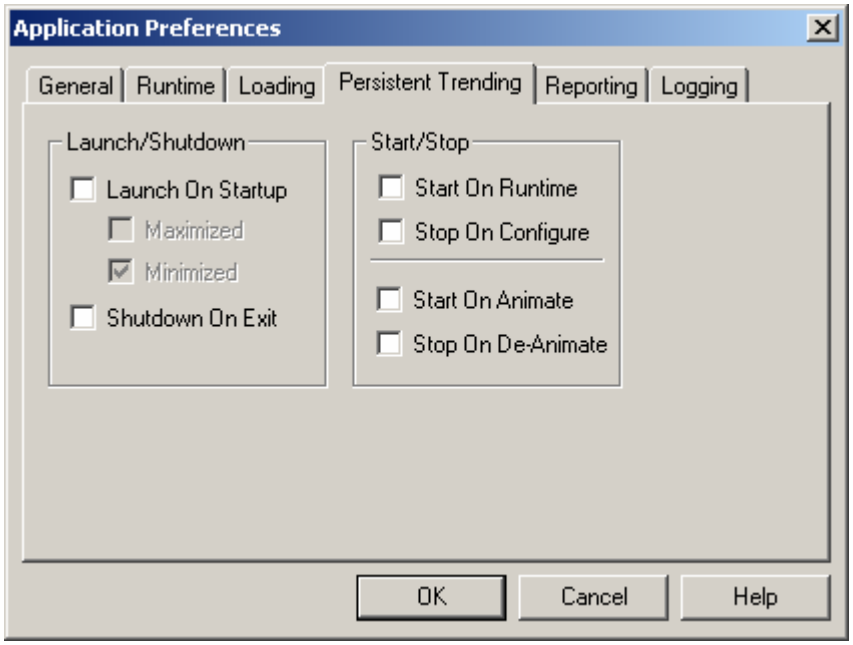
TrendWorx starts up.



Application Preferences: Loading Tab

Persistent Trending Tab

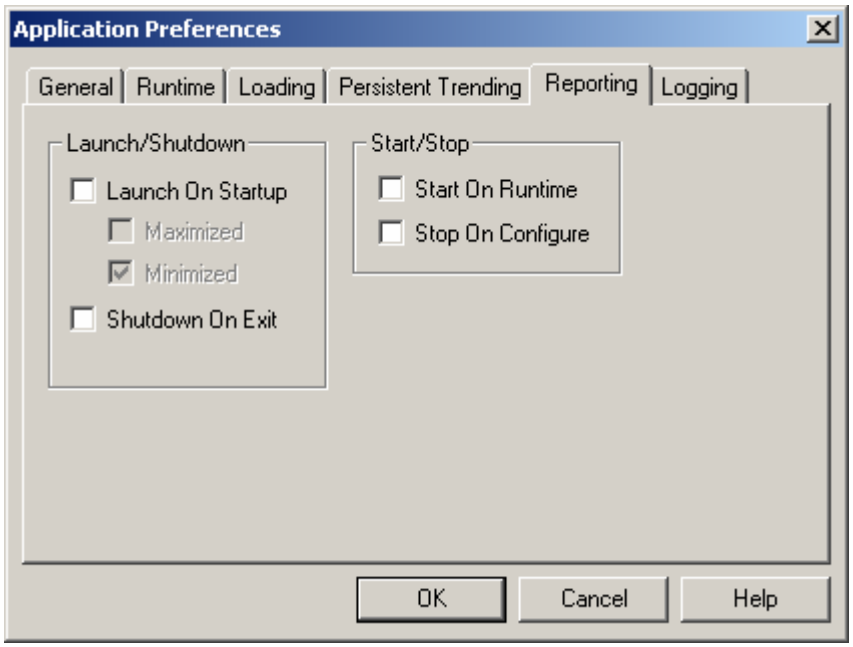
The **Persistent Trending** tab, shown in the figure below, sets when TrendWorx Persistent Trending is started, stopped, launched, and shut down.



Application Preferences: Persistent Trending Tab

Reporting Tab

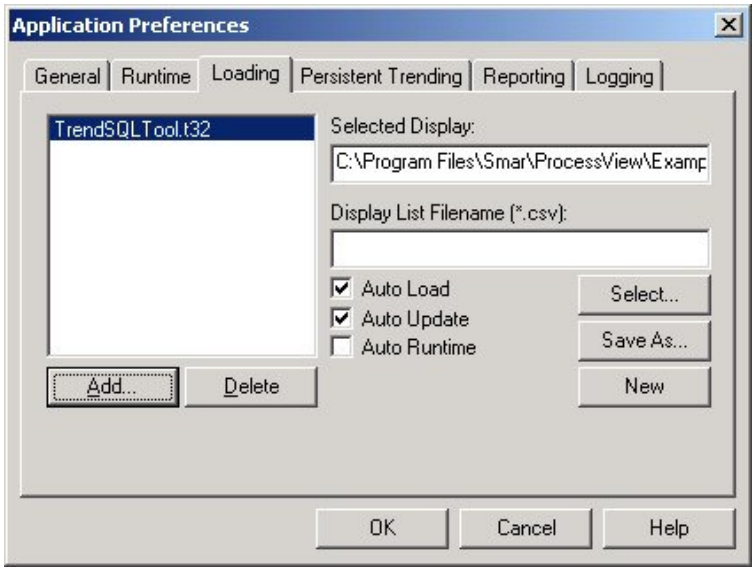
The **Reporting** tab, shown in the figure below, configures when TrendWorx Reporting is started, stopped, launched, and shut down.



Application Preferences: Reporting Tab

Logging Tab

The **Logging** tab, shown in the figure below, enables you to interface with the TrendWorx SQL Data Logger. Note that the TrendWorx Container will connect to the SQL Data Logger via a COM interface. As a result, when the TrendWorx SQL Data Logger is loaded, it will not be visible. The most important feature on this tab is the **Computer Name** field, which allows the user to choose which machine on the network they want to start the TrendWorx SQL Data Logger. It is assumed that all components are properly registered and DCOM properly configured for this function to work.



Application Preferences: Logging Tab

ActiveX Toolbar

The **ActiveX** toolbar consists of two main parts. The **OLE** button is used to display the ActiveX Control Selection dialog, while the next five buttons represent Smar ActiveX controls:

- GraphWorx ActiveX Control
- AlarmWorx ActiveX Control
- TrendWorx SQL Tool ActiveX Control
- GraphWorx Gauge ActiveX Control
- GraphWorx Switch ActiveX Control

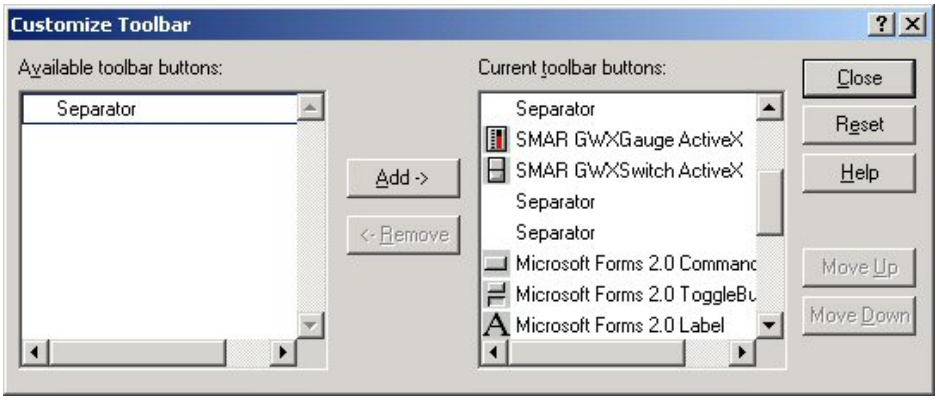
ActiveX Toolbar

The other buttons represent common ActiveX controls, which are supported by and can be referenced in VBA.

The **TrendWorx SQL Tool ActiveX Control** is an invisible-at-runtime control used to retrieve TrendWorx historical data on a per-tag basis.

Customizing the ActiveX Toolbar

You can add, remove, or relocate items on the **ActiveX** toolbar within TrendWorx. To access the **Customize Toolbar** dialog box, shown in the figure below, simply right-click the toolbar and the dialog box will appear.



Customize Toolbar Dialog Box

To remove a button from the **ActiveX** toolbar, select the button from the **Current toolbar buttons** list on the right and click **<-Remove.** Similarly, if you wish to add a button to the toolbar, select the button from the **Available toolbar buttons** on the left and click **Add->.**

Click **Move Up** and **Move Down** to relocate buttons on the toolbar. This feature is helpful because there may be a button on the toolbar that you do not use, in which case it should be removed.

Note: All functions of the **ActiveX** toolbar will either be in the list of available buttons or in the list of current toolbar buttons. It is impossible to remove a function entirely from the dialog box.

TrendWorx OLE Automation

TrendWorx Container exposes a rich and useful set of OLE Automation properties and methods. The various OLE objects exposed are:

- Application Object (Twx32App)
- Documents Object (Twx32Documents)
- Document

Application Object (Twx32App)

The **Application Object** has the following properties and methods:

Properties

- BSTR Name
- boolean Visible
- boolean RuntimeMode
- IDispatch* Application
- IDispatch* Documents

Methods

- boolean EnterRuntime()
- boolean ExitRuntime()
- void Quit()
- boolean LoadBgTrend()
- boolean ShutDownBgTrend()
- void CloseAllDocuments()

Documents Object (Twx32Documents)

The **Documents** property exposes another OLE object, which can be used to manipulate individual TrendWorx displays. It has the following properties and methods:

Properties

- long Count

Methods

- boolean Open(BSTR FilePath)
- boolean Add(BSTR Caption)
- boolean RunDocument(BSTR Item)
- boolean CfgDocument(BSTR Item)
- boolean PrintDocument(BSTR Item)
- boolean IsDocRunning(BSTR Item)
- boolean CloseDocument(BSTR Item)
- boolean CloseSaveDocument(BSTR Item)

Document

TrendWorx Container supports the following properties, methods, and events at the **Document** (Display) level:

Properties

- IDispatch* Application
- BSTR FullName
- BSTR Path
- boolean Saved
- boolean RuntimeMode
- boolean VBADesignMode
- boolean Maximized
- BSTR Caption
- boolean Visible
- boolean IgnoreBackColor
- boolean IgnoreObjectBackColor
- boolean GridsOn

Methods

- void EnterRuntime()
- void ExitRuntime()
- long NumberOfObjects()
- void Activate()
- void Save()
- void SaveAs(BSTR fileName)
- void Print() *

Note
For the document print method, use the following code in a VBA application

Events

- void Open()
- void Close()
- void Runtime()
- void Configure()
- void NewTrend()
- void NoSecurity()
- void NoKey()
- void Print()

OLE Automation Examples and Samples

The Smar ProcessView installation directory on your hard drive contains a folder called **Examples,** which contains a folder called **TrendWorx Examples.** This folder contains the following folders.

Aliasing. The files in this folder are example files demonstrating the use of the OLE Automation interface of the TrendWorx Trend ActiveX Viewer within a VBA-enabled application, such as GraphWorx, in aliasing.

EXCEL Templates. This folder contains some sample MICROSOFT Excel 2000 templates to be used with the TrendWorx Reporting Tool.

Real Time Trend Configuration. The files in this folder are example files demonstrating the use of the OLE Automation interface of the TrendWorx Trend ActiveX Viewer through a VBA-enabled application, such as GraphWorx. It demonstrates adding pens on the fly by reading pen configuration from a Microsoft Access database (.mdb) file and utilizing the OLE Automation properties of the TrendWorx ActiveX through VBA scripts.

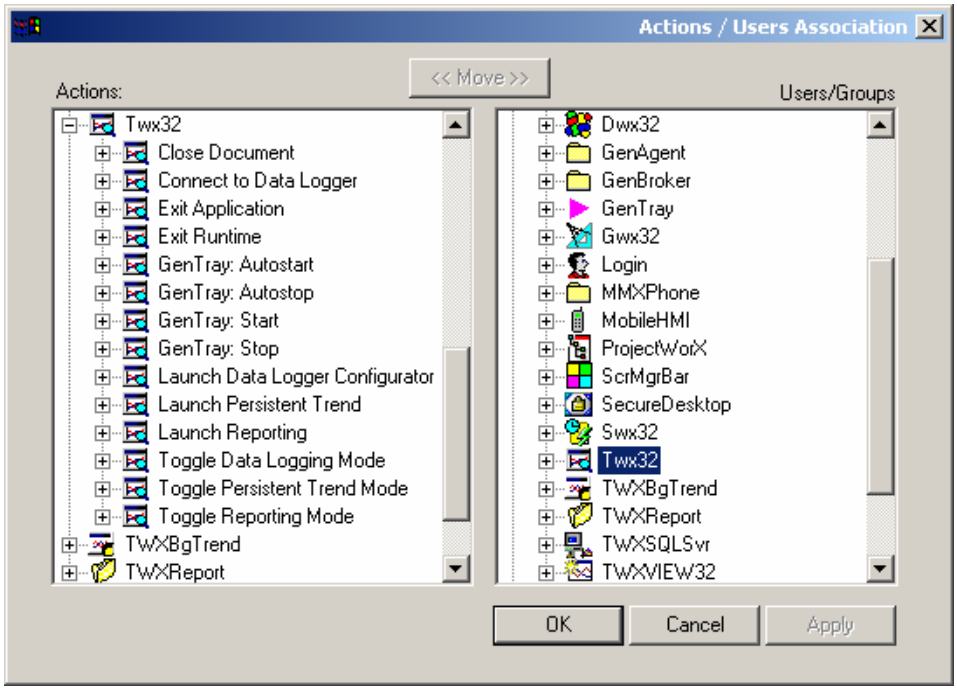
TrendWorX Data Logging and Reporting. This folder contains sample TrendWorx Data Logging Configuration, a sample historical database, as well as sample reporting and historical replay displays.

TrendWorx VBA Examples. This folder contains several TrendWorx displays that demonstrate the rich VBA OLE Automation support of the TrendWorx Trend ActiveX Viewer Control.

The **Examples** folder also contains a folder called **TrendWorX VB Samples**, which contains a folder called **Twx32.** The **Twx32** folder contains a complete Visual Basic project with source code, which demonstrates the usage of the OLE Automation interface of the TrendWorx Container. The "readme.txt" file explains how to use this sample Visual Basic application to exercise the TrendWorx OLE Automation interface.

TrendWorx Security

TrendWorx has an interface with the Smar Security Server and currently supports the security actions shown in the dialog box below.



Security Server

Important Note
The TrendWorx container has support for starting the TrendWorx Configurator application, which enables TrendWorx data-logging configuration and administration. Although the Security Server protects this menu action, the TrendWorx Configurator itself has not been interfaced to the Smar Security Server. It is recommended that floor operators do not have access to the TrendWorx Configurator, because they can accidentally delete data-logging configurations and/or stop data logging.

Downloading ProcessView Configuration Files to Your Pocket PC

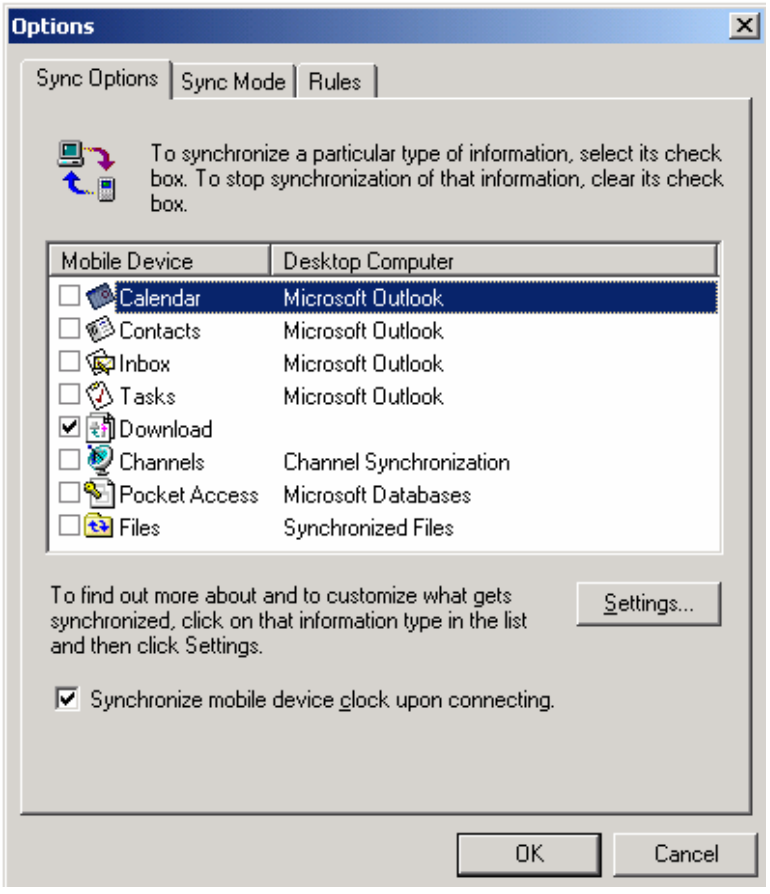
Once you have configured your application in ProcessView and saved the Pocket Smar display file, you can use the file Download to Windows CE Utility in ProcessView to download configuration files from GraphWorx, TrendWorx, and AlarmWorx to your Pocket or CE device. When developing a configuration file for a Pocket Smar application, this feature allows you to download the configuration file to a Windows CE or Pocket PC device. The file download function uses Microsoft ActiveSync to connect to the CE device.

Setting up the Download

The download to CE tool requires modules on both a desktop or workstation PC as well as a Pocket PC or CE device, because Microsoft ActiveSync services are used for connecting and authenticating the CE device.

Configuring the Desktop

The desktop is the only part that has to be configured. If the file download tool is installed properly, it will be listed in the ActiveSync Manager list of ActiveSync modules in the **Sync Options** tab of the Windows **Options** dialog box. You must enable the file download ActiveSync module in the ActiveSync Manager by checking the **Download** box, as shown in the figure below.

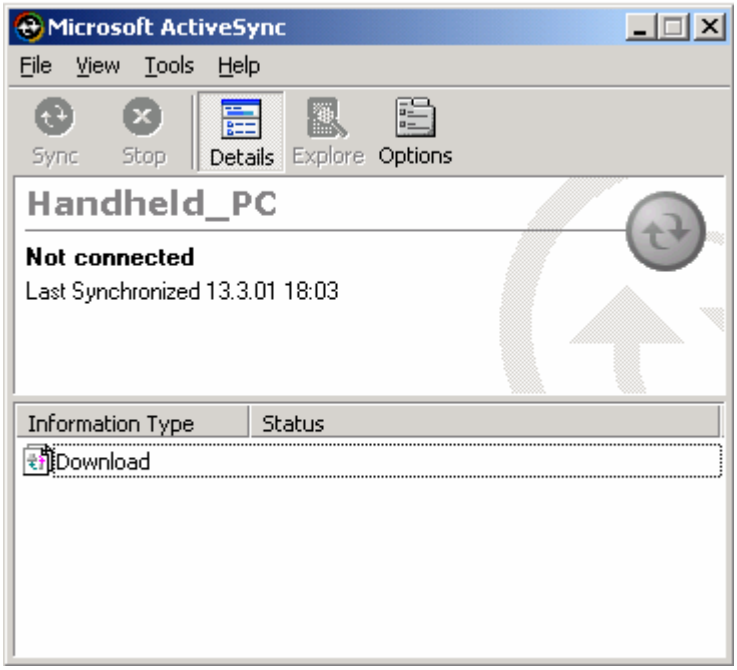


Windows Options Dialog Box

An association with the CE device must be created to synchronize the download ActiveSync modules, as shown in the figure below. When the CE device responds without any problems, the download synchronization module is active.

When enabled, the file download tool immediately downloads the configuration file for Windows CE to the CE device. When disabled, the configured file will only be saved.

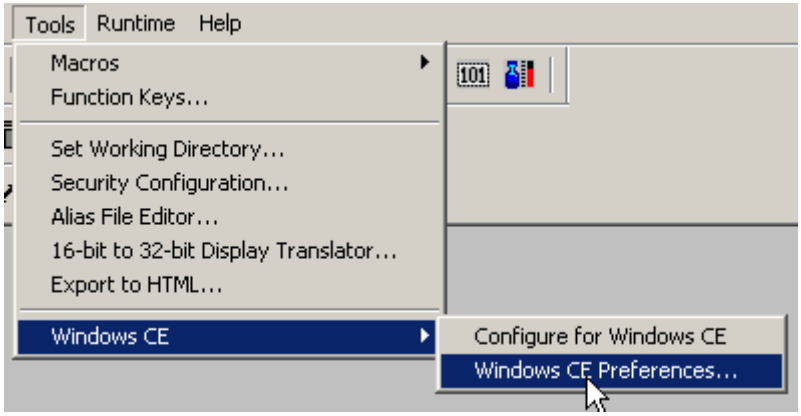
For more information about Microsoft ActiveSync services, please refer to the Microsoft ActiveSync help documentation.



Microsoft ActiveSync

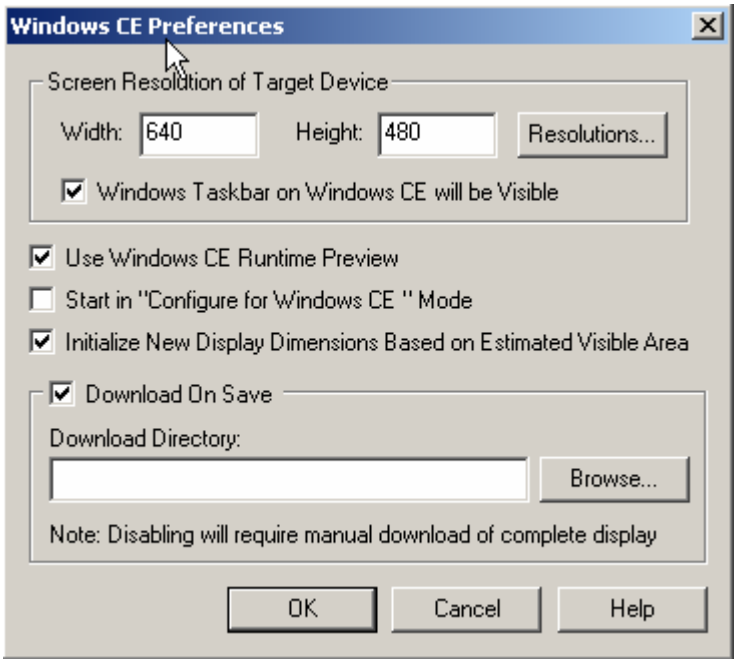
File Download Application Configuration

GraphWorx, TrendWorx, and AlarmWorx have their own version of the file download tool. In these applications, choose **Tools > Windows CE > Windows CE Preferences,** as shown in the figure below.



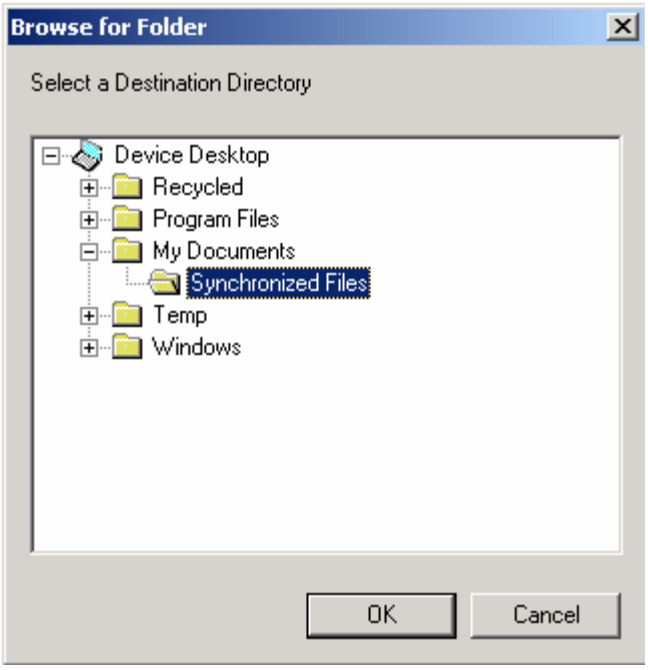
Starting the Windows CE Download Tool

This opens the **Windows CE Preferences** dialog box, which allows you to enable or disable the file download tool. To enable this tool, check the **Download On Save** check box. Then select the destination directory on the CE device by entering the path name in the **Download Directory** field, as shown in the figure below.



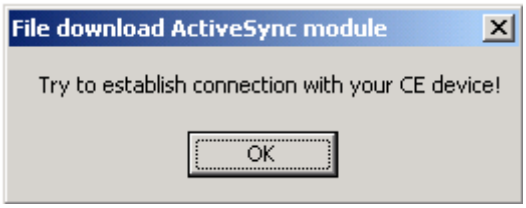
Setting Windows CE Preferences

You can also click the **Browse** button to select the destination directory. Clicking the **Browse** button opens the **Browse for Folder** dialog box, which shows the CE device directories, as shown in the figure below. A warning message box will be displayed when the file download ActiveSync module is inactive.



Browsing for a Folder on the CE Device

To establish a connection with the CE device, click **OK,** as show in the figure below.



File Download ActiveSync Module

You can also use the **Windows CE Preferences** dialog box to configure other settings for the CE device. You can set the resolution of the target device by clicking the **Resolution** button. This displays a list of resolutions from 200 x 320 up to 1024 x 768.

Downloading the File to the CE Device

When you have finished configuring a display file and would like to save it to Windows CE, choose **Save As** from the **File** menu. This opens the **Save As** dialog box.

- In GraphWorx, enter the file name and select either "GraphWorx Displays for WinCE (*.gdc)" or "GraphWorx Templates for WinCE (*.gdc)" from the **Save As Type** box.
- In AlarmWorx, enter the file name and select "AWXview32 CE File (*.awv)" from the **Save As Type** box.
- In TrendWorx, enter the file name and select "TWXviewerCE File (*.tce)" from the **Save As Type** box.

The Smar **Import File** dialog box will be displayed, indicating that the files are downloading to the Windows CE device.

Starting Pocket Smar Applications on Your Pocket PC

Once you have downloaded your GraphWorx, AlarmWorx, or TrendWorx configuration files from your desktop PC to your Pocket PC or CE device, you can run the applications on your Pocket PC. The Pocket Smar client applications (Pocket GraphWorX, Pocket AlarmWorX, and Pocket TrendWorX) are located in the Smar **/Pocket** Smar directory on your Pocket PC. Open the application you wish to run, and then select **Open** from the **File** menu. Browse for the desired .gdc, .awv, or .tce file.

Chapter 2

Logger Configurator

Introduction

The TrendWorx Configurator is used to create and maintain a tag database for use by the TrendWorx SQL Data Logger. Its main function is to perform configuration for data logging. In addition to simple tag configuration, the Configurator is used to create and maintain a process-area hierarchy and to group tags into one or more named configurations to support servers running on multiple network nodes.

The TrendWorx Configurator receives field data from any OPC-compliant data access server and performs configuration.

Using the TrendWorx Configurator, you will perform the following basic steps:

1. Open a new configuration for data logging.
2. Configure a database group, a logging group, and tags.
3. Download the configuration to the server by using the **Make Active** command on the **File** menu.
4. Start or stop data logging.

The server can read its configuration information from a Microsoft Access .mdb file, provided the relevant driver is installed on your local machine. You can select either a machine source or a file as a data source for the Configurator. This means that you have the option of selecting a data source that need not necessarily reside on your local machine. The Configurator can retrieve data either from a database on your PC (machine source) or from a database that resides on the network (file source).

About the TrendWorx Configurator

The Configurator application ("Twx32Cfg.exe") is used to make changes to the database file that the server uses for configuration information. This file is the Configurator component of the TrendWorx SQL Data Logger. The "Twx32Cfg.exe" file is installed in the ProcessView "Bin" directory.

The TrendWorx Configurator has enhanced multiple configuration support. The TrendWorx SQL Server stores its configuration data in a database file (default is .mdb file). The TrendWorx Configurator is interfaced to the TrendWorx SQL Data Logger through a COM interface. Through this COM interface, you can download configurations to the TrendWorx SQL Data Logger, start and stop data logging, and retrieve status information.

The configuration data are stored by default in a .mdb file. The Smar ProcessView installation utility installs a default configuration database, called "Twx32.mdb," which is located in the ProcessView "Bin" directory. It also installs a template file for configuration databases, called "Twx32Cfg.src," under the ProcessView "Bin" directory. By copying the file to "MyName.mdb," you can create a new configuration database. The configuration database default file and template file contain all of the defined configuration tables as well as all the used restrictions and constraints. These files should never be altered because they can violate database integrity.

Starting the TrendWorx Configurator

There are three different ways to start the TrendWorx Configurator:

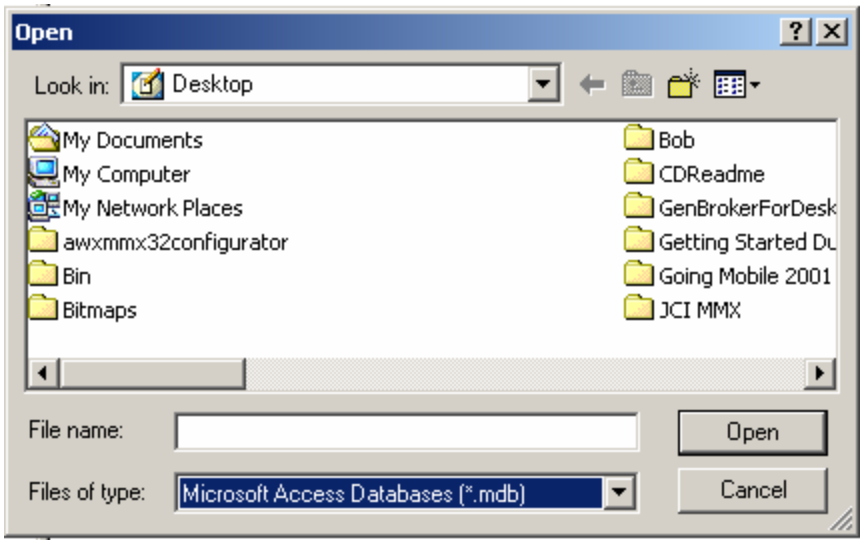
1. From the Windows **Start** menu select **Programs > Smar ProcessView > TrendWorx > TrendWorx Configurator.**
2. Open the "Twxcfg.exe" file in the "Bin" directory.
3. In the TrendWorx Container, select **TrendWorx Configurator** from the **Tools** menu, or click the **TrendWorx Configurator** button on the main toolbar.

Important Note
The TrendWorx Container has security protection on starting the TrendWorx Configurator. However, the TrendWorx Configurator itself is *not* interfaced to the Smar Security Server. Therefore, you should exercise caution when starting the Configurator because the Configurator enables you to stop data logging or even delete currently used configurations.

Once you have started the Configurator, one of the following will occur:

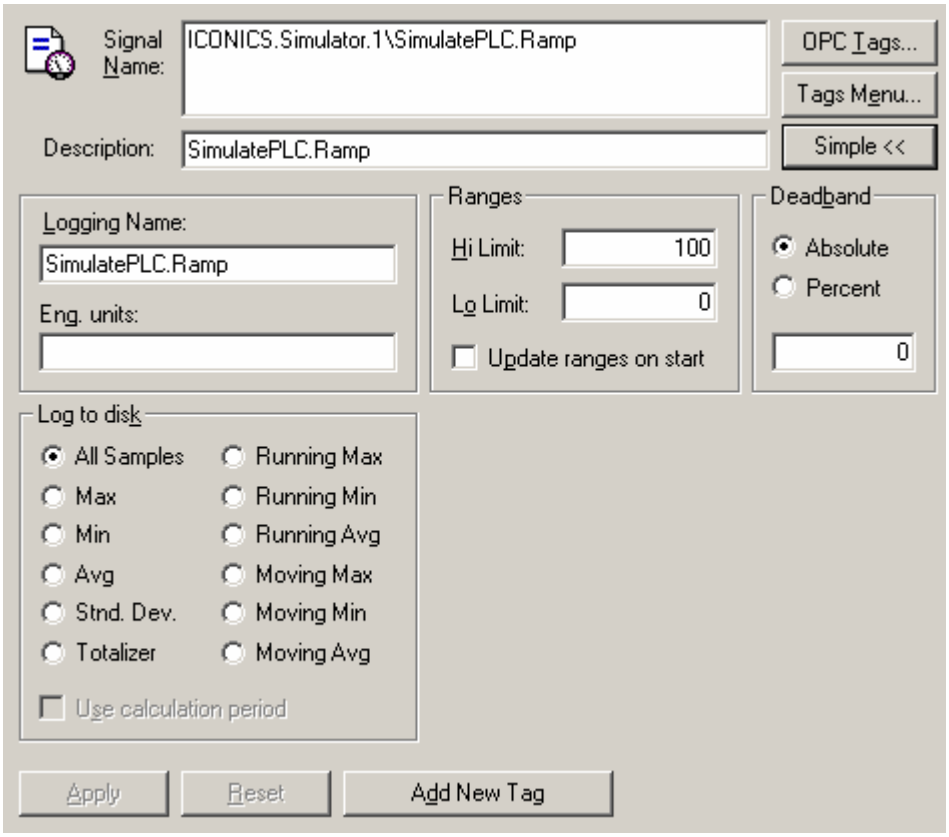
- An empty configuration file will open.
- The last-used database file will open in the TrendWorx Configurator.
- A message box may appear, prompting you to upgrade the existing configuration file to the latest version.

To open a different .mdb file, select **Open** from the **File** menu. This opens the **Open** dialog box, shown below, which enables you to browse for configuration files.



Selecting a Configuration Database

To access the configuration file interface, select a .mdb file. The following dialog box will be displayed in the right-hand pane of the Configurator screen.



TrendWorx Configuration With a Loaded Configuration Database

Configuration

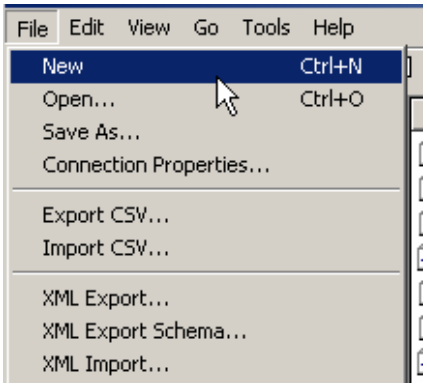
The configuration layout of the TrendWorx Configurator is quite similar to that of an OPC server configuration. The key concept here is the **database object,** which replaces the **device** of the OPC data server configuration.

A **configuration** is the name given to a block of information to be used by a server. Only one configuration per node can be active at one time. Only one server per node can run at one time. The database can store multiple configurations.

Creating Configuration Databases

The Configurator provides a Configuration Database Wizard for creating new Microsoft Access and SQL Server configuration databases. To create a new configuration database in the Configurator:

1. Select **New** from the **File** menu, as shown in the figure below**.**



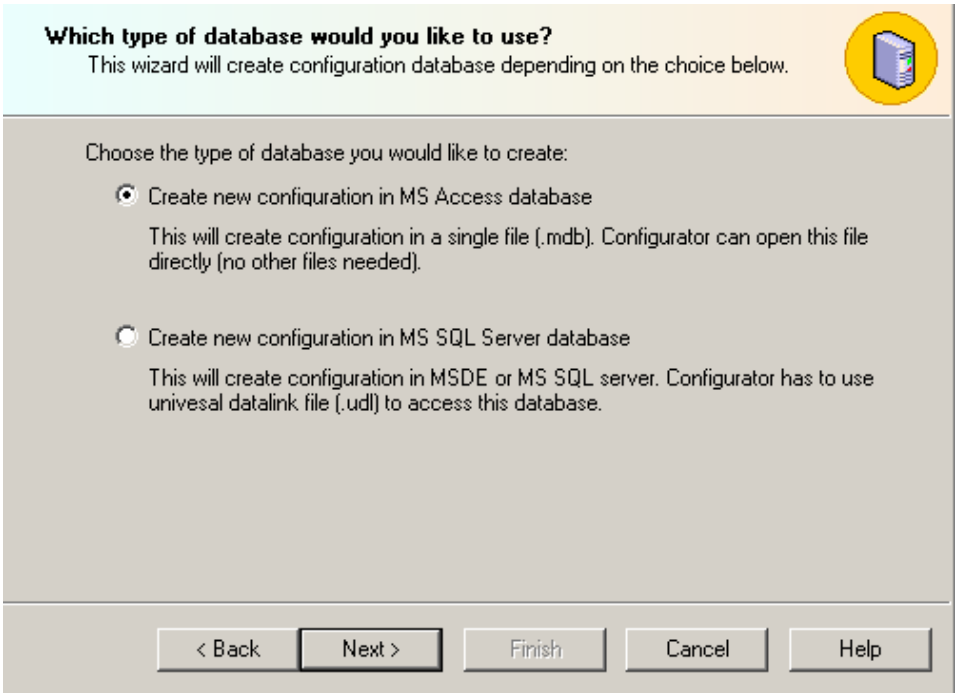
Creating a Configuration Database

2. The introduction screen for the Configuration Database Wizard appears. Click the **Next** button to continue.

3. You have two options for creating your new database, as shown in the figure below:

- **Create a new Microsoft Access configuration database:** For a Microsoft Access database, the Configurator uses a single .mdb file
- **Create a Microsoft SQL Server database:** The Configurator uses Universal Data Link (.udl) files to connect to a Microsoft SQL Server or MSDE database.

Select the database type you want to create, and then click **Next.**

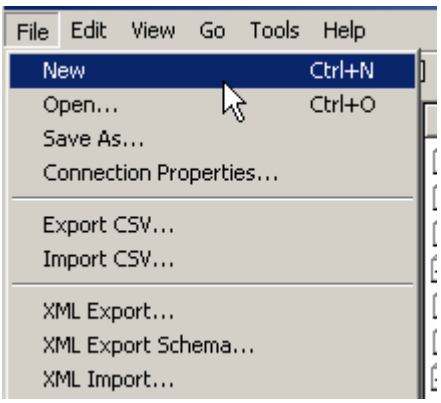


Choosing the Type of Database To Create

Creating a Microsoft Access Configuration Database

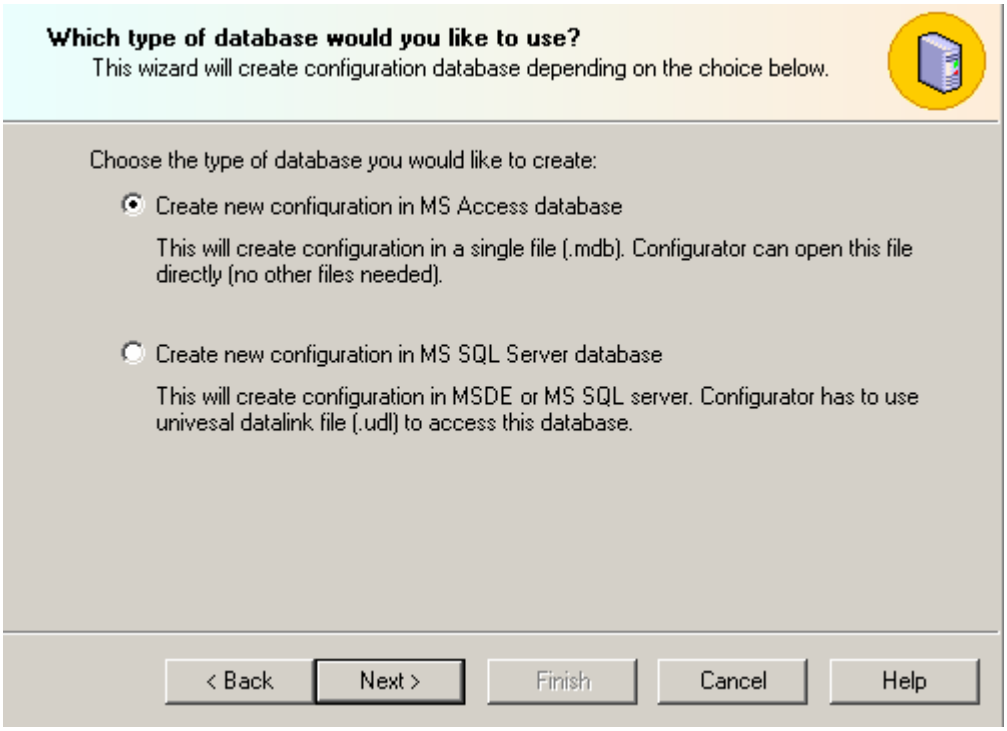
To create a new Microsoft Access configuration database in the Configurator:

1. Select **New** from the **File** menu, as shown in the figure below**.**



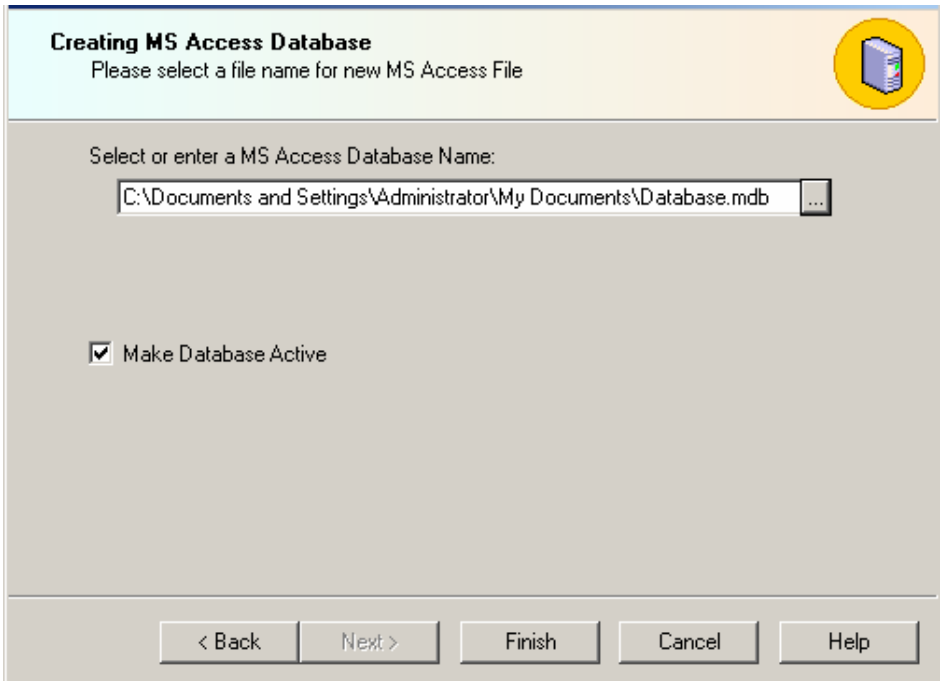
Creating a Configuration Database

2. The introduction screen for the Configuration Database Wizard appears. Click the **Next** button to continue.
3. You have two options for creating your new database, as shown in the figure below. Select **Create new configuration in MS Access database.** Click the **Next** button to continue.



Creating a New Microsoft Access Database

4. Specify the directory path and file name for the new database, as shown in the figure below. Click the **...** button to browse for a directory. If you want this new database to be the active configuration database, check **Make Database Active.**



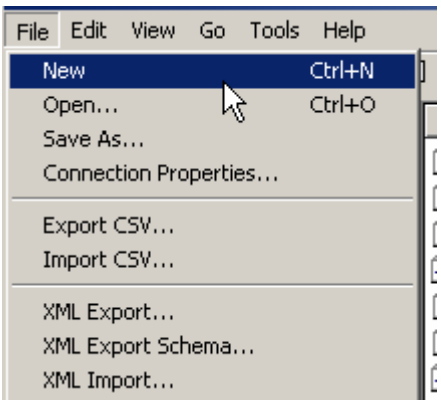
Naming the New Access Database

5. Click the **Finish** button. The new database is created and opened in the Configurator.

Creating a Microsoft SQL Server Configuration Database

To create a new Microsoft SQL Server configuration database in the Configurator:

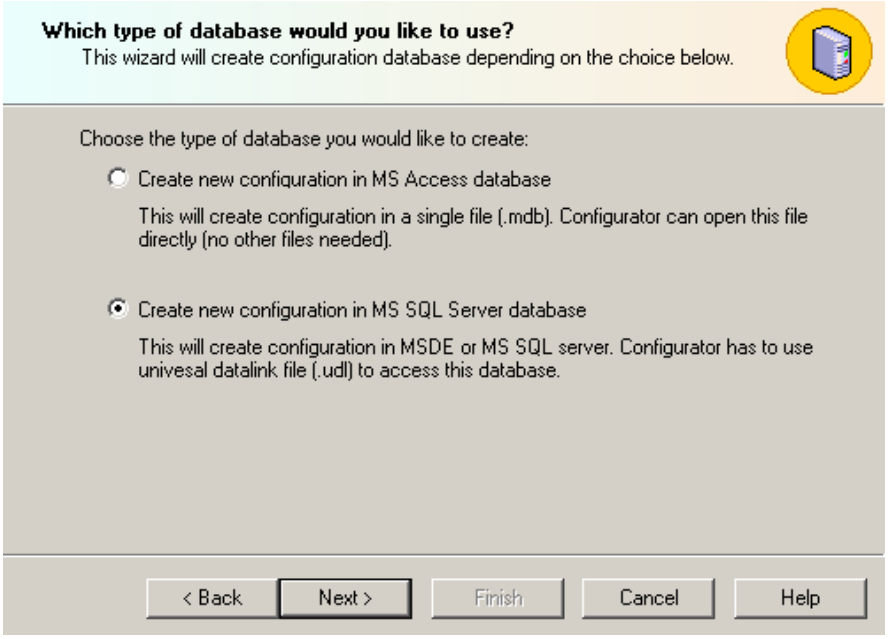
1. Select **New** from the **File** menu, as shown in the figure below**.**



Creating a Configuration Database

2. The introduction screen for the Configuration Database Wizard appears. Click the **Next** button to continue.

3. You have two options for creating your new database, as shown in the figure below. Select **Create new configuration in MS SQL Server database.** Click the **Next** button to continue.

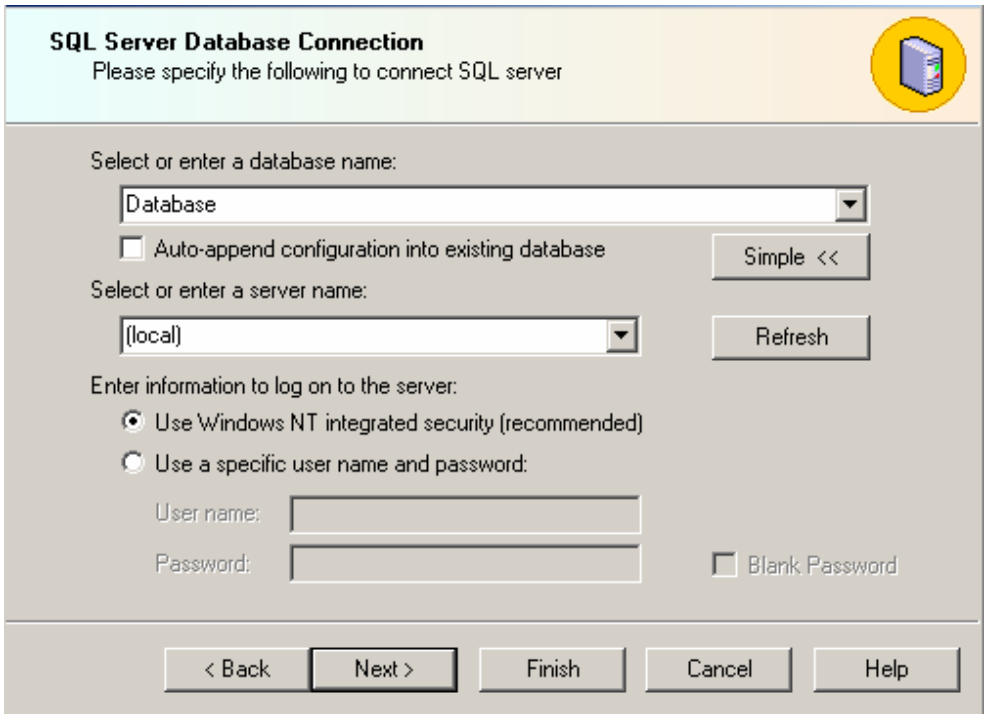


Creating a New Microsoft SQL Server Database

4. To connect to a SQL Server database, either select an existing database from the **Database Name** drop-down list, or a type a new name to create a new database, as shown in the figure below. If you choose to use an existing database, you have the option of adding (auto-appending) the configuration to the existing database. (For more information about the auto-append function, please see "Adding the Configuration to an Existing Database.")

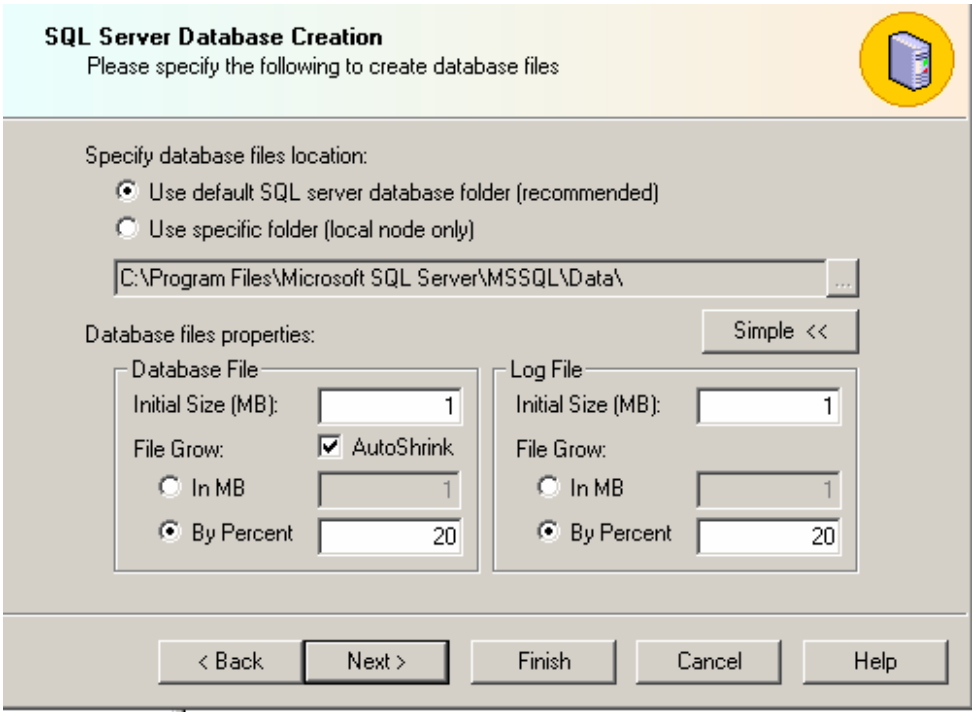
In the **SQL Server Name** field, select the local SQL Server on which to create the database. If necessary, enter a user name and password to log on to the SQL Server. (It is recommended that you use Windows NT integrated security.)

Note
Usually you have only one instance of SQL Server running on the local node. In this case, the drop-down list under **SQL Server Name** has only one option: "(local)." However, it is possible to run multiple SQL Server instances on the local node, in which case the **SQL Server** field lists all those SQL Server instances: "(local)" for the default instance and "node_name/instance_name" for all others. The drop-down list may show SQL Server instances on other nodes as well.



Connecting to a SQL Server Database

5. Specify a directory path location in which to create the database, as shown in the figure below. You can either use the default SQL Server database folder, or you can click the **...** button and browse for a specific folder.



Specifying the Database Location and Properties

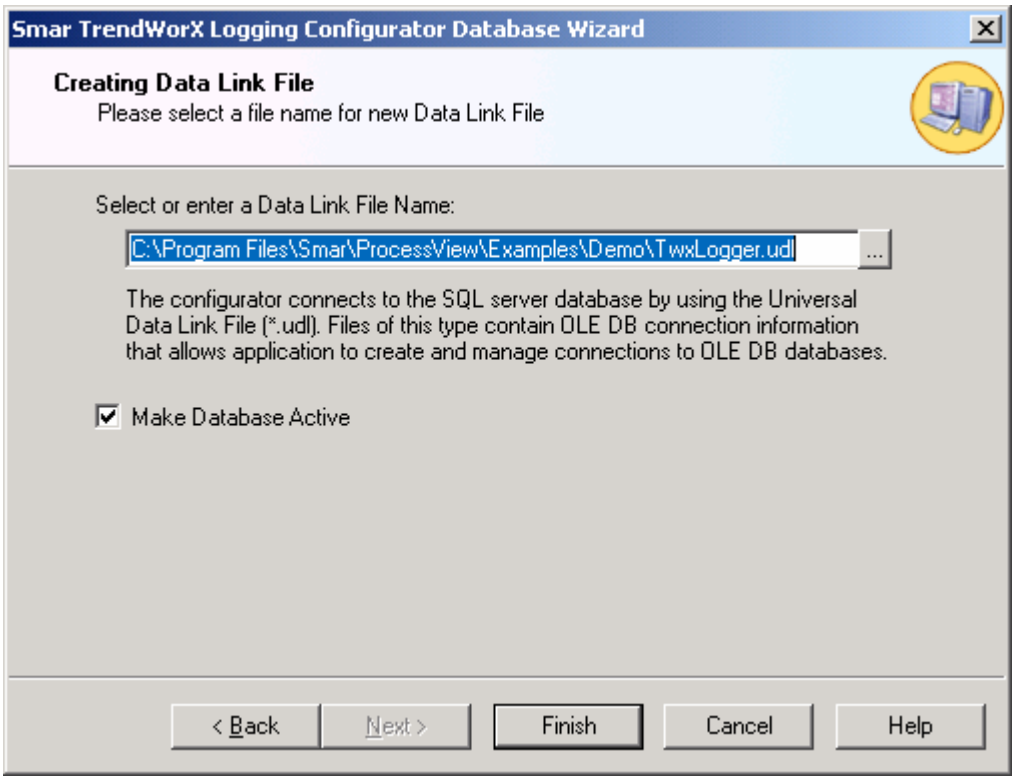
Under the Database Properties section, specify an initial size for the database, which should be as large as possible. You can also specify a Database Growth option (in megabytes) or as a percentage of the total size. MSDE servers are capable of growing the database on the fly to store more data. However, if this operation is performed frequently, the overall system performance may

decrease. Choosing an initially large database size and a corresponding database growth option can drastically improve system performance.

Under the Log File Properties section, you can also modify the settings for the database transaction log file. Specify a Log File Growth option (in megabytes) or as a percentage of the total size. Again, a sufficient initial size setting can greatly improve performance. The default options should be adequate for most applications with a small to medium size load.

Click the **Next** button to create the new SQL Server database.

6. The Configurator uses Universal Data Link (.udl) files to connect to the Microsoft SQL Server database. These .udl files contain OLE database connection information that allows the Configurator to create and manage connections to OLE databases. Enter a name and directory path for the new .udl file in the **Data Link File Name** field, as shown in the figure below. You can browse for a directory by clicking the **…** button to the right of this field. Click the **Next** button to continue. If you want this new database to be the active configuration database, check **Make Database Active.**



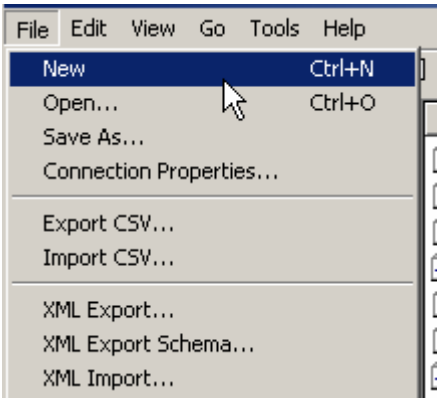
Creating a Universal Data Link File

7. Click the **Finish** button. The new database is created and opened in the Configurator.

Adding a Configuration Database to an Existing SQL Server Database

The Configuration Database Wizard also gives you the option to add the configuration database structure to an existing Microsoft SQL Server database:

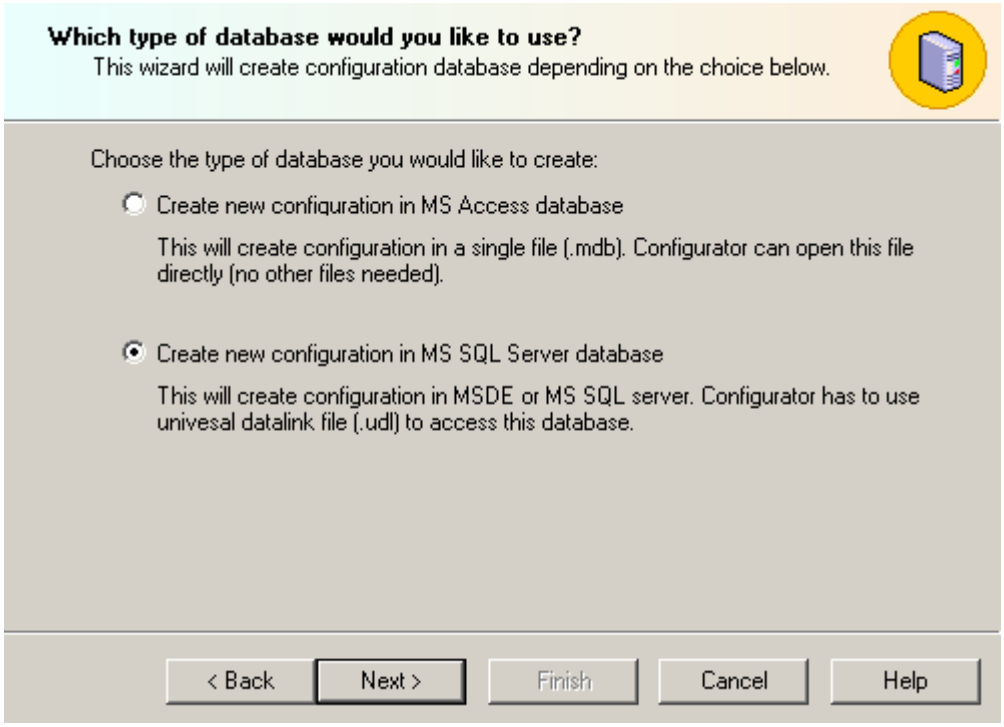
1. Select **New** from the **File** menu, as shown in the figure below.



Creating a Configuration Database

2. The introduction screen for the Configuration Database Wizard appears. Click the **Next** button to continue.

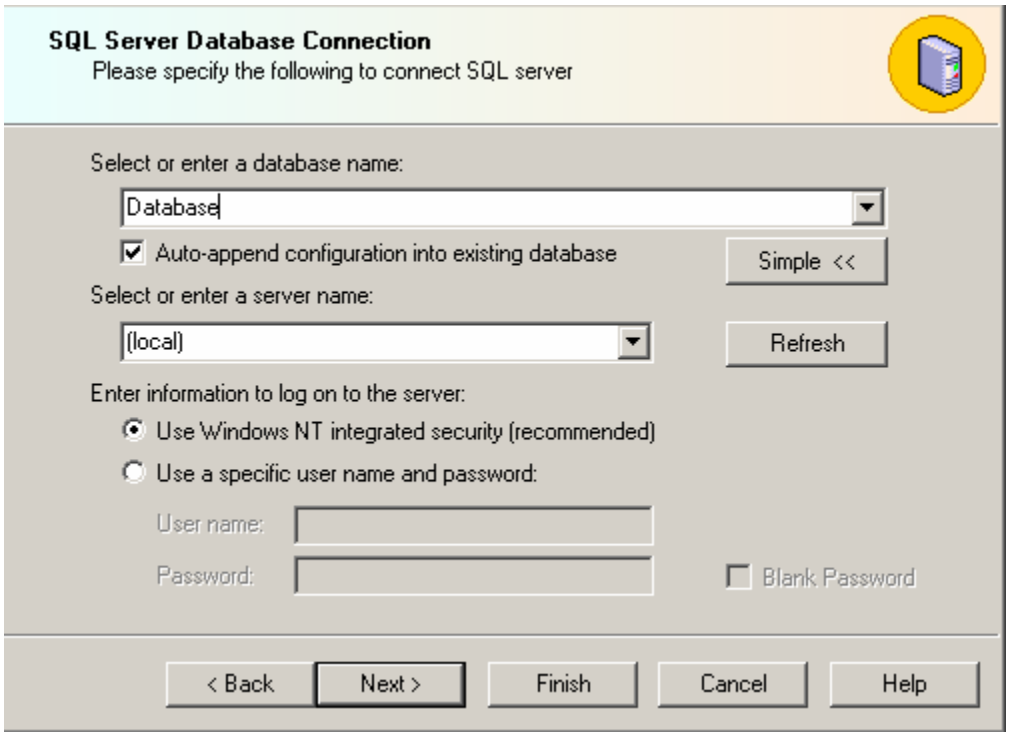
3. You have two options for creating your new database, as shown in the figure below. Select **Create new configuration in MS SQL Server database.** Click the **Next** button to continue.



Creating a Microsoft SQL Server Database

4. To connect to a SQL Server database, select the existing database from the drop-down list, as shown in the figure below. Check the **Auto-append configuration into existing database** check box. In the **SQL Server** field, select the local SQL Server on which to create the database. Type a name for the database in the **Database Name** field. If necessary, enter a user name and password to log on to the SQL Server. (**Note:** It is recommended that you use Windows NT integrated security.) Click the **Next** button to continue.

Note
Usually you have only one instance of SQL Server running on the local node. In this case, the drop-down list under **SQL Server Name** has only one option: "(local)." However, it is possible to run multiple SQL Server instances on the local node, in which case the **SQL Server** field lists all those SQL Server instances: "(local)" for the default instance and "node_name/instance_name" for all others. The drop-down list may show SQL Server instances on other nodes as well.



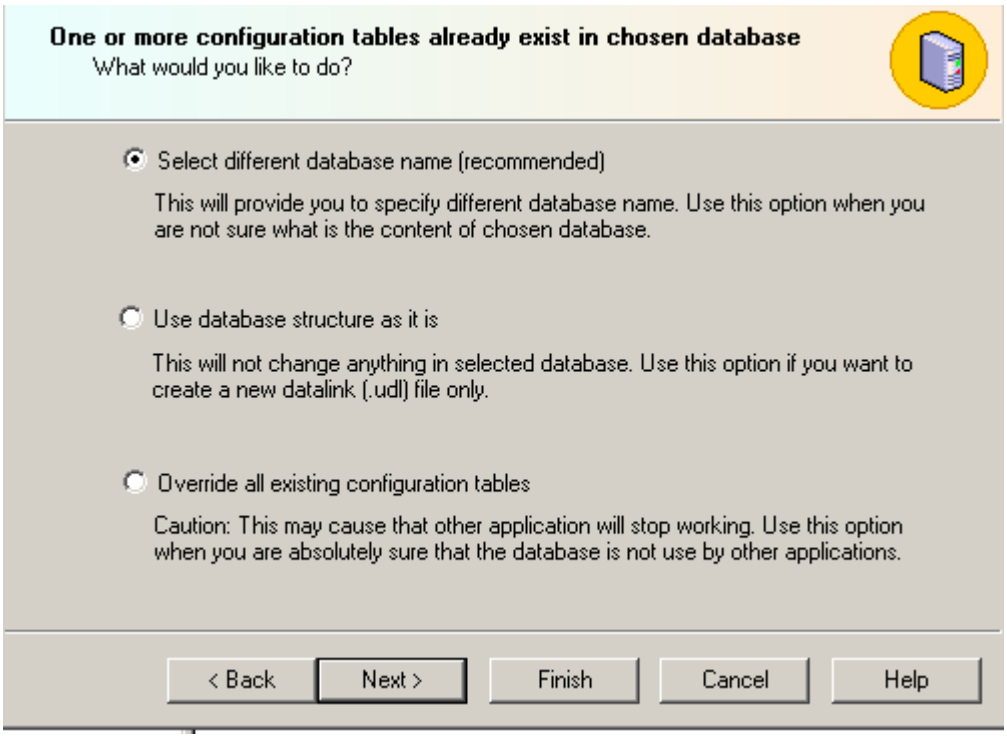
Connecting to an Existing SQL Server Database

5. If the existing database already has configuration tables, you have the following options, as shown in the figure below:

- **Select a different database name (recommended):** This option allows you to rename the database without affecting the existing database as well as create a new Data Link (.udl) file.
- **Use the existing database structure:** This option preserves the content of the existing database and allows you to create a new Universal Data Link (.udl) file.
- **Override all existing configuration tables:** This option expunges the content of the existing database and allows you to create a new Universal Data Link (.udl) file.

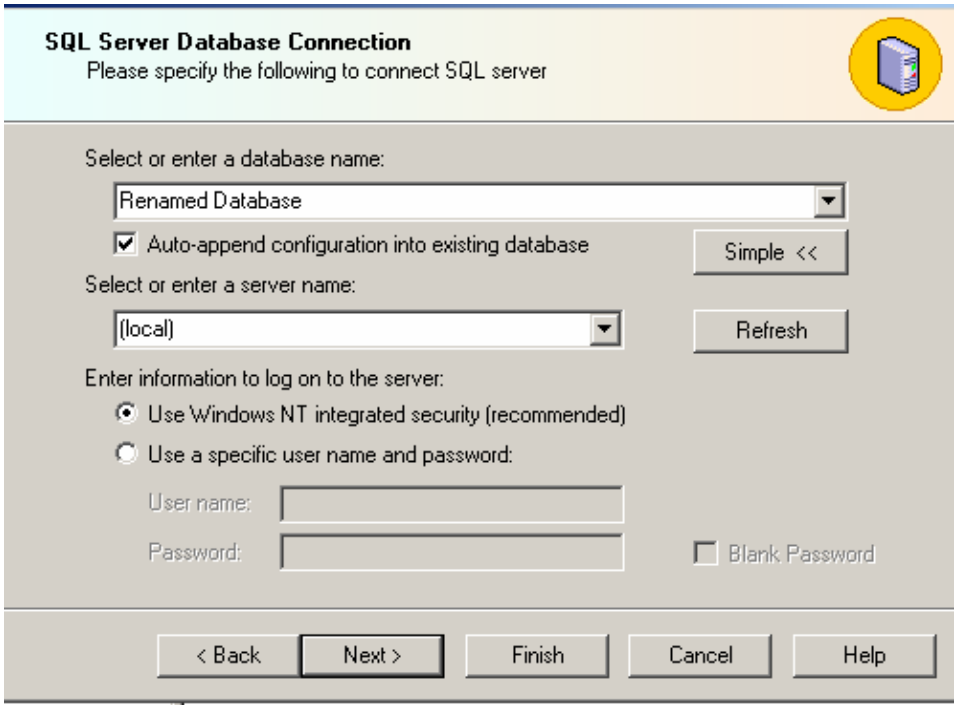
Note
Overriding the database may disable other applications that also use the database.

Click the **Next** button to continue.



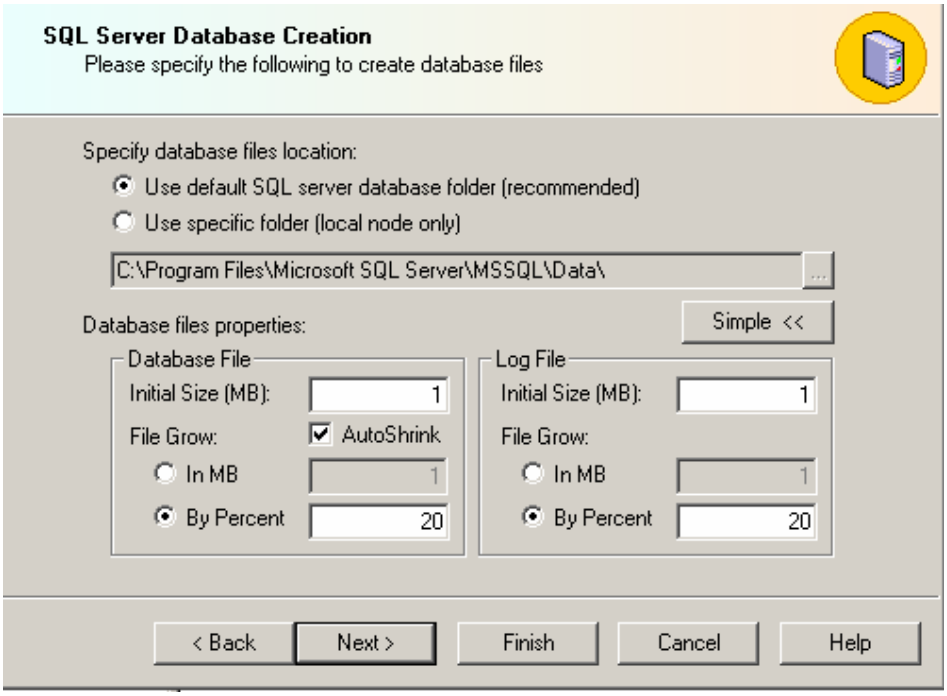
Adding the Configuration to an Existing SQL Server Database

6. If you chose **Select a different database name (recommended),** you are directed back to the SQL Server Database Connection dialog box, as shown in the figure below. Enter a new name for the database, and then click **Next.**



Renaming the Existing SQL Server Database

7. Specify a directory path location in which to create the database, as shown in the figure below. You can either use the default SQL Server database folder, or you can click the **...** button and browse for a specific folder.



Specifying the Database Location and Properties

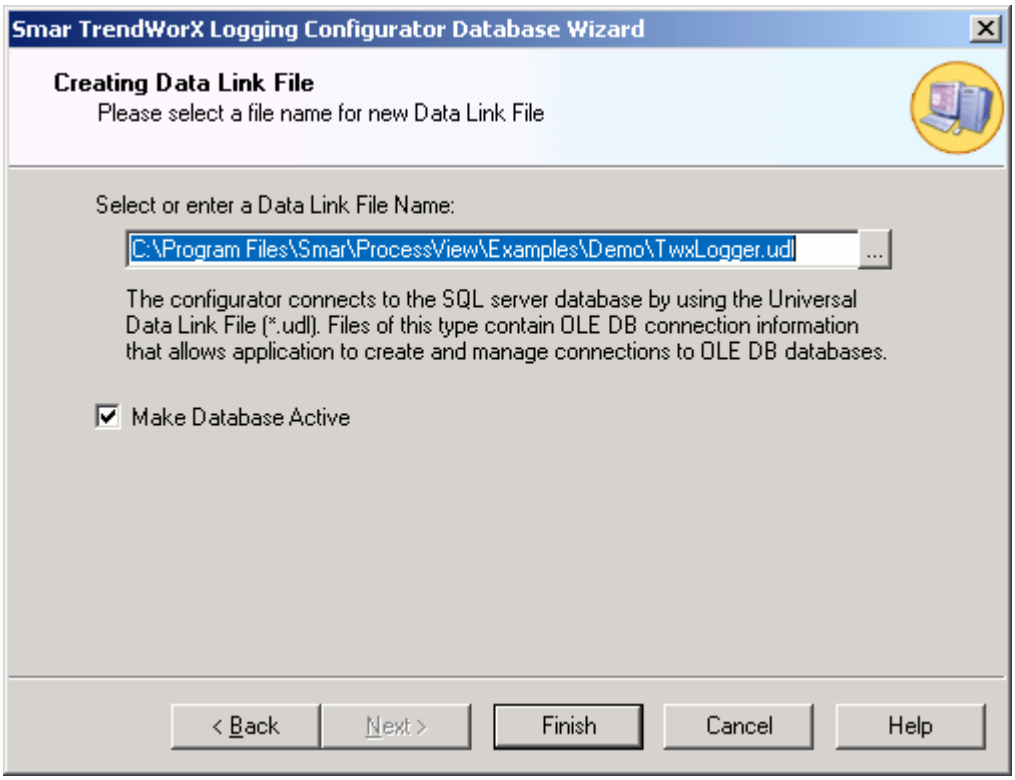
Under the Database Properties section, specify an initial size for the database, which should be as large as possible. You can also specify a Database Growth option (in megabytes) or as a percentage of the total size. MSDE servers are capable of growing the database on the fly to store more data. However, if this operation is performed frequently, the overall system performance may decrease. Choosing an initially large database size and a corresponding database growth option can drastically improve system performance.

Under the Log File Properties section, you can also modify the settings for the database transaction log file. Specify a Log File Growth option (in megabytes) or as a percentage of the total size. Again, a sufficient initial size setting can greatly improve performance. The default options should be adequate for most applications with a small to medium size load.

Click the **Next** button to create the new SQL Server database.

8. The Configurator uses Universal Data Link (.udl) files to connect to the Microsoft SQL Server database. These .udl files contain OLE database connection information that allows the Configurator to create and manage connections to OLE databases. Enter a name and directory path for the new .udl file in the **Data Link File Name** field, as shown in the figure below. You can browse for a directory by clicking the **…** button to the right of this field. Click the **Next** button to continue. If you want this new database to be the active configuration database, check **Make Database Active.**

Note
If you chose to Use the existing database structure or to Override all existing configuration tables, you will still need to create a new Data Link file.



Creating a Universal Data Link File

9. Click the **Finish** button. The new database is created and opened in the Configurator.

Toolbars

All actions associated with the TrendWorx Configurator can be accessed through the menu commands and the toolbars. To show/hide the toolbars, select **Toolbars** from the **View** menu.

Main Toolbar

The **Main** toolbar of TrendWorx Configurator, shown in the figure below. contains the following command buttons. For more information on these commands, see the **Menus** section.

New: Creates a new database.

Open: Opens an existing database.

Import: Imports data into the configuration database from a text file.

Export: Exports data from the configuration database to a text file.

Navigate Back: Jumps to the last screen viewed.

Navigate Forward: Jumps to the next screen viewed.

Up One Level: Moves up one level in the tree view.

Cut: Deletes current selection, sending it to the clipboard.

Copy: Copies the current selection to the clipboard.

Paste: Pastes the current contents of the clipboard.

Large Icons: View items as large icons.

Small Icons: View items as small icons.

List: View items as a list.

Details: View items as a list with details.

Dialog View: View additional configuration options.

Global Refresh: Reloads data from the connected database.

Start/Stop Data Logging: Starts/stops data logging to the database.

About: Displays information about the application.

Help: Displays context-sensitive help.

Help Topics: Launches online help for the application.

Configuration Toolbar

The **Configuration** toolbar of TrendWorx Configurator, shown in the figure below, contains the following command buttons. For more information about these commands, see the **Menus** section.

New Configuration: Inserts a new configuration at the Master Configuration level.

New Database Group: Inserts a new database group at the Configuration level.

New Logging Group: Inserts a new logging group the Database Group level.

Insert New Opc Tags: Inserts a new OPC tag at the Group level.

New Simulation Variable: Inserts a new simulation variable at the Group level.

New Expression: Inserts a new expression at the Group level.

Multiply: Multiplies the selected item in the tree control.

Delete: Deletes the selected item from the tree control.

Menus

The TrendWorx Configurator menu bar contains the following menus:

- File menu
- Edit menu
- View menu
- Go menu
- Action menu
- Tools menu
- Help menu

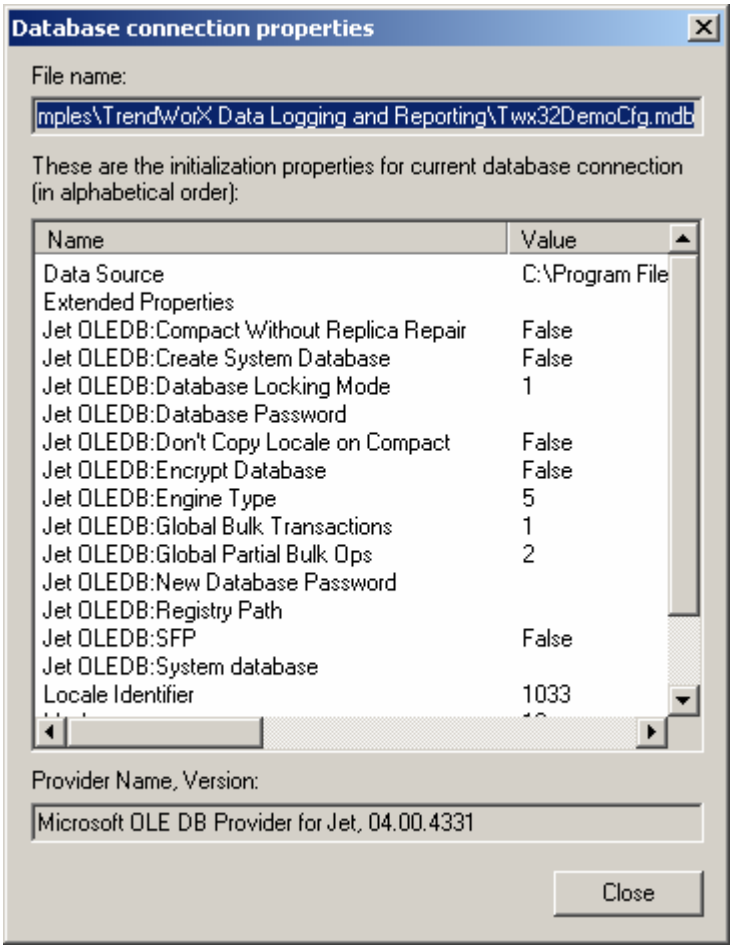
File Menu

The **File** menu of the TrendWorx Configurator contains the following commands:

Command	Shortcut Key	Function
New	CTRL+N	Creates a new configuration database.
Open	CTRL+O	Opens a new .mdb (Microsoft Data Access) or .udl (Microsoft Data Link) file.
Save As		Saves the database under a different name.
Connection Properties		Opens the **Database Connection Properties** dialog box.
Export		Exports data from a selected .csv file.
Import		Imports data from a selected .csv file.
XML Export		Exports configuration data to an XML file.
XML Export Schema		Exports configuration data to an XML Schema file.
XML Import		Imports configuration data from an XML file.
XML Validate		This feature does not import an XML data file, but it will try to validate its structure using stored XML schema. Once it passes this validation, the XML file is acceptable for import by the Configurator.
Make Active		Downloads a configuration to the server before data logging.
Exit		Closes the applications and stops data logging if it started within the Configurator.

Database Connection Properties

Selecting **Connection Properties** from the **File** menu opens the **Database Connection Properties** dialog box, shown below, which lists the initialization properties for the current database connection.

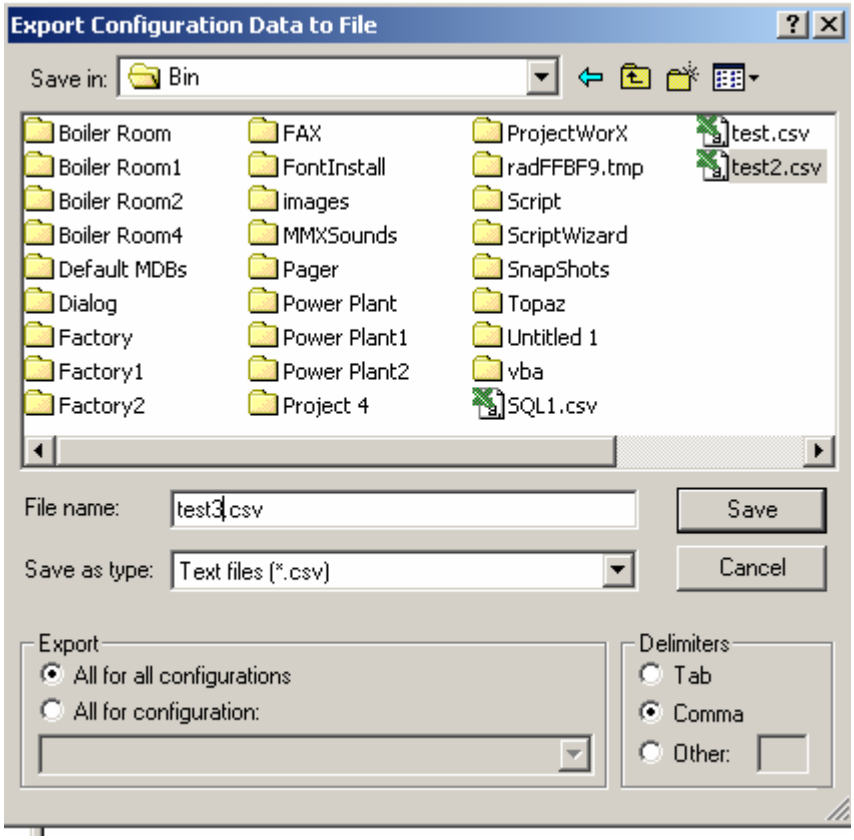


Database Connection Properties Dialog Box

Exporting Configuration Data

Exporting Data to a Text or CSV File

The Configurator offers the flexibility of exporting data from your configuration database to a text (.txt) file or a Microsoft Excel (.csv) file. To export data, select **Export** from the **File** menu. This opens the **Export Configuration Data to File** dialog box, as shown in the figure below. You can then specify the delimiters for exporting the data. Unless you specify delimiters in the **Export Configuration Data to File** dialog box, the file uses **Commas** as delimiters by default. Each group contains headings and columns that provide information about each item, such as descriptions and associated translations and expressions. It also provides the "tree" pathway for each item. Choose the directory to which you want to export the data from your database. In the **Save As Type** field, choose the file type (.txt or .csv) that you would like to save.



Exporting Configuration Data

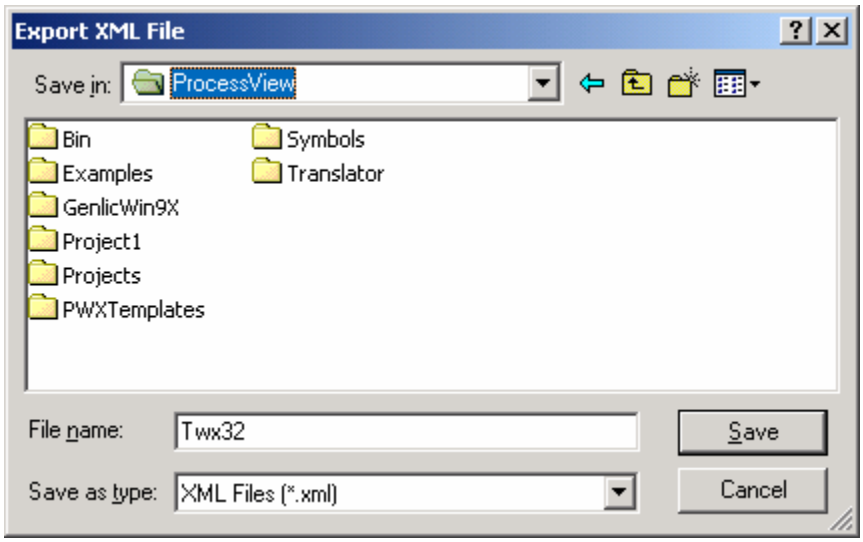
Exporting Data to an XML File

The Configurator also allows you to export data from your configuration database to an XML file. The XML export/import functionality was mainly developed for Windows platforms that do not support databases (e.g. Windows CE and Windows Embedded). XML has the following advantages over the CSV import/export function:

- XML has a standardized format, unlike the text/CSV format, which uses various delimiters (e.g. TAB instead of commas, strings could not accept all characters, etc.)
- XML is language-independent, whereas CSV converts date/time, floats, and currency fields according to local settings in Windows. For example, using CSV, you cannot export data on German Windows and import it on English windows without making changes
- Windows has an installed automation object that has the capability to work with XML. Thus, programmers can create/modify their configurations outside the Configurator using Visual Basic, if desired.
- XML supports schemas. A **schema** is a special XML file that specifies the data structure of an XML data file.

To export data, select **XML Export** from the **File** menu. This opens the **Export XML File** dialog box, as shown in the figure below. Give the file a name, and then choose the directory to which you want to export the data from your database. Click **Save.**

Note
You can also export configuration data to an XML Scheme file by selecting **XML Export** from the **File** menu.



Exporting Configuration Data to an XML File

Importing Configuration Data

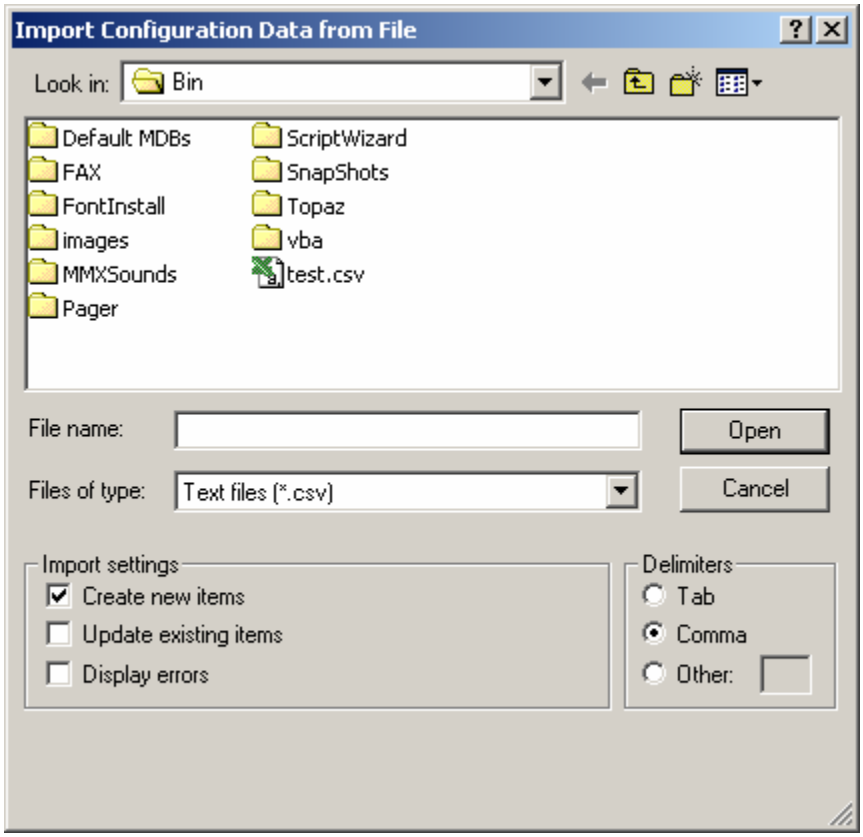
Importing Data From a Text or CSV File

The Configurator offers the flexibility of importing data from a text (.txt) file or a Microsoft Excel (.csv) file to your configuration database. To import data, select **Import CSV** from the **File** menu. This opens the **Import Configuration Data From File** dialog box, shown below. You can then specify the delimiters and choose from the following import settings:

- **Create new items.** When the import file contains items that are not yet in the configuration database, then it creates them. Otherwise it skips these items.
- **Update existing items.** When the import file contains items that are in the configuration database, then it updates them using data from the import file. Otherwise it skips these items.

Note
Either **Create new items** or **Update existing items** must be selected. Otherwise there is nothing to import.

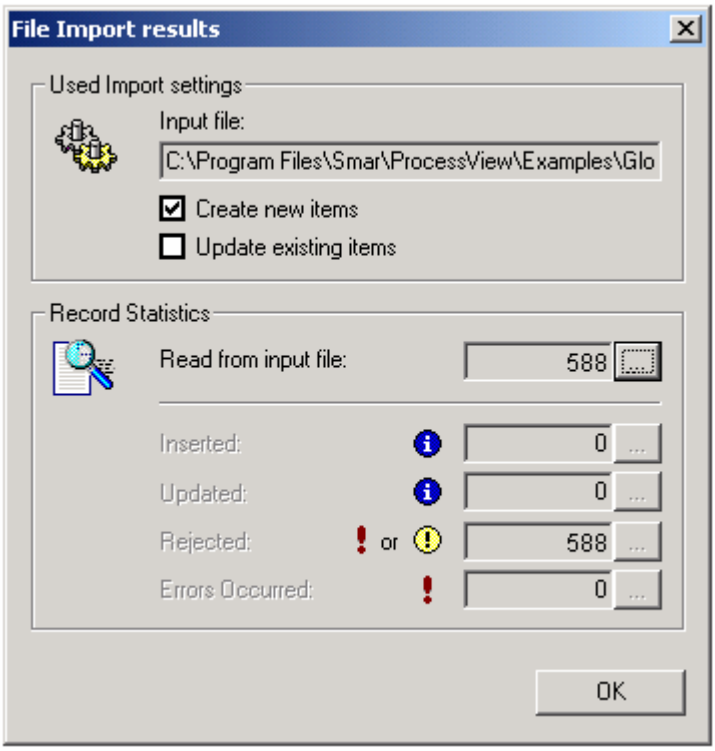
- **Display errors.** When this item is checked, the Configurator shows a dialog box if an error occurs, and then asks you if you want to proceed with the import. When it is not checked, it skips all items where an error occurred.



Importing Configuration Data

When you have selected a file to import, click **Open.** When the import is completed, the **File Import Results** dialog box opens, as shown below. This shows the import settings, including the input file name. It also provides a summary of the import, including how many items were inserted, updated, or rejected, and shows how many errors occurred.

Click the **...** button to the right of each field to get the details view of the import results, as shown below. This view shows the specific items that were inserted, updated, or rejected, as well as a description of any errors that occurred.



File Import Results Dialog Box

Importing Data From an XML File

The Configurator allows you to import data from your configuration database to an XML file. The XML export/import functionality was mainly developed for Windows platforms that do not support databases (e.g. Windows CE and Windows Embedded). XML has the following advantages over the CSV import/export function:

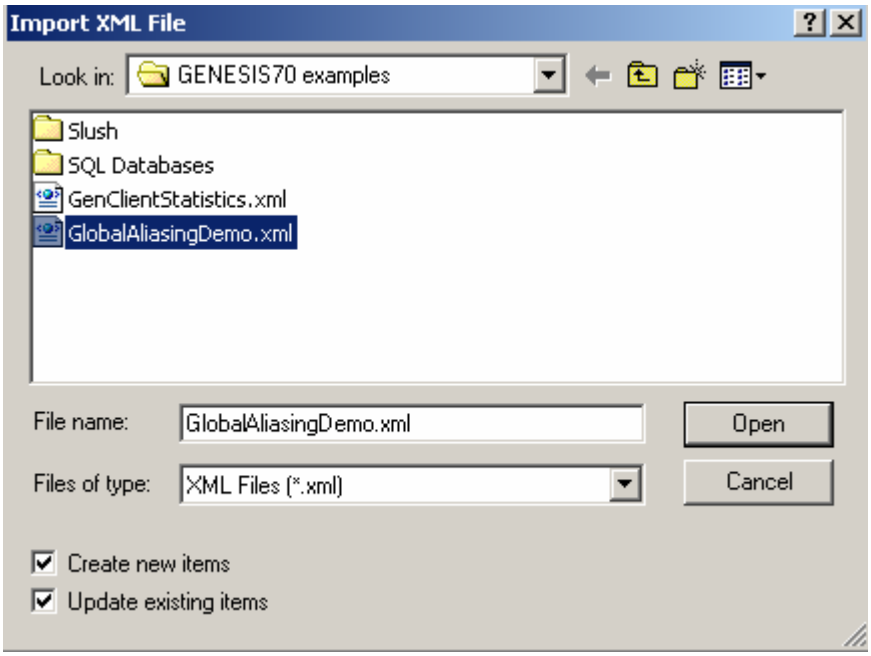
- XML has a standardized format, unlike the text/CSV format, which uses various delimiters (e.g. TAB instead of commas, strings could not accept all characters, etc.)
- XML is language-independent, whereas CSV converts date/time, floats, and currency fields according to local settings in Windows. For example, using CSV, you cannot export data on German Windows and import it on English windows without making changes
- Windows has an installed automation object that has the capability to work with XML. Thus, programmers can create/modify their configurations outside the Configurator using Visual Basic, if desired.
- XML supports schemas. A **schema** is a special XML file that specifies the data structure of an XML data file.

To import data, select **XML Import** from the **File** menu. This opens the **Import XML File** dialog box, as shown in the figure below. Give the file a name, and then choose the directory from which you want to import the data. You can then specify the delimiters and choose from the following import settings. Click **Open.**

- **Create new items.** When the import file contains items that are not yet in the configuration database, then it creates them. Otherwise it skips these items.
- **Update existing items.** When the import file contains items that are in the configuration database, then it updates them using data from the import file. Otherwise it skips these items.

Note
Either **Create new items** or **Update existing items** must be selected. Otherwise there is nothing to import.

Note
Selecting **XML Validate** from the **File** menu does not import an XML data file, but it will try to validate its structure using stored XML schema. Once it passes this validation, the XML file is acceptable for import by the Configurator.



Importing Configuration Data From an XML File

Activating the Database

Once your configuration is complete, you need to make sure that it is the active database. The database that is currently active is the one that the alarm server will use. To make the current database active, select **Make Active** from the **File** menu. If the **Make Active** selection is grayed out, then the current database is already the active database.

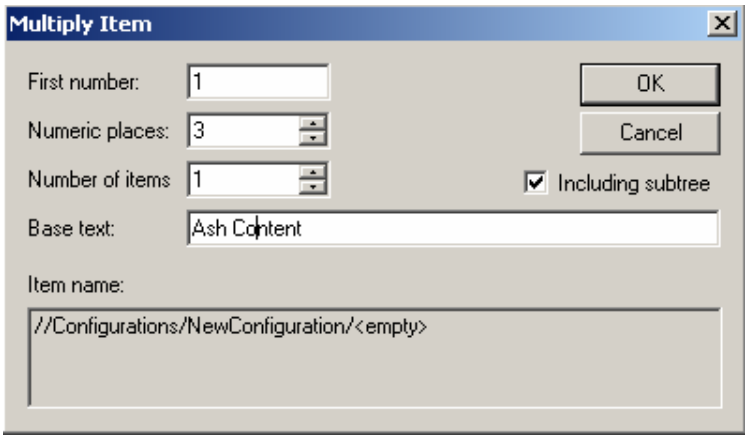
A dialog box appears showing both the current active database and database that is currently being edited, as shown in the figure below. To set the edited database as the active database, click the **Yes** button.

Edit Menu

The **Edit** menu contains the following commands, which enable you to change the Configurator interface:

Command	Shortcut Key	Function
New - Configuration	CTRL+T	When you select the Master Configuration level, this command inserts a new configuration.
New - Database Group	CTRL+D	When you select the Configuration level, this command inserts a new database group.
New - Logging Group	CTRL+G	When you select the Database Group level, this command inserts a new logging group.
New - OPC Tag, Expression, or Simulated Variable	CTRL+W CTRL+E	When you select the Group level, this command inserts a new tag attached to an OPC tag, an expression, or a simulated variable.
Rename	CTRL+R	Renames the selected object.
Multiply	CTRL+M	Multiplies the selected object in the tree control. (For more information on this command, see the section below.)
Delete	DEL, CTRL+DEL	Deletes the selected object.
Cut	CTRL+X	Cuts the selected object from the current view and places it on the clipboard.
Copy	CTRL+C	Copies the selected object to the clipboard.
Paste	CTRL+V	Pastes the last object placed on the clipboard.
Select All	CTRL+A	Selects all objects in a list. The selection is shown in the upper-right-hand section of the Viewer.
Invert Selection		Unselects all selected items and selects all unselected items in a list in the upper-right-hand section of the viewer.

Multiply Item Command
To multiply an item, select the item and then choose **Multiply** from the **Edit** menu. This opens the **Multiply Item** dialog box, shown below.



Multiply Item Dialog Box

The following fields are available in the **Multiply Item** dialog box.
First number. Refers to the number that will be attached to the first multiplied item.
Numeric places. Refers to how many digits should be attached to the end of the initial item name.
Number of items. Determines how many items will be added to the current configuration.
Base text. Sets the initial item name for all multiplied items.
The dialog box shown above would produce the following tag: 'Ash Content001.'
If you want to multiply all subfolders as well, check the Including **Subtree** check box.

Note
It is possible to move (drag-and-drop), or copy groups and tags from one area to another. It is also possible to move or copy tags from one group to another. In addition, it is possible to move or copy areas from one configuration to another.

View Menu

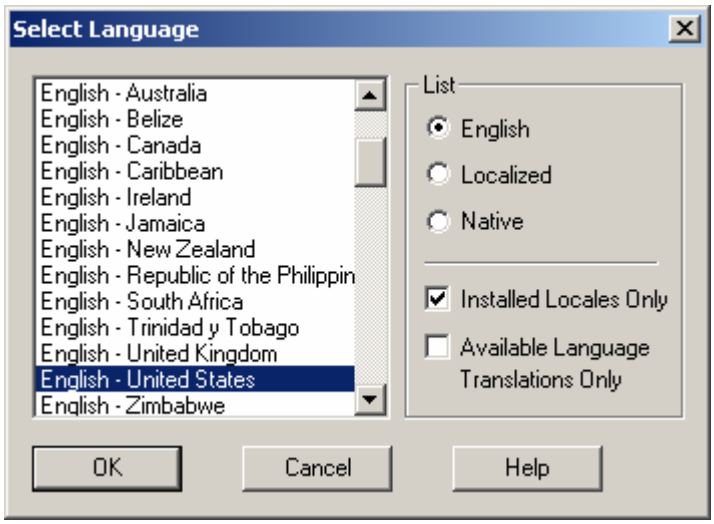
The **View** menu contains the following commands:

Command	Shortcut Key	Function
Toolbars - Standard Buttons		Displays the **Main** toolbar**.**
Toolbars - Data Manipulation Buttons		Displays the **Configuration** toolbar**.**
Status Bar		Toggles the status bar, which indicates the status of the Configurator, which mode you are in (configuration or runtime), and the date and time. When navigating through the menu items, whichever item the mouse is over will be displayed in the status bar. Also indicates any actions that are being performed by the server.
Large Icons	F7	Displays items as large icons.
Small Icons	F8	Displays items as small icons.
List	F9	Displays items in a list.
Details	F10	Displays the items in a list along with detailed information about the configuration of each item.
Dialog View	F11	Toggles the configuration window.
Sort By		Displays a list of options for sorting the view. The options listed depend on the level within the view.
Show/Hide Columns		Displays a list of options that you can choose to show or hide in the view. The options listed depend on the level within the view and are identical to those in the **Sort By** submenu.
Select Language		Specifies the language to be used in the Configurator from the **Select Language** dialog box. Select the language you wish to use for your system and click **OK.** For navigation purposes, use the radio buttons and check boxes in the **List** section.
Global Refresh	F5	Refreshes the data for the entire Configurator screen.
Subtree Refresh	CTRL+F5	Refreshes only the data contained in the currently selected subtree.

Note: It is possible to select only one of these display options (Large Icons, Small Icons, List, or Details).

Selecting Languages

The **Select Language** function on the **View** menu allows you to choose which language to use in your display. Choosing **Select Language** from the **View** menu opens the **Select Language** dialog box, shown in the figure below.



Select Language Dialog Box

Define the parameters listed in the table below. Then click **OK** to return to the work area.

Select Language Parameters

Parameter	Description
List	Lists available languages. Depending on which item you have selected, the view on the left will change. If **English** is checked, the languages will appear as their English name. If **Localized** is checked, the languages will appear with the native country in parentheses (for languages with several dialects only). When **Native** is checked, the languages are displayed the way they would be written in that language.
Installed Locales Only	If this is checked, local languages appear in the box.
Available Language Translations Only	Checking this box allows you to choose from available language translations only.

Go Menu

The **Go** menu contains the following commands, which serve as navigation aides:

Command	Shortcut Key	Function
Back	CTRL+ALT+Left Arrow	Displays the previous screen.
Forward	CTRL+ALT+Right Arrow	Displays the next screen.
Up One Level		Moves the cursor up one level.
Next Item	ALT+Down Arrow	Moves the cursor to the next item.
Previous Item	ALT+Up Arrow	Moves the cursor back to the last item selected.
Expand Item	ALT+Left Arrow	Expands an item that contains a submenu.
Collapse Item	ALT+Right Arrow	Collapses an item that contains a submenu.
Page Up	ALT+PgUp	Moves the cursor up to the first item in the tree.
Page Down	ALT+PgDown	Moves the cursor down to the last visible item in the tree.
Home	ALT+Home	Moves the cursor up to the first item in the tree.
End	ALT+End	Moves the cursor down to the last visible item in the tree.
Next Pane	F6	Moves the cursor to the next pane.
Previous Pane	SHIFT+F6	Moves the cursor to the last pane used.

Action Menu

The **Action** menu contains the following commands:

Command	Function
Start logger	Starts data logging for the active configuration.
Stop logger	Stops data logging for the active configuration.

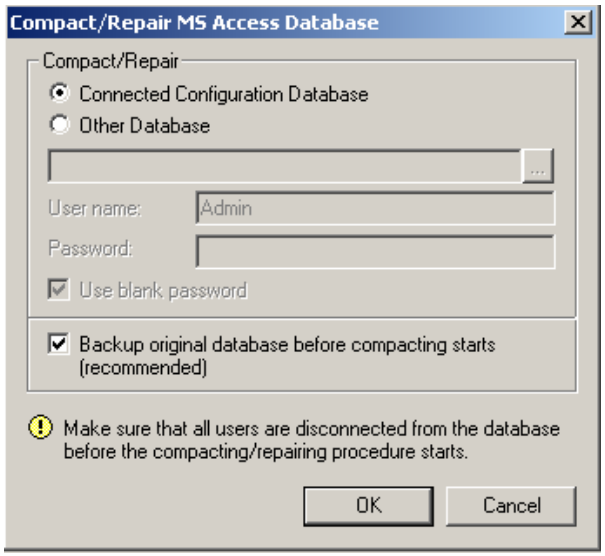
Tools Menu

The **Tools** menu contains the following options.

Command	Function
Set Working Directory	Sets a working directory for all files relating to the saved configuration.
Options	Launches a dialog that gives you several options for controlling the inserting and updating of tags, applying changes, and automatically connecting to and disconnecting from the server as well as automatically updating data.
Unload Tag Browser	Refreshes the **OPC Universal Tag Browser.**
Compact/Repair MS Access Database	Opens the **Compact/Repair MS Access Database** dialog box, which is described below in detail.
MSDE Manager	Launches the SMAR MSDE Manager for configuring MSDE 7.0 and MSDE 2000 databases.

Compacting and Repairing Microsoft Access Databases

You can compact Microsoft Access databases, which can be either TrendWorx configuration databases or historical databases, using the **Compact/Repair MS Access Database** dialog box, shown below. Microsoft Access-based databases are subject to database fragmentation over time, and the support for the database will compact the target database, reclaim unused space, and drastically improve database performance.

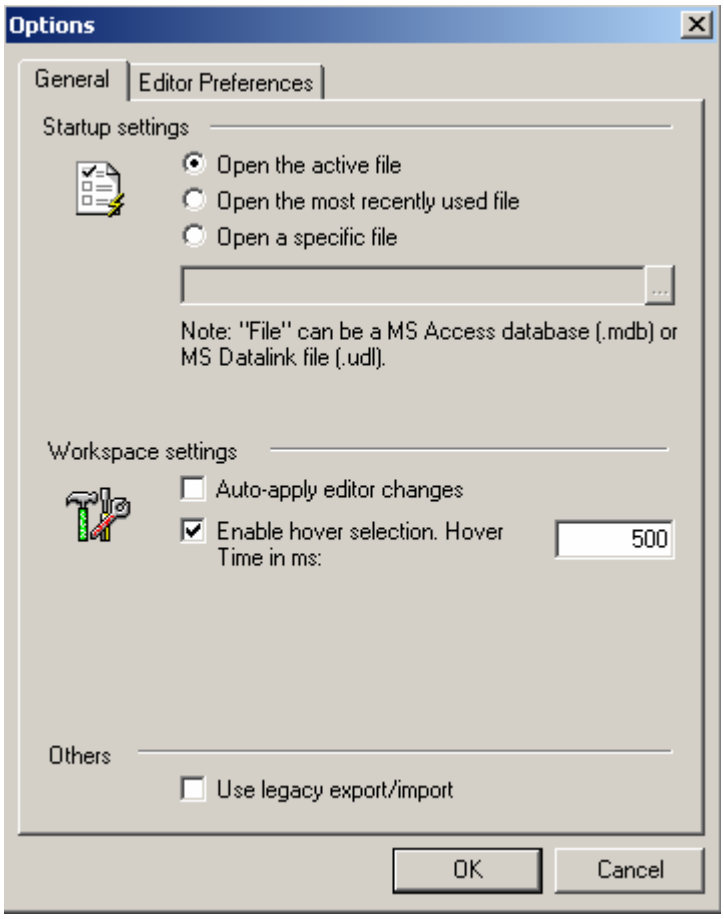


Compact/Repair Microsoft Access Database

It is critical that no users or client applications (including TrendWorx SQL Server) are connected to the database at the time of compacting and that, if the **Backup Original Database** option is selected, there is plenty of available hard disk space.

Options
Selecting **Options** from the **Tools** menu opens the **Options** dialog box, as shown in the figure below.

General Tab
The **General** tab of the **Options** dialog box, shown in the figure below, sets the startup and workspace parameters for the Configurator.



Options Dialog Box: General Tab

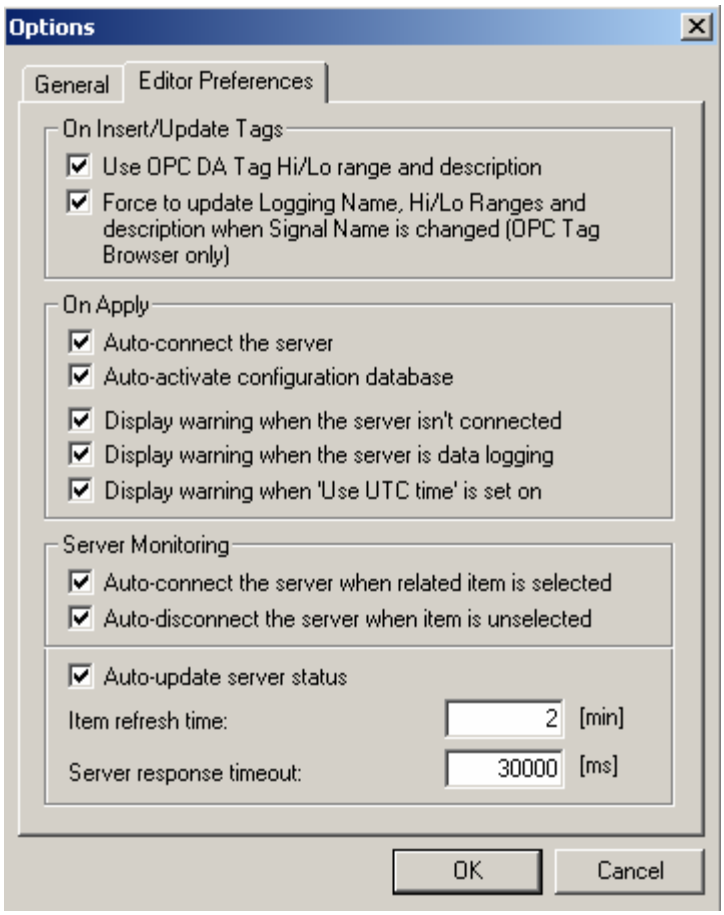
Startup Settings
The **Startup Settings** options allow you to save regional settings in the registry so that they are applied each time you start the Configurator. This applies to the language settings as well as time and date settings. Select one of the following startup settings:

- **Open the active file:** Launches the currently active database upon startup.
- **Open the most recently used file:** Launches the recently opened database.
- **Open a specific file:** Specifies a Microsoft Access (.mdb) or Microsoft Datalink (.udl) database to launch upon startup. To select a database, click the **...** button next to the text box and browse for the file. When this option is selected, the "active" database is overridden by the specified database.

Workspace Settings
The following **Workspace Settings** are available:

- **Auto-apply editor changes:** Checking this option allows changes to the configuration database to be saved each time you switch dialogs without clicking on the **Apply** button or being shown a message asking if you would like to apply changes.
- **Enable hover selection:** Checking this option allows you to highlight an item by moving the mouse pointer over that item and keeping it there for a specified amount of time (in milliseconds).

Editor Preferences Tab
The **Editor Preferences** tab of the **Options** dialog box, shown in the figure below, gives you several options for controlling the inserting and updating of tags, applying changes to your configurations, and automatically connecting to and disconnecting from the server as well as automatically updating data.



Options Dialog Box: Editor Preferences Tab

Help Menu

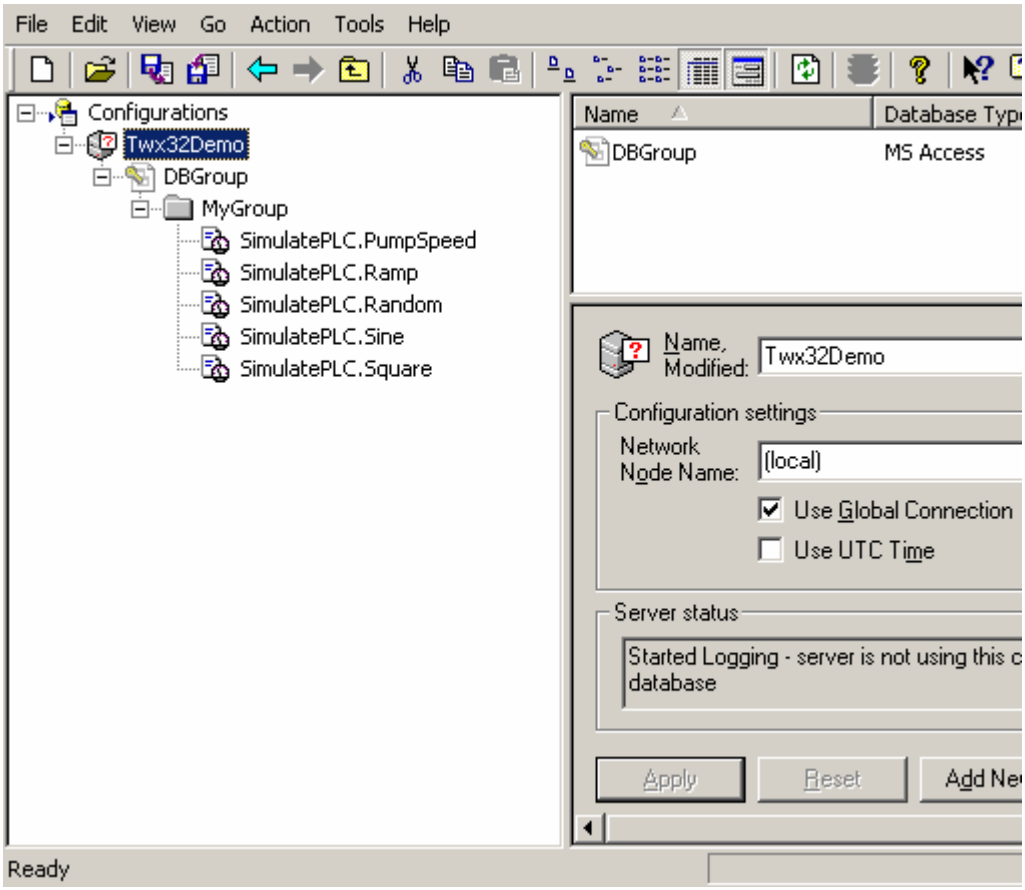
The **Help** menu contains the following commands:

Command	Shortcut Key	Function
Help Topics	F1	Launches the online help for the TrendWorx Configurator.
What's This?	SHIFT+F1	Displays context-sensitive help topics.
About Application		Launches the **SMAR About Box,** which contains information about the product version number, copyright, and available disk space. It also contains information about how to contact SMAR.

TrendWorx Configurator Setup

The TrendWorx Configurator setup "tree" in the left-hand pane of the Configurator screen, shown in the figure below, contains the following levels of configuration, from lowest to highest:

- Tags
- Logging group
- Database group
- Configuration



TrendWorx Configuration Tree

The extent of configuration varies from level to level. Starting from the highest level in the tree, the extent to which you can manipulate the settings changes depending on the current selection.

Tags. At the tags level, the lowest level, you can click on a tag to view information about the tag and to manipulate its settings. In addition, you can add new tags by clicking **Add New** at the bottom of the tags display.

Logging group. The logging group level allows more flexibility. At this level, you can configure data-collection, logging, and table-management settings, as shown in the figure above. You can also add new tags at this level.

Database group. At the database group level, you can actually establish database-connection settings. You can activate or deactivate the data-logging process. You can also switch logging databases.

Configuration. At the configuration level, which is just below the configuration file level, you can connect or disconnect to the logger by clicking the **Connect/Disconnect** buttons in the right-hand pane of the configuration setup. You can also start or stop data logging by clicking the **Start Data Logging/Stop Data Logging** buttons. It is important to download the configuration before you start data logging. You can do this by clicking the **Make Active** button.

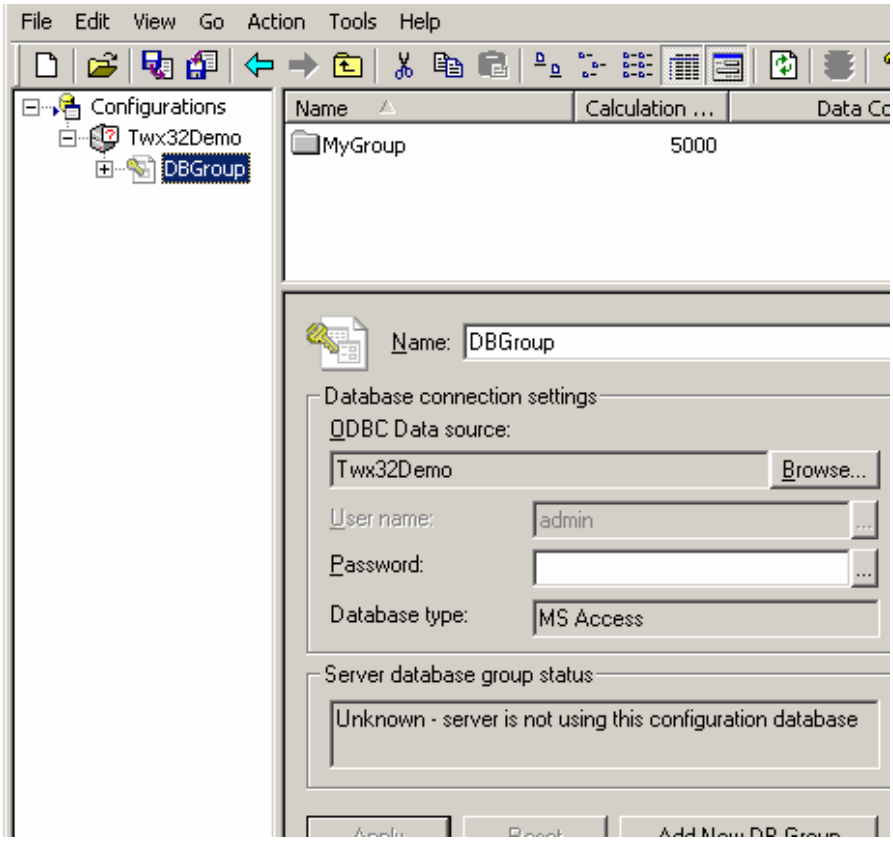
Note
At each level, you can add an item from the level below by using the right-click menu.

Database Groups

From a configuration point of view, a database group represents a:

- High-level grouping of data-logging groups.
- Multithreaded object for managing data updates and logging to disk activities, along with an extensive runtime user interface.
- Physical connection to an underlying database.

In addition, each database maintains a list of recent errors for troubleshooting, which you can view by selecting a database object and selecting **Error Log View** from the **View** menu.



Database Group Configuration

As shown in the figure above, multiple database objects can exist within the same instance of the TrendWorx Configurator, and each of them can be physically connected to the same or different database media. The TrendWorx Configurator resolves any conflicts that might occur between databases, such as table names.

Each **database object** is responsible for managing groups of signals. A database group object allows for:

- A logical collection of signals to be data-logged.
- Common data-collection rate and data-logging table.
- Common data-logging configuration.
- Group style management and editing capability for a collection of signals.

A database group is used to group OPC tags. Clients can use this information for filtering purposes. A tag can exist under multiple database groups or even multiple times within the same logging group. In the latter case, the logging name of the tag must be different.

Tags

A **tag** represents a single object for OPC information. A tag can contain information for multiple types of OPC input and output.

Note
For historical replay, each historical tag is identified by:

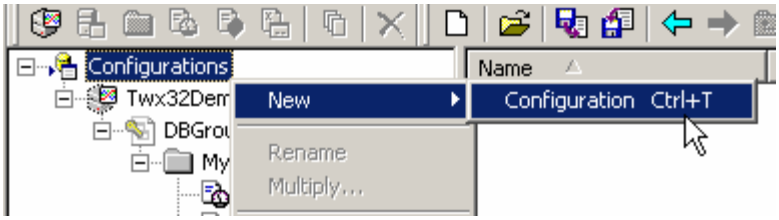
DatabaseObjectName.GroupObjectName.LoggingName
Modifying any of these elements requires re-establishing client connections.

Configuring a New File

Creating a New Configuration

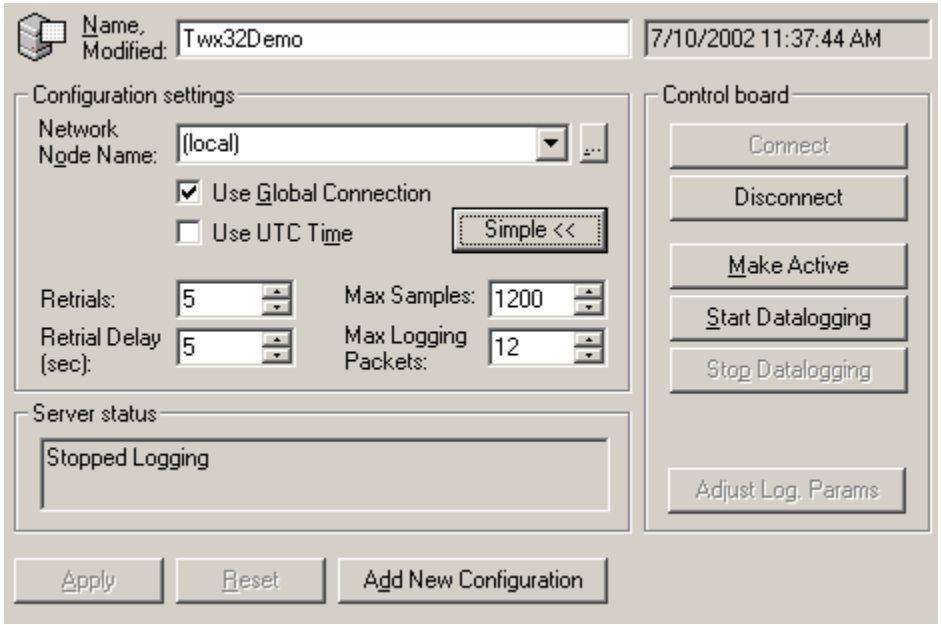
To start a new configuration:

1. Select **New** from the **File** menu of the TrendWorx Configurator. This displays window with a new **Configurations** folder displayed in the left-hand pane of the split window.
2. Right-click the **Configurations** folder and select **New > Configuration** from the pop-up menu (or press the shortcut keys **CTRL+T)**.



Creating a New Configuration

3. Enter the configuration settings in the **Configuration** dialog box displayed in the right-hand pane of the window, as shown below.
4. Click **Apply.** The name of the new configuration will be displayed in the left-hand pane of the window under **Configurations.**



Configuration Dialog Box

You can configure the following settings using the **Configuration** dialog box.

Name. Enter the name of the new configuration in the **Name** field.

Node name. Enter the name of the PC through which the TrendWorx SQL Server will be accessed. It is "local" by default.

Note
Once all configuration work here is completed, you should download the configuration to the TrendWorx SQL Data Logger by clicking **Make Active** to ensure that the Data Logger has processed all changes.

Network node name. The **Network Node Name** is the name of the network where the TrendWorx SQL Server will be accessed. It can be the local name, if the TrendWorx SQL Server is running locally, or a remote node name. Clicking **Nodes** displays a list of all available network nodes.

In addition to the above, the following functions are available within the configuration dialog box**.**

Start data logging. Clicking **Start Data Logging** starts the data-logging mode. This will not be activated if there are any errors that prevent proper logging of data (i.e. table naming conflicts, etc.).

Within this mode you can:

- Retrieve up-to-date information with respect to database generated errors.
- Retrieve up-to-date information with respect to database tables currently being logged.
- Retrieve up-to-date information with respect to the time it takes to log data.
- Deactivate a database object for maintenance, and then reactivate it.

Stop data logging. Clicking **Stop Data Logging** stops the data-logging mode.

Connect. Clicking **Connect** establishes a physical connection to the TrendWorx Data Logger. Once the connection has been established, you can make a configuration active, start or stop data-logging, and reset the Data Logger's configuration (i.e. erase *all* configured groups and tags from memory).

Disconnect. Clicking **Disconnect** disconnects the Data Logger. No interaction with the Data Logger will be available until the connection is re-established.

Make active. Clicking **Make Active** downloads the selected configuration to the Data Logger. The Data Logger will create a historical database "footprint" into the target databases, which can be used to configure the TrendWorx Reporting tool.

Add new configuration. Clicking **Add New Configuration** creates a new data-logging configuration and automatically selects it as the current node in the configuration tree.

Use UTC time. If **Use UTC Time** is checked, all time stamps stored in the database will be stored as UTC time stamps. This is to accommodate automatic daylight savings time switching in Windows when the Data Logger is logging data. All historical clients and TrendWorx Reporting tools will always retrieve historical data in their local (non-UTC) time.

Note
TrendWorx up to and including Version 6.1x is using the Windows-based APIs for converting a time from local time to UTC or from UTC to local time. The Windows APIs do not correctly adjust the conversion for the daylight savings time if the timestamp to be converted was obtained from a different time period (i.e. it was obtained in "summer" time but now we have "winter" time). TrendWorx Version 7.0 has new time conversion utilities that account for this discrepancy. There are, however, some things to consider:

- These functions are used by default (no user enabling is required).
- This is what they do in order to convert each timestamp:

  - They check Windows for the PC Time Zone Settings and to see if automatic daylight savings is enabled.
  - They also obtain from Windows the times/dates for switching over. (These dates do not change; they are in the form of, e.g., the first Sunday of April.)
  - Depending on the previous information, the new functions properly adjust the conversion times to compensate for daylight savings time.

Use global connection. This option instructs the TrendWorx SQL Server to maintain an open database connection, for each database group, for the duration of the data-logging activity. By default, it is set to TRUE. It should be used when the data-logging application writes frequently to the database; it yields a better performance. However, if data-collection rates are slower and logging

to disk is configured to be slow, disabling this option may actually improve performance, memory utilization, and CPU and database server resource usage.

Advanced/Simple. Clicking the Advanced/Simple button displays/hides the Retrials, Retrial Delay, Max Samples, and Max Logging Packets parameters.

Retrials. Since version 5.00, the TrendWorx Data Logger has supported retrials for data logging, if the data-logging operation failed for any reason. As such, the number of retrials indicates the number of times TrendWorx SQL Server will try to log data if the operation fails for the specific data-logging package.

Retrial delay (sec). The **Retrial Delay** option controls the elapsed time (in seconds) between successive retrials.

Max samples. This sets the maximum number of samples to be kept in the memory buffers prior to data logging on a per-signal (tag) basis. It is used to avoid cases in which an excessive amount of samples could consume large memory resources.

Max logging packets. The **Max Logging Packets** option is used with the **Retrials** option to handle data-logging failure cases and to provide a more robust system. It sets the maximum number of data-logging packets to keep in memory, in case of data-logging failure, so that the data-logging activity will not utilize all available PC memory. The larger the number of retrials and max logging packets, the more system memory the TrendWorx SQL Server will utilize.

Adjust logging parameters. You can adjust the values of data-logging parameters and then click the **Adjust Log. Params** button to apply the changes. Of all the available parameters, the **Use Global Connection** field cannot be adjusted while the TrendWorx SQL Server is in data-logging mode.

Note
Once you have completed all configuration work, it is recommended that you click the **Make Active** button to download the selected configuration to the Data Logger. Once this is done, the Data Logger creates a historical database "footprint" in the target databases, which can be used to configure the TrendWorx Reporting tool.

Remote Download

The TrendWorx Configurator supports remote download of database group connections. You can now locally configure ODBC DSN connections. When you click the **Make Active** button, the TrendWorx Configurator will download the configuration to the remote PC where the TrendWorx SQL Server resides. Upon doing so TrendWorx SQL Server will perform a test connection using the database connection strings downloaded by the TrendWorx Configurator.

If the test fails with Microsoft Access, it will try to create a new .mdb file in the desired directory. If the test succeeds, it will create an ODBC system data source on the fly using the newly created .mdb file.

If the test fails with Microsoft SQL/MSDE, it will replace the workstation ID with the current node name in both OLEDB and ODBC connection strings. If the test succeeds, it will create an ODBC System data source on the fly using the Microsoft SQL/MSDE database.

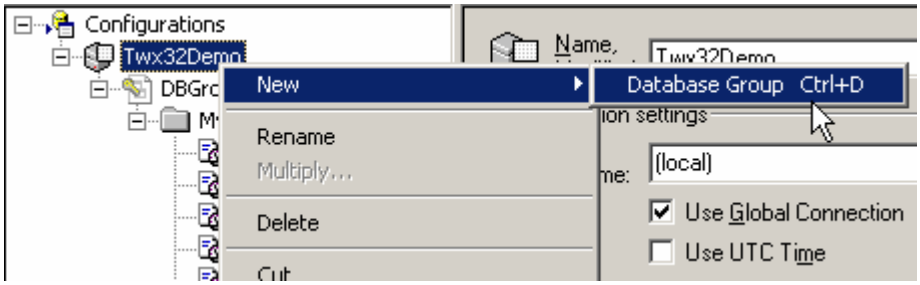
Any errors generated will be reported to the NT event logger and to the Configurator database. The remote data source creation support has also been integrated into the switch database functionality of TrendWorx SQL Server to enable "hot-switching" of data-logging databases.

Note
There is no support for this functionality when configuring an Oracle-based data-logging application.

Creating a New Database Group

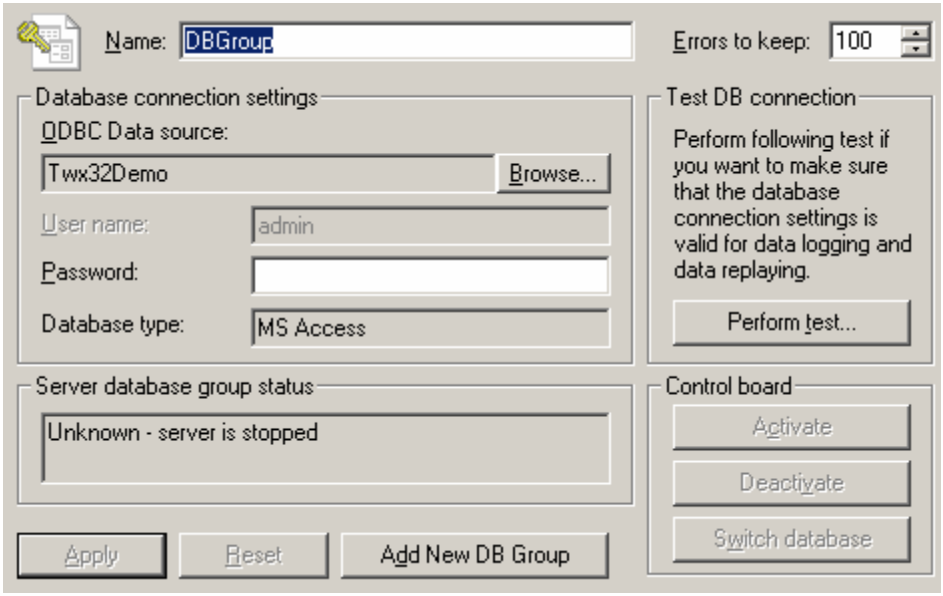
To create a new database group:

1. Right-click on the new configuration and select **New > Database Group** from the pop-up menu, as shown in the figure below.



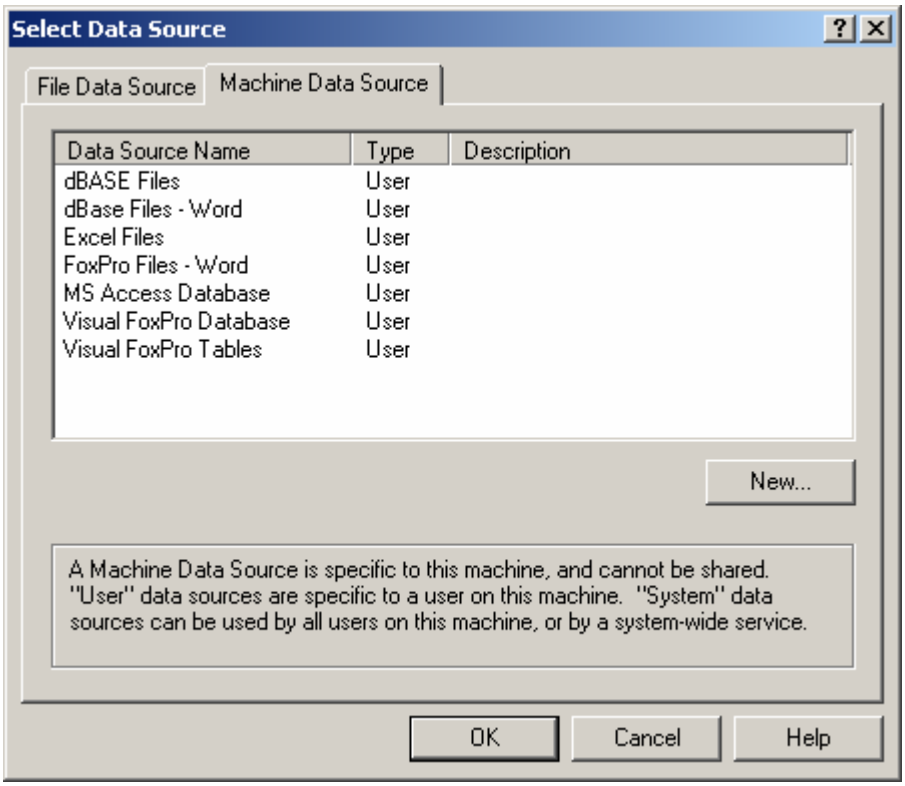
Creating a New Database Group

2. Enter the name of the database group.
3. Enter the database settings in the **New Database Group** dialog box in the right-hand pane of the window, as shown in the figure below.
4. Select a data source by clicking **Browse** in the **Database Connection Settings** field. This opens the **Select Data Source** dialog box, shown below. You have the option of selecting an existing machine data source that is specific to the machine or creating a new machine data source. When you have made your selection, click **OK.**



New Database Group Dialog Box

Note
Currently the TrendWorx SQL Data Logger only supports the **Machine Data Source** tab of the **Select Data Source** dialog box. This tab establishes the data source and sets a database connection.



Select Data Source Dialog Box

You can configure the following database group settings using the database group dialog box.

Name. Enter the name of the database group in this field.

Database connection settings. This section allows you to set up a connection to the data source. It also allows you to set up a new data source.

Activate database group. If the TrendWorx SQL Data Logger is in runtime mode, clicking **Activate** starts data collection and data logging for all logging groups of the selected database group.

Deactivate database group. If the TrendWorx SQL Data Logger is in runtime mode, clicking **Deactivate** stops data collection and data logging for all logging groups of the selected database group.

Database switching. Clicking **Switch Database** allows you to switch to a different database while in runtime mode.

Note
Database switching is supported in runtime mode; that is, when data logging is active. You need to follow these steps:

1. Select the database to which you would like to switch by clicking **Browse** in the **Database Connection Settings** field), and then click **Apply.** A warning message will appear indicating that the changes will not take effect until the Data Logger exits data-logging mode and the changes are downloaded to the Data Logger or the **Switch Database** button is clicked.
2. Click the **Switch Database** button to switch the logging database. A message box will warn you again and will give you the choice of whether to redirect pending writes to the new database connection.

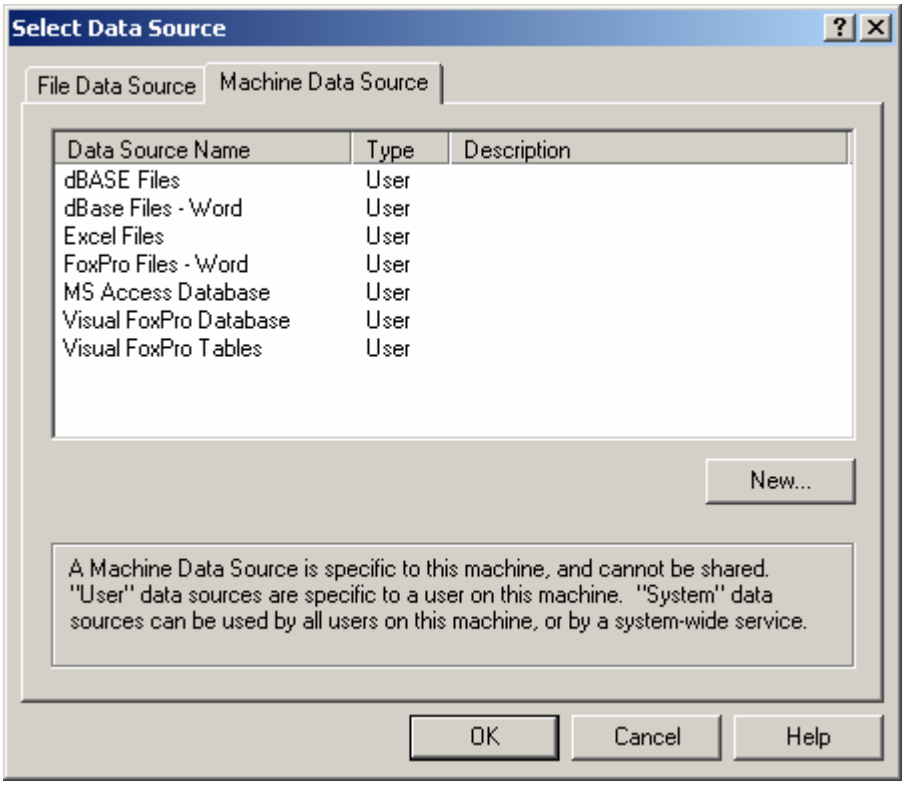
When the Data Logger detects a database switch operation, it also may require a higher count of client units if the database switch is an upgrade from a Microsoft Access database to a SQL server database or an Oracle database. If the client units are not available, the database switching operation will fail and the active logging database will revert back to the old one. For more

information, please review the SMAR licensing and client units registration documentation.

Creating a New Data Source

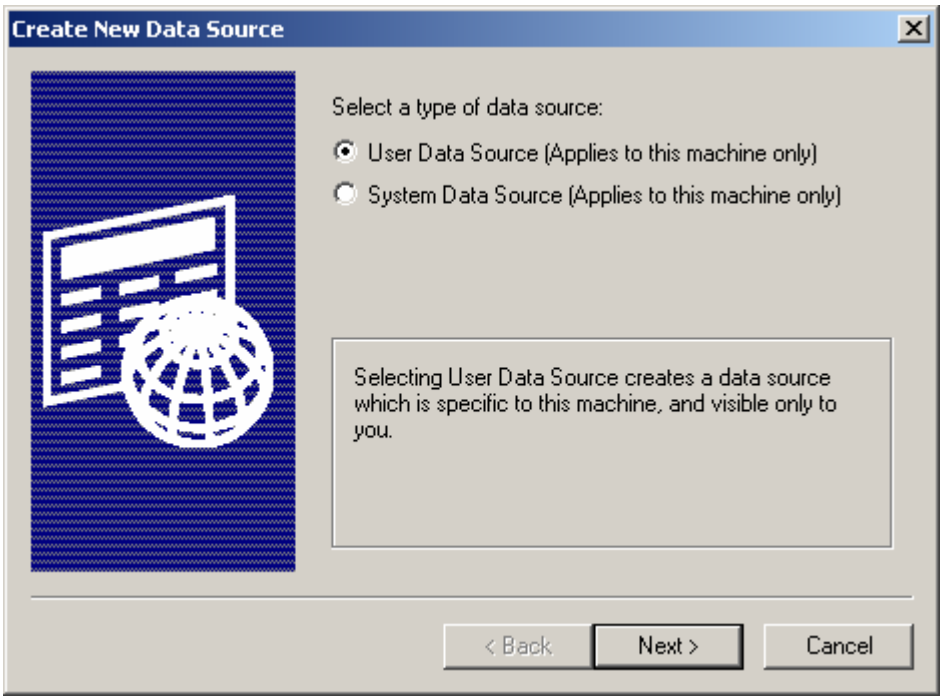
You can also create a new data source and establish a new database connection for the new database group you have just created by using the following procedure:

1. Click the **New** button in the **Select Data Source** dialog box, as shown in the figure below.



Select Data Source Dialog Box

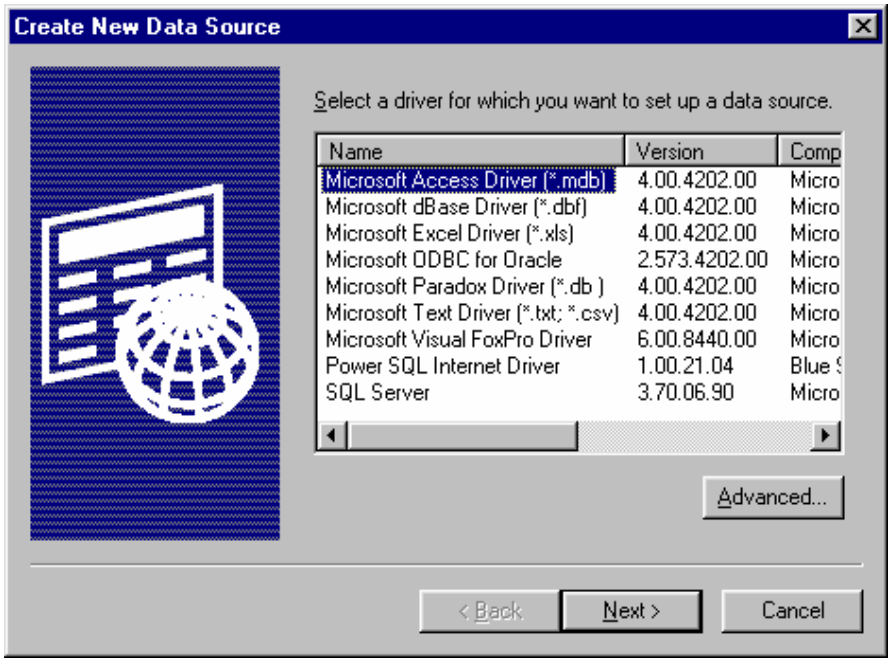
2. This opens the **Create New Data Source** wizard, shown below, which is a series of dialog boxes that will guide you through the required steps to create a new data source. Select a **User Data Source** or a **System Data Source.** We recommend choosing a system data source. Then click **Next** to continue with the data source creation.



Create New Data Source Wizard

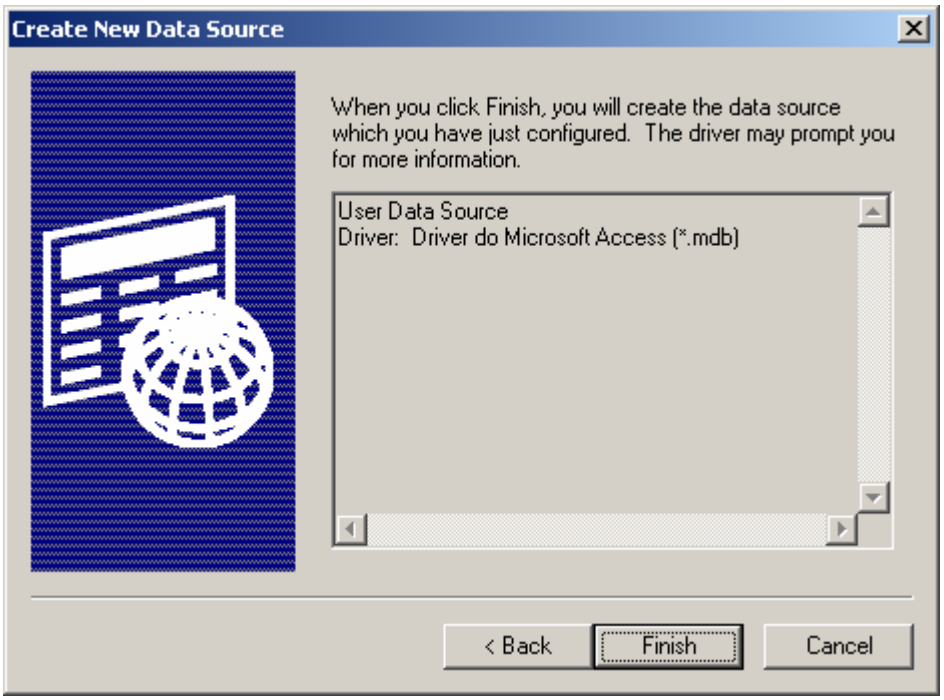
3. Select an installed driver that you wish to use, and then click **Next.**

Note
Currently, the TrendWorx SQL Data Logger only supports Microsoft Access, Microsoft SQL Server, MSDE and Oracle databases using the Oracle provided ODBC Driver.



Create New Data Source Wizard

4. In the next dialog box of the **Create New Data Source** wizard, shown below, click **Finish** to create the data source you have just configured.



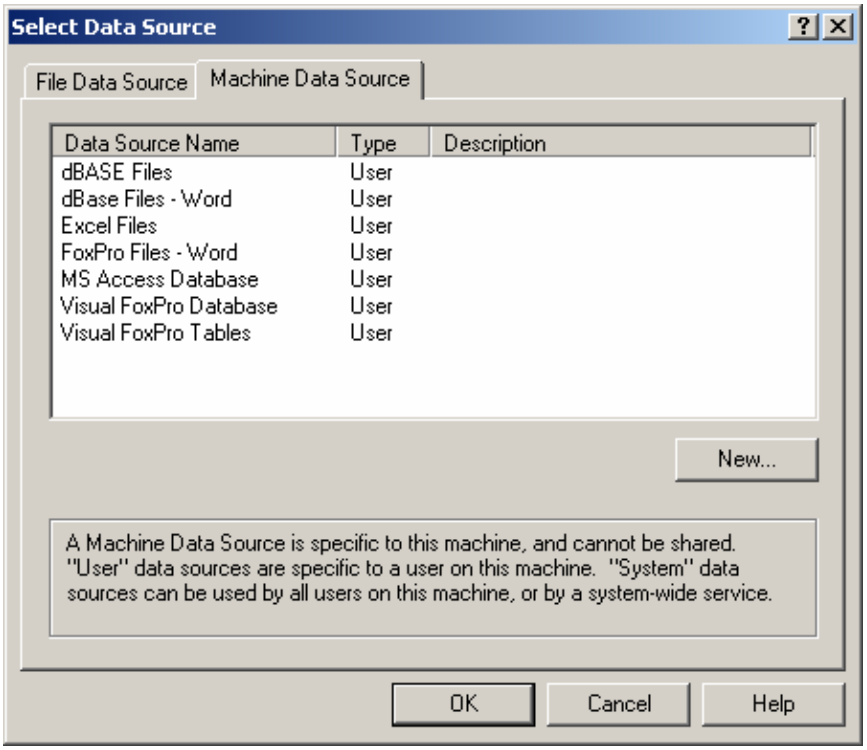
Create New Data Source Wizard

5. The wizard will then provide you with further instructions.

Selecting a Logging Database

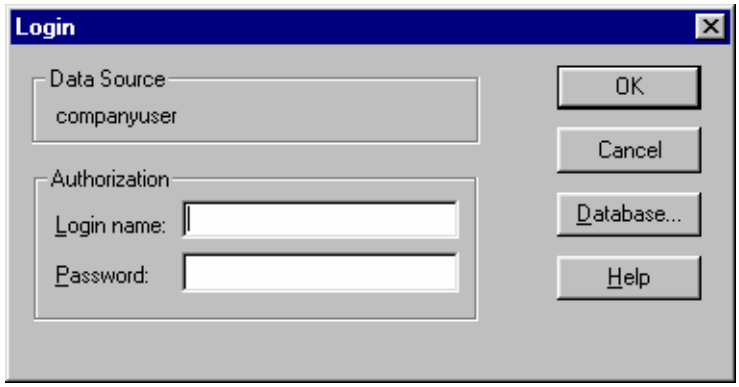
You can now select the data source to which you want to log the data by using the following procedure:

1. Select a logging database by clicking **Browse** in the ODBC Data Source field in the **New Database Group** form.
2. The new data source is then displayed in the **Select Data Source** dialog box, as shown below.



Select Data Source Dialog Box

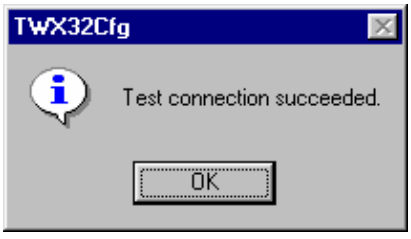
3. Once you select the proper data source name, click **OK.** You will then be asked to login if you have selected a machine data source, as shown below.



Data Source Login Dialog Box

4. Enter your login name and password.

5. Click the **Perform Test** button in the **New Database Group** form to execute the test for connectivity. You will be notified when the test has been completed, as shown below. Click **OK.**

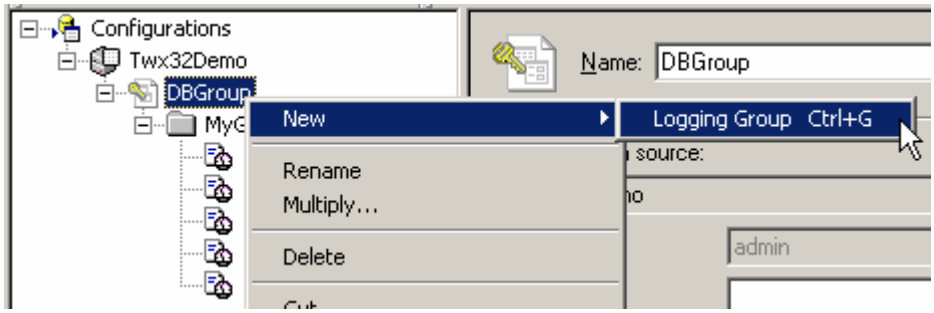


Test Connection

Creating a New Logging Group

To create a new logging group:

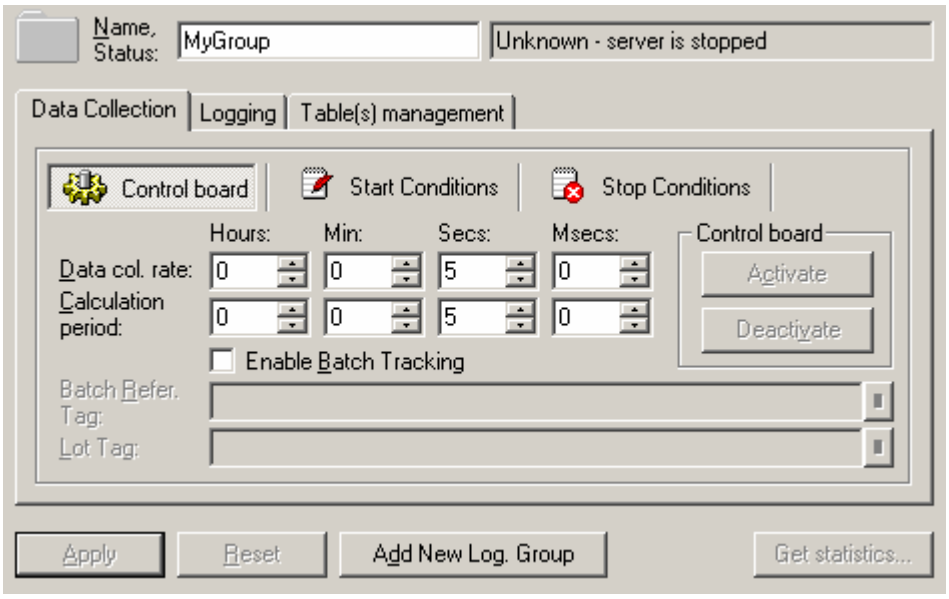
1. Right-click on a database group and select **New > Logging Group** from the pop-up menu, as shown in the figure below.



Creating a New Logging Group

2. This opens the **New Logging Group** dialog box in the right-hand pane of the TrendWorx Configurator screen, as shown below.
3. Enter the name of the new logging group in the **Name** field at the top of the dialog box.
4. Define the parameters for the following three tabs:

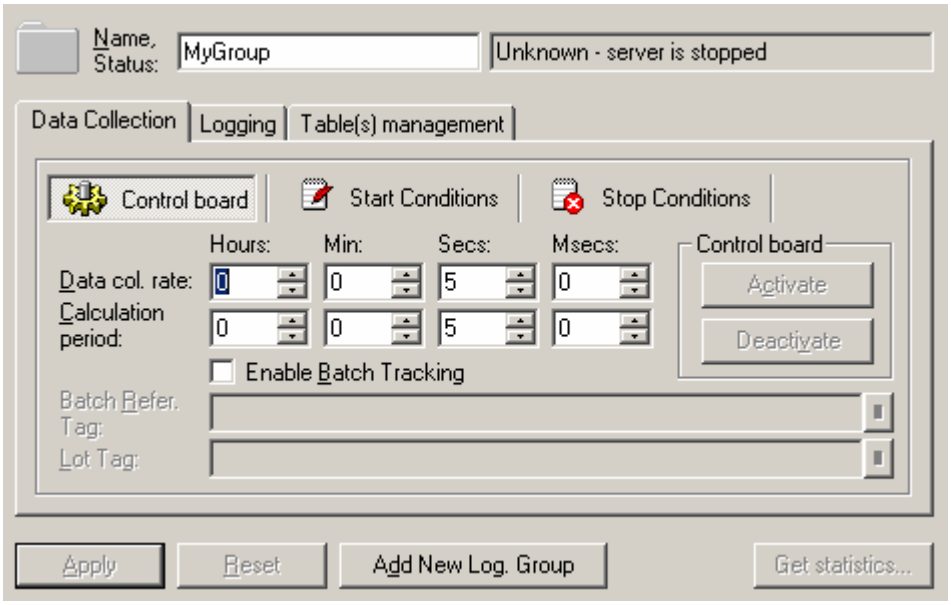
- Data collection tab
- Logging tab
- Table management tab



New Logging Group Dialog Box

Data Collection Tab

The **Data Collection** tab in the **New Logging Group** dialog box, shown below, allows you to define the **Control Board,** the **Start Conditions,** and the **Stop Conditions** for the new group. Enter the appropriate fields in this tab as defined below.



Data Collection Tab: Control Board

Control Board

Data-collection rate. This field allows you to enter the rate at which data will be collected in units of hours, minutes, seconds, and milliseconds.

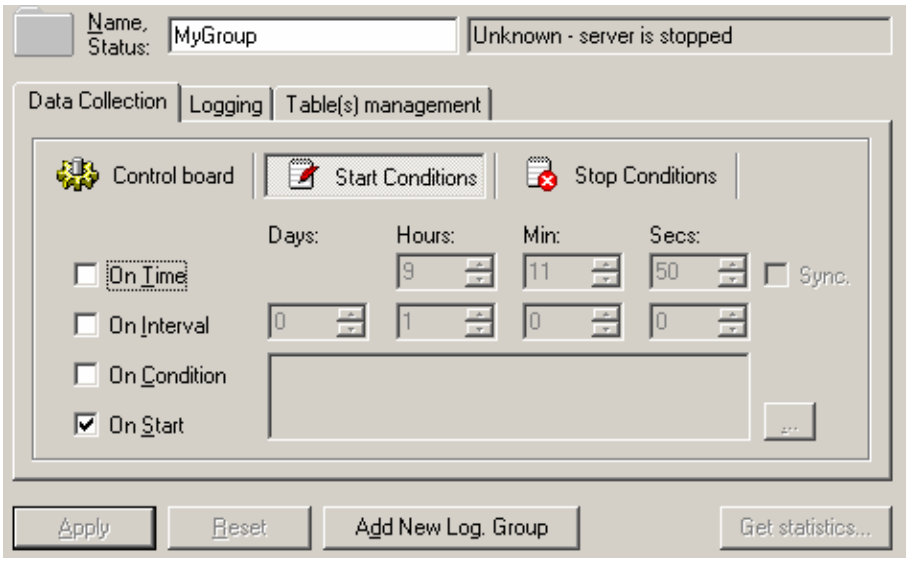
Calculation period. This field allows you to define when a new calculation period will begin.

Note
Warnings are built into the system to ensure that the new calculation will not begin at an inappropriate time.

Batch and lot tracking. The TrendWorx Configurator supports batch and lot tracking. You can enable this support on a per-data-logging group basis and define OPC string signals that store the current batch and lot information. These values may be automatically retrieved through a bar scanner or manually entered through a graphics screen within a GraphWorx or VBA Form.

Start and Stop Conditions

Click **Start Conditions** and **Stop Conditions,** as shown in the figure below, to define the beginning and end of data collection, or the period during which the logging group is connected to the data source and is logging data.



Logging Group Start Conditions

The **Start Conditions** field contains the following options for starting data collection.

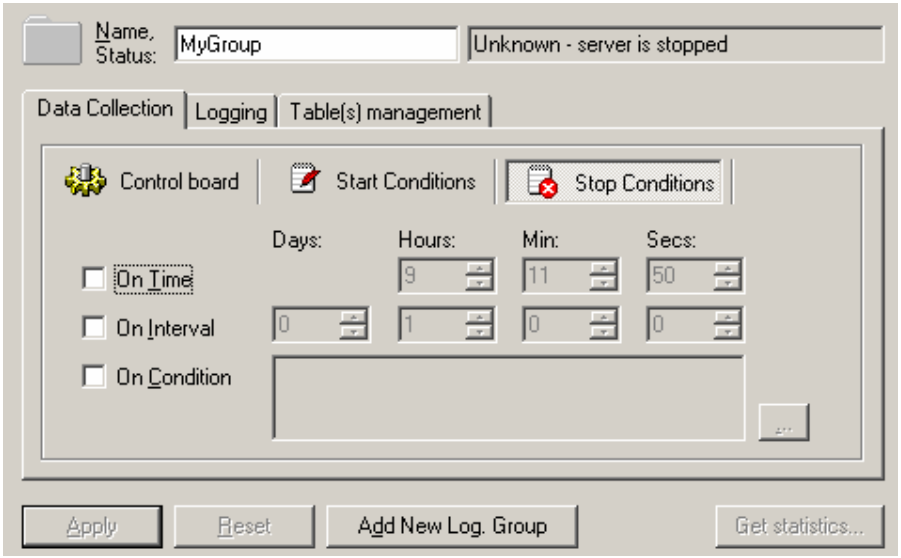
On time. When **On Time** is checked, data logging and data collection for the selected group will start at a specified time in hours, minutes, and seconds.

Sync. When **Sync.** is checked, the data collection for the selected logging group will be synchronized to start on the next full time interval starting one full data-collection period from the time selected. For example, if the desired start time is 10:00:00 AM, the data-collection rate is 1 hour, and the Data Logger enters runtime mode at 10:15:00 AM, the data-collection and data-logging activity for the selected logging group will start at 11:00:00 AM.

On interval. When **On Interval** is checked, you can specify the time period (interval) during which you want data logging and data collection to start.

On condition. When **On Condition** is checked, you can define a specific condition for starting data logging. Once you check this box, you can click the **Browse** (…) button on the right. This will display the **Edit Expression** dialog box. Refer to the **Expression Editor** documentation for more information.

On start. Selecting **On Start** starts data collection and data logging for the selected group whenever the Data Logger enters runtime mode (default selection).



Logging Group Stop Conditions

The **Stop Conditions** field contains the following options for stopping data collection.

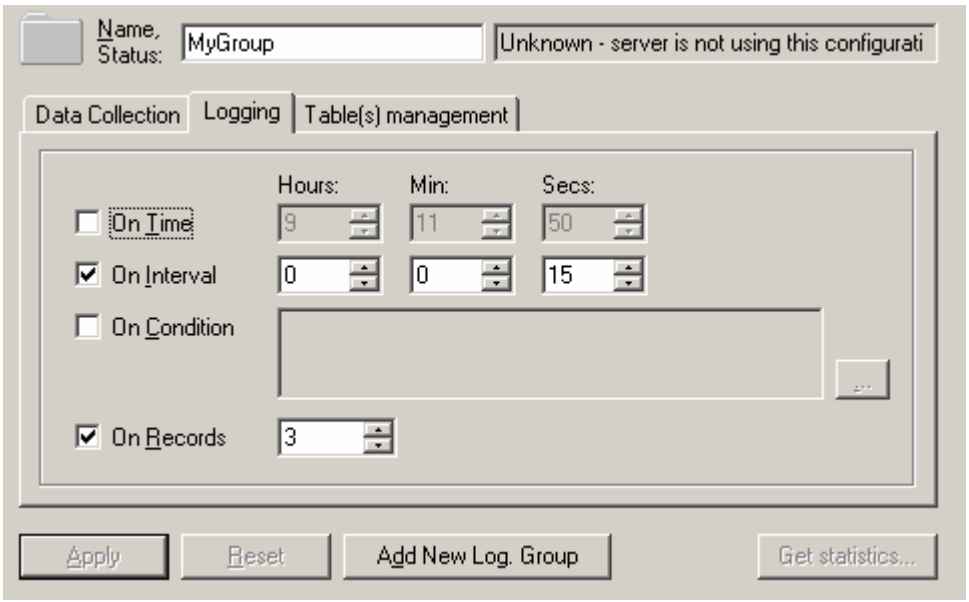
On time. When **On Time** is checked, data logging and data collection for the selected group will stop at a specified time in hours, minutes, and seconds.

On interval. When **On Interval** is checked, you can specify the time period (interval) during which you want data logging and data collection to stop.

On condition. When **On Condition** is checked, you can define a specific condition for stopping data logging. Once you check this box, you can click the **Browse** (…) button on the right. This displays the **Edit Expression** dialog box. Refer to the **Expression Editor** documentation for more information.

Logging Tab

The **Logging** tab in the **New Logging Group** dialog box, shown below, determines the settings and conditions for the storage of historical information to the database for the selected logging group. It also provides excellent load-balancing capabilities when writing to disk.



Logging Tab

The manner in which the collected data are actually logged to the database by the Data Logger is determined by the settings on the **Logging** tab. The **On Time** check box refers to a data-logging time. **On Interval** refers to a selected time period during which data logging occurs (for example, every 30 minutes). The logging subinterval is used for tags, which have this option enabled. It basically averages samples, at the selected subinterval, prior to logging to disk. If the option for the tag is not enabled, and the tag is not configured to log all values, only one averaged sample will be data-logged.

Note
Currently, the fastest time allowed for logging data to disk is 5 seconds.

Enter the appropriate fields in this section as described below. Click **Apply** to implement the settings.

On time. The **On Time** option enables you to specify the data-logging time in hours, minutes, and seconds.

On interval. When **On Interval** is checked, you can specify the time period (interval) during which you want you want data logging to occur.

On condition. When **On Condition** is checked, you can define a specific condition for data logging. Once you check this box, you can click the **Browse** (…) button on the right. This displays the **Edit Expression** dialog box. Refer to the **Expression Editor** documentation for more information.

On records. When **On Records** is checked, every time the desired number of samples is collected for any of the tags within the logging group, it will log the data to the server. Selecting this check box allows you to request data logging on records only.

Table Management Tab

The **Table Management** tab in the **New Logging Group** dialog box, shown below, enables you to configure the data-logging process such that a new table can created from the data when requested. This allows a better overview of the data than a continuous stream of data would. Enter the appropriate fields in this section as described below. Click **Apply** to implement the settings.

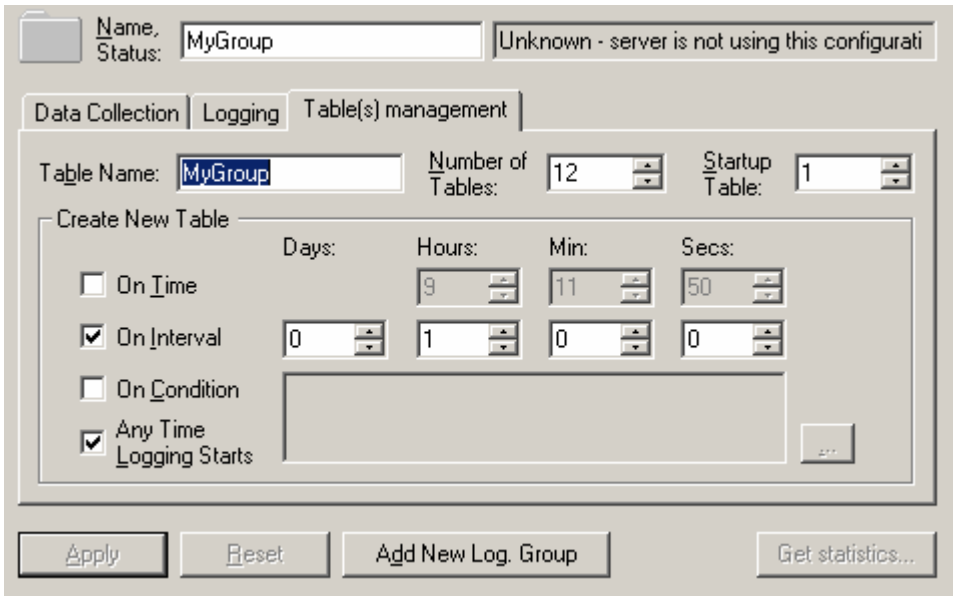


Table Management Tab

Each group of signals stores its data to a single table or a cyclic sequence of tables (user-configurable). This allows for a controlled size of database storage. For example, you can set up the data-logging configuration for a group such that the data are stored to multiple, sequential tables. Trend clients may be configured to retrieve data from the most recent tables, while the other tables are maintained for reporting and comparison with recent data. Although historical information is retrieved by combining information from various historical tables, the ability to store data in multiple (sequential) tables can be used for database maintenance optimization as well as overall system load balancing. By controlling the size of each historical table, you can avoid creating extremely large tables, which may degrade overall data logging and database performance.

To accelerate data retrieval, TrendWorx SQL Server creates the necessary database schema to maintain updated information with respect to the time interval for which each table logs data.

The **Table(s) Management** tab configures how the data will be stored in terms of the number of tables and when a new table will be started. The number entered in the **Number of Tables** field determines the maximum number of tables that will be created. Therefore, when that number is reached and the last table is full, the TrendWorx SQL Server will wipe out all information in the first table to make room for new data. This is important to remember when configuring the settings in the **Create New Table** field. The reason for limiting the number of tables is to save room in your system.

Table name. Enter the name of the table.

Number of tables. Use the "up" and "down" arrows to specify the number of tables you want created. The maximum number of tables allowed in the **Number of Tables** field is 3000.

Startup table. Use the "up" and "down" arrows to specify the number of tables you want created at startup.

Create new table. This section specifies certain conditions that will determine when a new table should be created.

On time. The **On Time** option enables you to specify a time in hours, minutes, and seconds when you want a new table to be created.

On interval. When **On Interval** is checked, you can specify a time period after which a new table should be created during the data-logging process.

On condition. When **On Condition** is checked, you can define a specific condition upon which the creation of a new table is contingent. Once you check this box, you can click the **Browse** (…) button on the right. This displays the **Edit Expression** dialog box. Refer to the **Expression Editor** documentation for more information.

Any time logging starts. When option is checked, table management will occur the moment logging starts.

Control Board for Groups

The **Control Board** is common to all dialog boxes used for group configuration. The **Control Board** allows you to control the server status as well as activation and deactivation of data logging for the selected logging group.

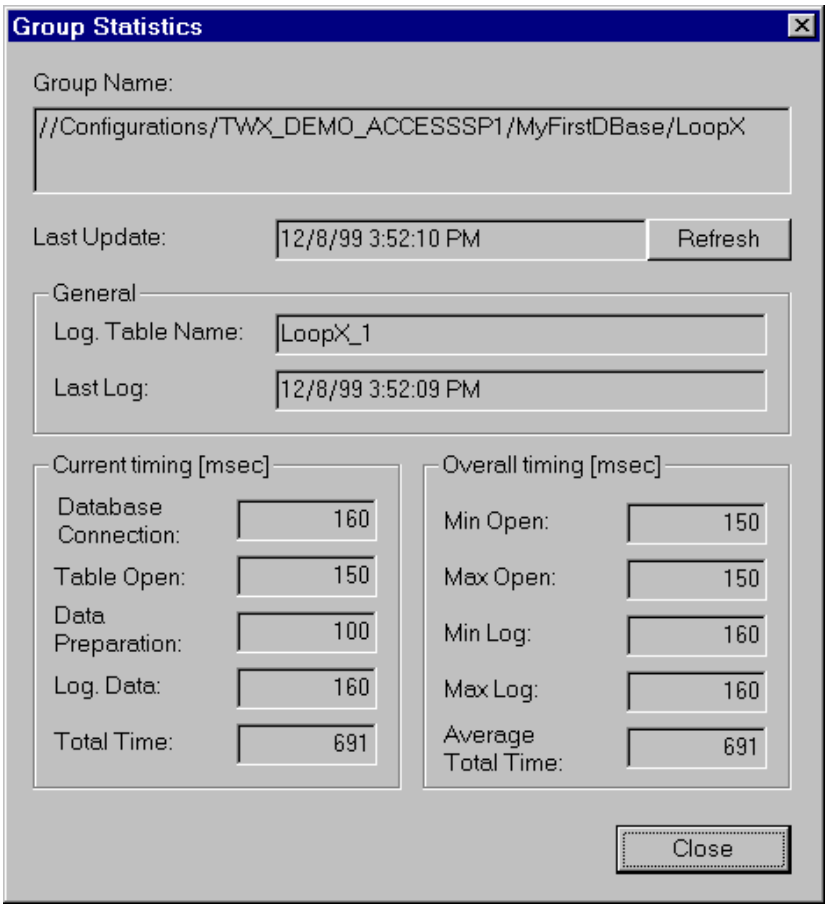
Status. This communicates the status of the server.

Activate. Clicking the **Activate** button activates a logging group. Once the logging group is successfully activated, depending on its configuration, all data-logging and data-collection activity for the selected group will begin.

Deactivate. Clicking the **Deactivate** button tells the server to deactivate a logging group. Once the logging group is successfully deactivated, all data-logging and data-collection activity for the selected group will stop.

Group Information

Clicking the **Get Statistics** button opens the **Group Statistics** dialog box, shown below. This dialog box has two main sections: **Current Timing** and **Overall Timing.**



Group Statistics Dialog Box

Current timing. This section shows the time:

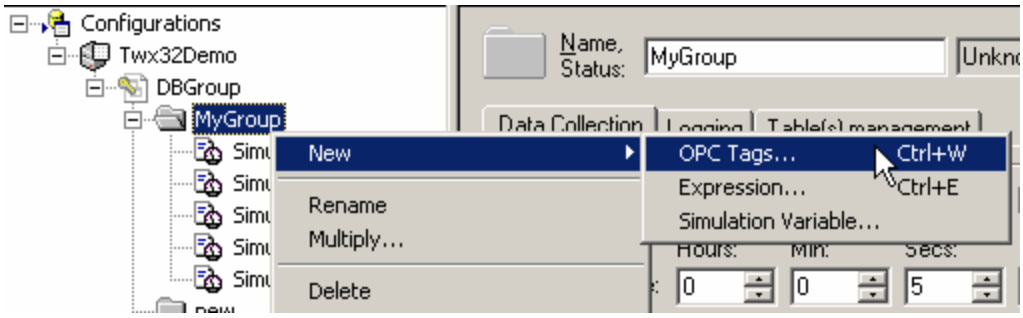
- To get a database connection.
- For a table to open.
- For data preparation.
- To log data.
- Since the logging group last logged historical data to the database (in seconds).

Overall timing. This section shows the minimum and maximum time for the server to open a group. It also shows the minimum and maximum time it took for data logging since the logging group entered data-collection and data-logging mode.

Note
If the maximum time to open or log keeps increasing, there might be a problem with your server or overall available system and hardware resources.

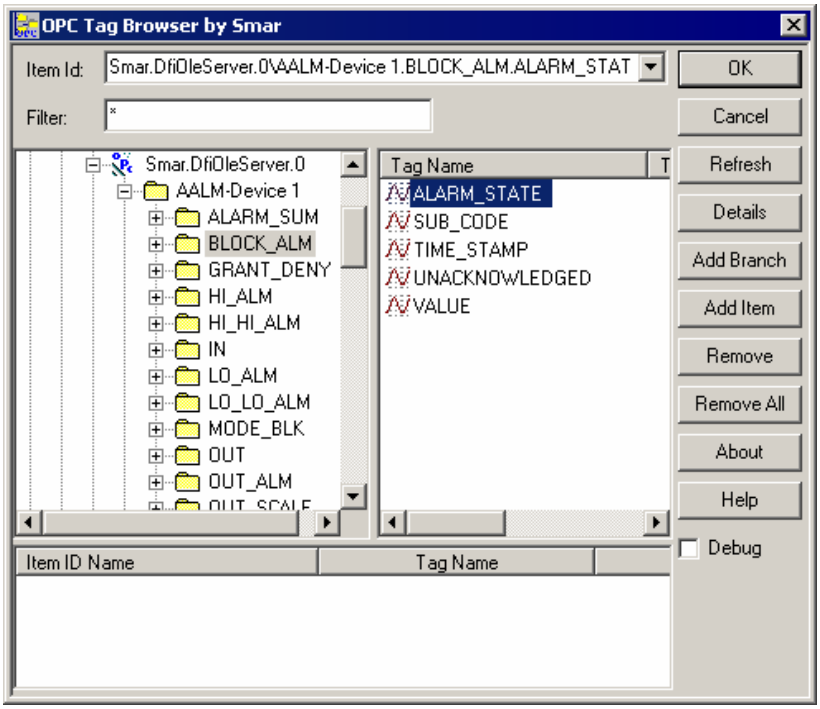
Creating a New Tag

There are three sources for new tags: OPC data tags, expressions, and simulated variables. To create a new tag, right-click the group you have just created. Select **New** and then **OPC Tag, Expression** or **Simulated Variable** from the pop-up menu. If you select **Expression,** the **Edit Expression** dialog box will open. If you select **OPC Tag,** the **OPC Universal Tag Browser** will open as shown below.



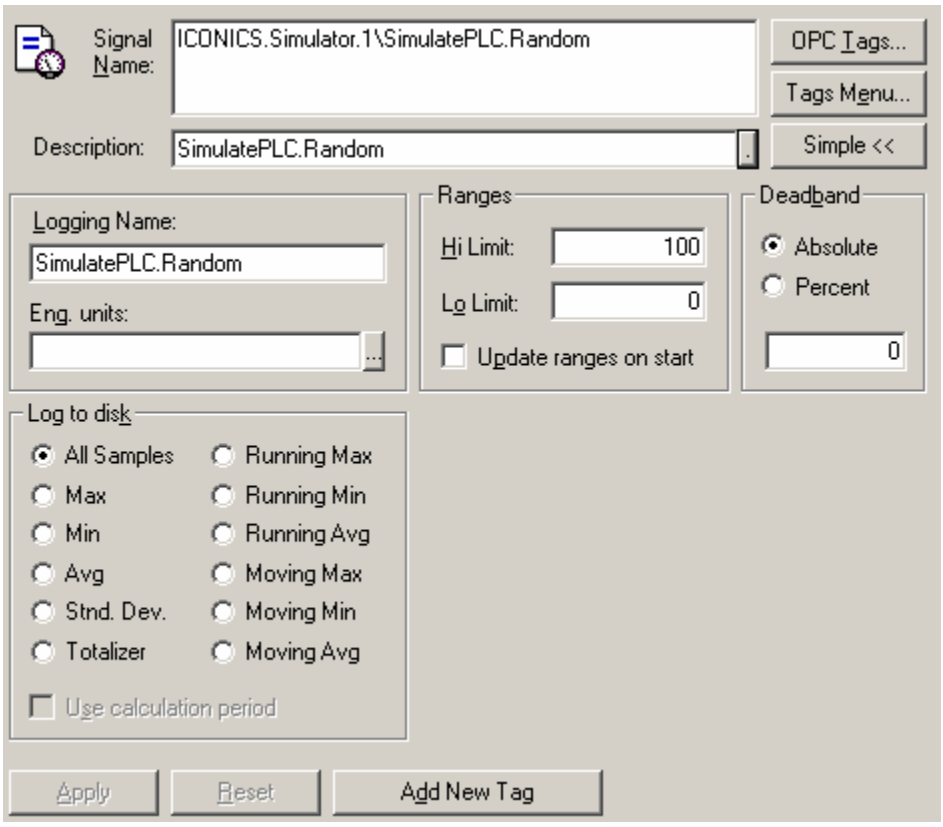
Creating a New Tag

Note
Currently, TrendWorx SQL Data Logger does *not* support data logging of string type tags (signals).



OPC Universal Tag Browser

The **OPC Universal Tag Browser** allows you to navigate all of the installed OPC servers on the local computer or a network. Use the left-hand pane to find the desired tag. Then click **OK.** Click any of the OPC servers that are displayed to select a tag that you wish to configure. The tag name, which uniquely identifies the data item, will be displayed in the **Item ID** field at the top of the **OPC Universal Tag Browser** dialog box. Click **Add Item** to add the tag, which will now be displayed at the bottom of the **OPC Universal Tag Browser** dialog box, as shown above. The tag you have just added will be displayed in the Configurator screen at the **Tag** level and under the **Group** level, as shown in the figure below. Configure the fields described below, and then click **Apply** to implement the configuration.



Data Logging Tag Configuration

Each group maintains a collection of individual tags. These signals can be OPC signals or calculated signals. Each signal can be configured with respect to various attributes, such as deadband and logging.

Signal name. The **Signal Name** filed shows the actual signal (point) name or expression. When you click the tag name in the left-hand pane of the TrendWorx Configurator screen, the tag name or ID, which uniquely identifies the tag will be displayed in the **Signal Name** field, as shown above.

Description. This new field contains a description of the actual signal. For Unicode applications, the description can be language-aliased so that trend clients will use the translated description during animation (runtime) mode. TrendWorx Reporting now uses the Description text on a per-report tag basis. This option, if used, will label the resulting data columns of the target report using the defined Description entries in the TrendWorx Configurator. By default, when a signal is inserted in the TrendWorx Configurator, the Description entry of the signal will be its logging name. You can override the **Description** field, which will be used to label the resulting data column in the final report. If the **Description** field in the TrendWorx Configurator is left empty, the logging name will be used to label the resulting data column of the report. The TrendWorx Reporting application will still display in the tree view or edit dialogs the report tags using their logging names.

In addition, for the Unicode version of TrendWorx Reporting, the **Description** field can be language-aliased to be used with various languages.

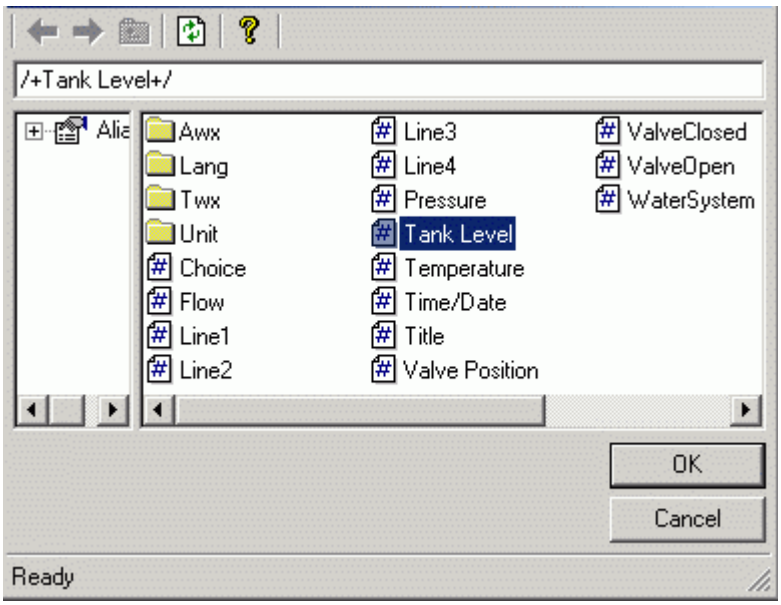
Logging name. Initially the signal's **Logging Name** is set to match the actual tag's (point) name. You can override this setting and choose a more appropriate name such as "Temperature Measurement". This, in turn, will represent the "**signal name**" by which Historian clients will **access** the data logged for that signal. If the signal is an expression, its logging name should be replaced with a description that does not include expression specific syntax.

Note
You can configure the same OPC Tag for data logging multiple times under the same logging group in order to log historical information for the tag using various data-logging filters. However, the corresponding logging names must be different so that the historical replay will clearly identify the related tags.

Note
Avoid using long logging names. If reporting will be used, logging names should be a maximum of 60 characters. If the tag is an expression, the logging name should be modified not to contain expression symbols or mathematical symbols. In addition, avoid using special characters, such as @, #, &, *, $, !, ^, %, ~, and ?.

Engineering units. This field allows you to enter engineering units that will be used. For a Unicode application, the **Eng. Units** field can be language-aliased, and as a direct result, the trend clients will scale the historical data upon switching to a new language.

When specifying a language alias in the **Description** and **Eng. units** fields, you can also select a language alias from the **Language Alias Browser,** which includes all language aliases in the language database. This eliminates the need to manually type in the alias name. Clicking the **...** button opens the **Language Alias Browser,** as shown in the figure below. The browser includes all languages aliases in the language configuration database. All language aliases that are configured in the Language Configurator are conveniently available to choose from inside the browser. The tree control of the Language Configurator is mimicked in the tree control of the Language Alias Browser. Select a language alias by double-clicking the alias name. The alias name appears at the top of the browser, which automatically adds the /+ and +/ delimiters to the alias name. Click the **OK** button.



Selecting an Alias From the Language Alias Browser

Deadband. Each group can also have an individual data-logging deadband and filter for each tag (signal) it maintains. For instance, you may choose to log data for all values retrieved from a certain OPC data server, or for the average of the values over a period of time. In addition, you can configure a deadband value (absolute or percentage) for each signal.

The **Deadband** field allows you to specify a specific (absolute) operational value or a percentage of operation value a signal must change before the server updates with the new value. The deadband is always computed using the most recent sample value, and it is *not* based on the High/Low range sample information. A deadband value of 0 results in storing all samples to the database.

Ranges. The **Hi Limit** field allows you to set the values for the high limit. The **Lo Limit** field allows you to set the values for low limit. In addition, if **Update Ranges on Start** is checked, the ranges for each tag will be refreshed from the OPC server. This ensures that ranges for this tag will be updated at the start of data logging.

Log to Disk

Clicking the Simple/Advanced button hides/shows the **Log to Disk** options. The **Log to Disk** field allows you to select the value(s) of the signal to log to the disk If **All Samples** is selected, the server will log all values for that signal that were collected during that specific data-collection period. **Max** will log the maximum of these values. **Min** will log the minimum of these values. **Avg** will log the average of these values. **Stnd. Dev.** will log the standard deviation of these values. **Totalizer** will run the totalizer function for these values. **Running Max** will log the running maximum of these values. **Running Min** will log the running minimum of these values. **Running Avg** will log the running average of these values (computed using an exponentially weighted moving average filter). **Moving Min** will log the moving minimum of these values. **Moving Max** will log the moving maximum of these values. **Moving Avg** will log the moving average of these values (computed using a **Moving Average** filter). These functions are described below in greater detail.

All samples. Writes to the database all samples collected for the specific tag within each logging-to-disk period.

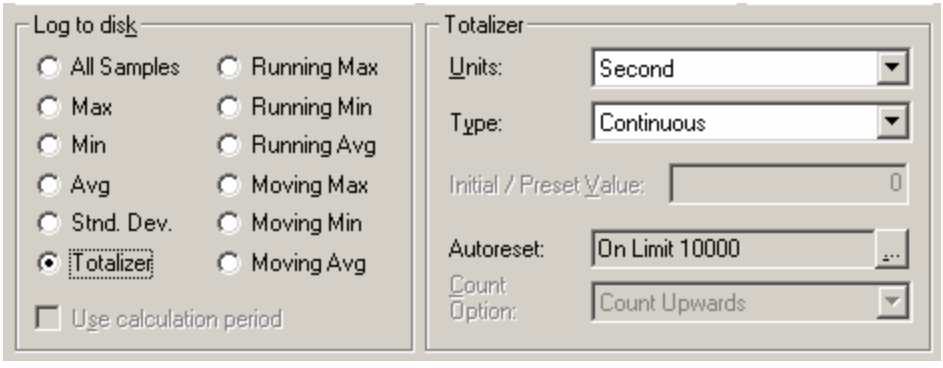
Maximum. Writes to the database the maximum value of all samples collected for the specific tag, calculating the maximum value over the calculation period defined for the logging group (if enabled). If the calculation period is *not* enabled, the entire maximum value for all the available samples at the time of writing to disk will be logged to the database.

Minimum. Writes to the database the minimum value of all samples collected for the specific tag, calculating the minimum value over the calculation period defined for the logging group (if enabled). If the calculation period is *not* enabled, the entire minimum value for all the available samples at the time of writing to disk will be logged to the database.

Average. Writes to the database the average value of all samples collected for the specific tag, calculating the average value over the calculation period defined for the logging group (if enabled). If the calculation period is *not* enabled, the entire average value for all the available samples at the time of writing to disk will be logged to the database.

Standard deviation. Writes to the database the standard deviation value of all samples collected for the specific tag, calculating the standard deviation value over the calculation period defined for the logging group (if enabled). If the calculation period is *not* enabled, the entire standard deviation value for all the available samples at the time of writing to disk will be logged to the database.

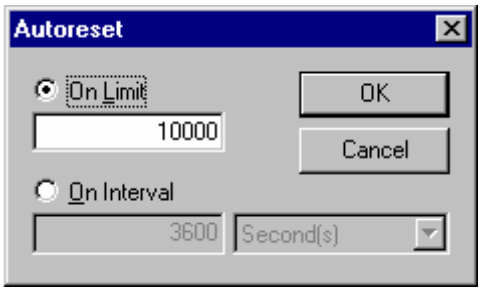
Totalizer. If the **Totalizer** data-logging filter is selected, there are additional options that you can select or enable, as shown in the figure below.



Totalizer Field in Tag Configuration Dialog Box

The Totalizer field contains the following options:

- The **Units** field sets the integration constant for the totalizer filter. It can be seconds, minutes, hours, or days.
- The **Type** field sets the type of totalizer filter, which can be "Continuous," "Preload," or "Preset."
- The **Initial/Preset Value** field sets the Initial (Pre-loaded) or Preset value based on the totalizer type used.
- The **Autoreset** field sets the autoreset mode and value of the totalizer. It can be value-based or time-interval based, as shown in the figure below. Once the condition is met, the totalizer will reset to the configured levels.
- The **Count Options** field sets the integration direction of the totalizer. It can be "Upward" (from a given value) or "Downward" (to a given value).



Autoreset Options

Running maximum. Writes to the database the running maximum value of all samples collected for the specific tag, continuously calculating the maximum value over the entire data-logging period.

Running minimum. Writes to the database the running minimum value of all samples collected for the specific tag, continuously calculating the minimum value over the entire data-logging period.

Running average. Writes to the database the running average value of all samples collected for the specific tag, calculating the running average value over the entire data-logging period using an exponentially weighted moving average (EWMA) filter equation.

If the calculation period is enabled for the tag, and no new samples are received within the calculation time period, the Data Logger will use the last known value to provide a more accurate EWMA estimate. In addition, if new samples are being received irregularly, the Data Logger will try to "backfill" missing samples (by using the last known value) in order to provide a more-accurate EWMA estimate. This way the Data Logger accommodates slowly changing signals, which, due to the event nature of OPC data updates, change less frequently than the desired data collection. If the calculation period is *not* enabled, the Data Logger will still try to "backfill" missing samples (by using the last known value), but no new historical values will be entered to the database until a new (updated) sample arrives. The following EWMA filter equation used is :

EWMA(n) = coefficient * Measurement(n) + (1 -coefficient)*EWMA(n-1)

In this equation, *n* is the sample count, and *coefficient* is a constant typically chosen to be between 0 and 1. From this equation, we can view the EWMA estimate as a weighted average of all past and current measurements, with the coefficients of each new measurement declining geometrically. From this point of view, it is an ideal filter equation to use in the case of random individual measurements. In order to accelerate the filter convergence, the Data Logger will use the following equation:

EWMA(n) = (1/n+1) * Measurement(n) + (n/n+1)*EWMA(n-1)

Until *n* = 32 (i.e. using the first 32 samples). After the first 32 samples, the value of the coefficients in the EWMA equation will stay constant.

Moving maximum. This option is new in Version 6.10. It is similar to the moving average except that it computes the moving maximum value of the samples collected.

Moving minimum. This option is new in Version 6.10. It is similar to the moving average except that it computes the moving minimum value of the samples collected.

Moving average. Writes to the database the moving average value of all samples collected for the specific tag, calculating the moving average value over the entire data-logging period using a **Moving Average** filter equation similar to the one used by Microsoft Excel, where the moving average for each period is based on the average value of the tag over a specific number of preceding periods.

If the calculation period is enabled for the tag, the Data Logger will use the calculation period to define the order of the moving average filter. By default, it will use a fourth order filter, which means that four previous samples will be used in computing a moving average estimate for each time interval. Also, if no new samples are received within the calculation time period, the Data Logger will use the last known value to provide a more accurate moving average estimate.

In addition, if new samples are being received irregularly, the Data Logger will try to "backfill" missing samples (by using the last known value) in order to provide a more accurate moving average estimate. This way, the Data Logger accommodates slowly changing signals, which, due to the event nature of OPC data updates, change less frequently than the desired data collection. If the calculation period is *not* enabled, the Data Logger will still try to "backfill" missing samples (by using the last known value), but no new historical values will be entered to the database until a new (updated) sample arrives.

Note
For all data-logging filters in which calculation is involved, the quality of the "calculated" sample is based upon the qualities of the samples participating in the calculation. If any of them are bad, the calculated sample will be marked with bad quality. For running averages, if the quality of the new sample coming in is bad, the historical sample logged to the database will have the last EWMA computed value, with updated time stamp (the time stamp of the actual sample) and uncertain quality.

Note
TrendWorx SQL Server supports a variety of data-logging filters, which you can customize to meet specific needs. These filters can also provide considerable levels of data-logging compression and disk space savings. For example, if you are setting up a monitoring application at a high-speed data-collection rate, where only certain statistical values are required to be historically archived, the usage of data-collection filters and calculation period can considerably save disk space used for data storage and improve historical data replay performance.

Use calculation period. Checking this box ensures that the calculation period set at the **Group** level settings will be used.

Troubleshooting Data Logging

Using a technology that has been incorporated into all Smar products, TraceWorX provides online diagnostics and tuning of applications running in the ProcessView system. TraceWorX is designed expressly for systems integrators, OEMs and customers who want to have tools for doing their own troubleshooting and diagnostics.

TraceWorX tracks the runtime activity for the TrendWorx SQL Data Logger and logs the runtime data to a log file based on user-configured trace levels. The log file provides a thorough, color-coded report detailing all activity for the application, including the time, the date, the severity level, and a description of the event or problem.

TraceWorX also features several options for reporting issues to technical support. If you are experiencing problems with any applications, the log file deployment options, such as compressing and e-mailing log files, are ideal for tracking and archiving data and sending detailed reports to technical support. Developers can use these reports to identify the source of the problems.

Please see the TraceWorX Help documentation for more information.

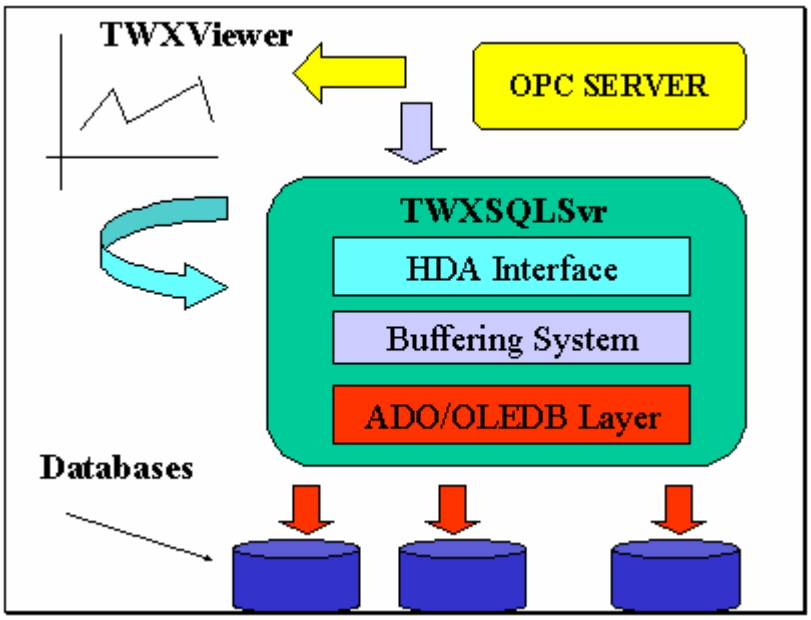
SQL Data Logger

Introduction

The primary purpose of TrendWorx 32-bit data logging is to provide both a data-collection system and a data-retrieval station for historical data to trending and reporting clients. The TrendWorx SQL Data Logger:

- Collects real-time data from OPC servers.
- Logs real-time data to a database.
- Provides data-retrieval capability by implementing a prerelease draft of the OPC HDA (Historical Data Access) specification.
- Provides data-retrieval services locally and remotely across computer boundaries via DCOM.

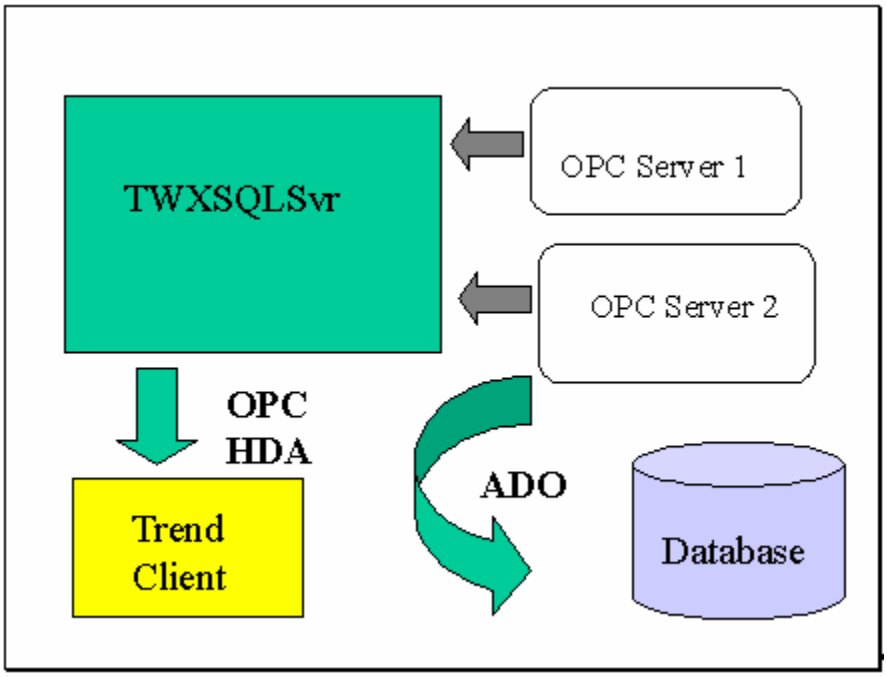
The following diagram shows the internal system architecture of the TrendWorx SQL Data Logger:



Trending and Data Logging Architecture

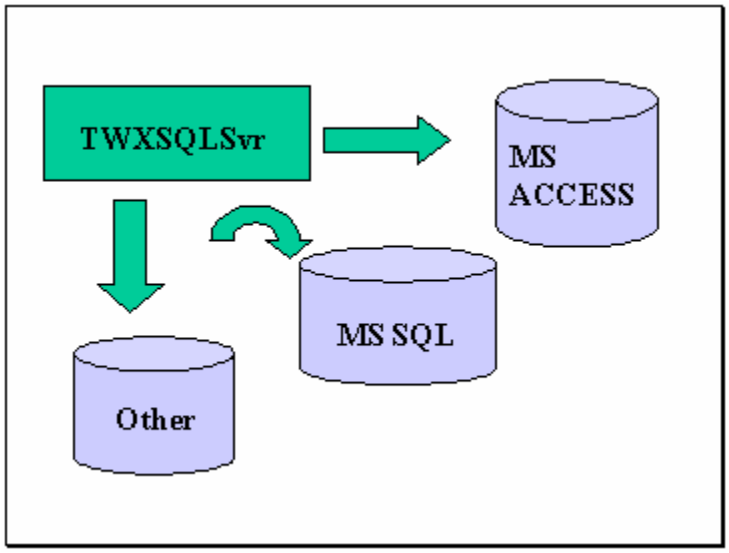
The Smar TrendWorx SQL Data Logger is a true 32-bit Windows application written from the ground up to take advantage of 32-bit operating systems for multitasking and load distribution across multiple threads and processors. The TrendWorx SQL Data Logger not only contains data-logging and data-retrieval historian services, but it also while adds a scalable, client-server architecture to the Smar Trending and MMI software. This architecture ensures optimal load balancing and distribution, even for large-scale applications.

The TrendWorx SQL Data Logger uses the most current data-access technology called (ActiveX Data Objects) ADO. ADO is a database-access mechanism that provides a wrapper of the OLE DB. OLE DB is a COM approach to database programming that can be used to program any database (relational or not relational) as long as there is a dedicated OLE DB data provider for that database. The end result is that applications based on ADO/OLE DB can potentially access any database regardless of the underlying storage media, file system, and location. TrendWorx SQL Data Logger currently uses ADO version 2.5, the Universal OLE DB ODBC data provider supplied by Microsoft, as well as native OLE DB providers to access Microsoft Access, Microsoft SQL Server, MSDE, and Oracle-compliant databases.



Functional Diagram of TrendWorx SQL Data Logger

TrendWorx SQL Data Logger can be deployed using the same PC on which the database resides, or using a different PC that is networked to the database. In addition, you can have TrendWorx SQL Data Logger is deployed on multiple PCs data logging to the same (or different) databases, therefore providing a scalable and distributed data-logging architecture.



TrendWorx SQL Data Logger Multiple Database Capability

A key feature of TrendWorx SQL Data Logger is its ability to handle data logging and data retrieval with respect to multiple types of databases concurrently, therefore enabling you to develop a very cost-effective data-logging and data-retrieval application.

TrendWorx SQL Data Logger will support data logging and data retrieval to or from:

- Microsoft Access
- Microsoft SQL Server 6.5, 7.0, and 2000
- MSDE 7.0 and 2000

- Oracle 8.0

TrendWorx SQL Data Logger is a MFC/ATL free-threaded server application that performs data logging and data retrieval by implementing a prerelease draft of the OPC HDA (Historical Data Access) specification.

Configuration

The configuration layout of the TrendWorx SQL Data Logger is quite similar to that of an OPC server configuration. The key concept here is the **database group object,** which replaces the **device** of the OPC data server configuration.

A database group object represents a:

- High-level grouping of groups of signals to data log.
- Multithreaded object for managing data updates and logging-to-disk activities along with extensive runtime user interface.
- Physical connection to an underlying database.

In addition, each database maintains a list of recent errors for troubleshooting, which can be in the TrendWorx Configurator.

Each database group object is responsible for managing **data-logging groups** of signals. A data-logging group includes:

- A logical collection of signals to be data-logged.
- Common data-collection rate and data-logging table
- Common data-logging configuration.
- Group style management and editing capability for a collection of signals.

For more information, refer to the TrendWorx Configurator Help documentation.

New Features

New features of the TrendWorx SQL Data Logger in version 7.0 include:

- New database connection dialog
- Enhanced data-retrieval support
- Microsoft ADO 2.7 support
- Enhanced expression support
- Daylight savings time support

Note
TrendWorx up to and including Version 6.1x is using the Windows-based APIs for converting a time from local time to UTC or from UTC to local time. The Windows APIs do not correctly adjust the conversion for the daylight savings time if the timestamp to be converted was obtained from a different time period (i.e. it was obtained in "summer" time but now we have "winter" time). TrendWorx Version 7.0 has new time conversion utilities that account for this discrepancy. There are, however, some things to consider:

- These functions are used by default (no user enabling is required).
- This is what they do in order to convert each time stamp:
  - They check Windows for the PC Time Zone Settings and to see if automatic daylight savings is enabled.
  - They also obtain from Windows the times/dates for switching over. (These dates do not change; they are in the form of, e.g., the first Sunday of April.)

- Depending on the previous information, the new functions properly adjust the conversion times to compensate for daylight savings time.

Other features include:

- NT service support for TrendWorx SQL Data Logger.
- Support for operator comments.
- Support for batch and lot tracking.
- Microsoft SQL 2000 and Microsoft MSDE 2000 support.
- Data-logging filters
- MSDE Manager application for managing MSDE-based data-logging applications.
- ProcView Tray support and integration.
- Remote configuration support.
- Data logging tuning parameters.
- ADO 2.5 and 2.6 integration.
- Support for logging tag descriptions.
- TrendWorx SQL Data Logger Configurator.
- Support for Oracle data logging.
- Support for MSDE data logging.
- Integration of native OLE DB providers for faster data replay.
- Asynchronous historical data retrieval for faster updates of real-time historical trends.
- UTC support for data logging. (See the note below.)
- Condition/event-handling mechanism.
- Scheduling for minimizing system load and fully decoupling data logging from data collection, while supporting data-logging retrials in cases of failure.
- Support for hot database switching during runtime mode without stopping data-logging activity. In this scenario, you can use the TrendWorx Configurator or OLE Automation to select a new database for data logging. You have the option to redirect pending writes to the new database or log them to the current one.
- OLE Automation interface to data logging.
- Integration of data-logging activity into the GenEvent Registrar.
- Support for data logging the same OPC tags in the same data-logging group but under a different-logging name.
- Integration of native OLE DB providers for faster replay and decreased CPU usage.

Note
UTC support refers to data logging the time stamps of samples in the UTC time format. However, all clients will replay historical data using the "local" (non-UTC) client time, unless they are otherwise configured.

Upgrading to Versions 6.00 and 6.10

Upgrading From Version 5.20 to Version 6.0

The biggest change in terms of upgrading an existing application of Version 5.20 to Version 6.0 is the new approach to data-logging configuration and administration. Now the configuration information of the TrendWorx SQL Data Logger server ("TWXSQLSvr.exe") is stored in a database file. By default, this file is in a Microsoft Access (.mdb) file format. The TrendWorx Configurator tool configures data-logging and then downloads the configuration data to the data-logging server, which may be local and/or remote. The most important step here is upgrading an existing 5.20 data-logging configuration to the new Configurator database. To upgrade from Version 5.20 to Version 6.00, use the procedure outlined in the following sections.

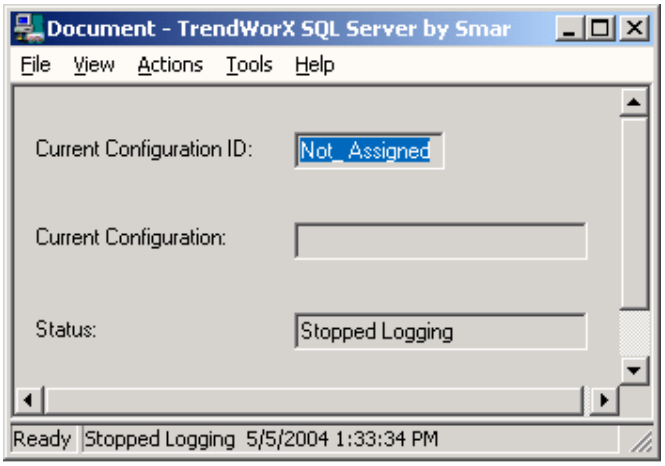
Note
It is suggested that you back up all-important historical data and or current (*.txd) configuration files prior to upgrading to the new database Configurator tool.

Upgrading From Version 6.00 to Version 6.10

To upgrade from Version 6.00 to Version 6.10, you simply need to open the TrendWorx Configurator and select the configuration database file to be upgraded to the Version 6.10 format. The TrendWorx Configurator will automatically convert the configuration .mdb file to the Version 6.10 format.

Upgrading From Version 5.20 to Version 6.00: Step 1

Start the TrendWorx SQL Data Logger from the **Programs** menu in Windows.



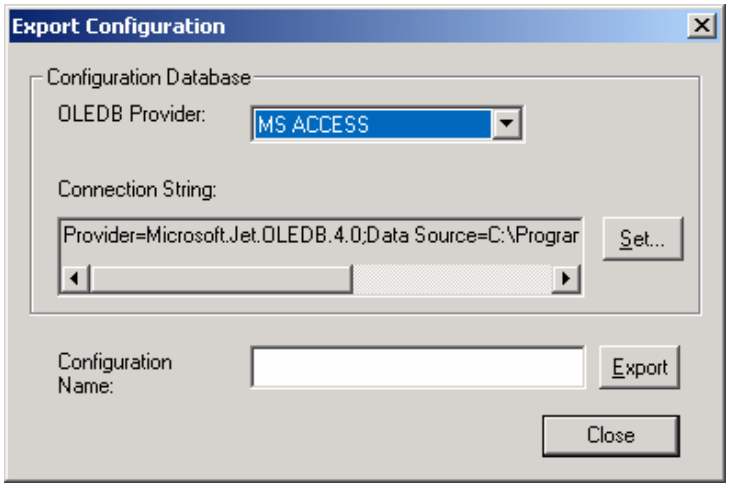
TrendWorx SQL Data Logger Screen

Upgrading From Version 5.20 to Version 6.00: Step 2

From the **File** menu, choose **Open** to open the file that you want to export to the new Configurator database.

Upgrading From Version 5.20 to Version 6.00: Step 3

From the **File** menu, choose **Export Configuration**. This opens the **Export Configuration** dialog box, shown below.



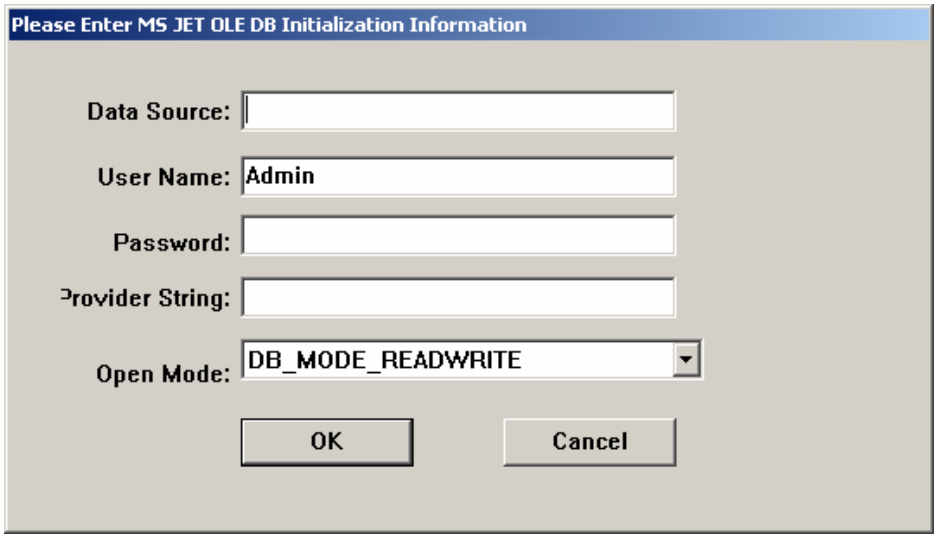
Export Configuration Dialog Box

The updated installation for Version 6.0 will install the following files under the ProcessView "Bin" directory:

- "Twx32Cfg.src"
- "Twx32.mdb"

The first file ("Twx32Cfg.src") is a "template" file for generating default ("empty") configuration databases. The second file ("Twx32.mdb") is a configuration database file that is ready to use. Upon proper installation, when the **Export Configuration** dialog is opened it should list the **OLE DB Provider** and the **Connection String** to the default configuration database file ("Twx32.mdb"), as shown in the figure above.

If this is not the case, select Microsoft Access as the OLE DB provider, and then click **Set.** This opens the **OLE DB Initialization Information** dialog box, shown below. In the **Data Source** field, fill in the correct pathway to the "Twx32.mdb" configuration file, including the ".mdb" Microsoft Access file extension, to properly establish a configuration database connection. Then click **OK.**



OLE DB Initialization Information Dialog Box

Click **Export** in the **Export Configuration** dialog box to export your configuration(s) to the Configurator database. From this point on, the TrendWorx SQL Data Logger will:

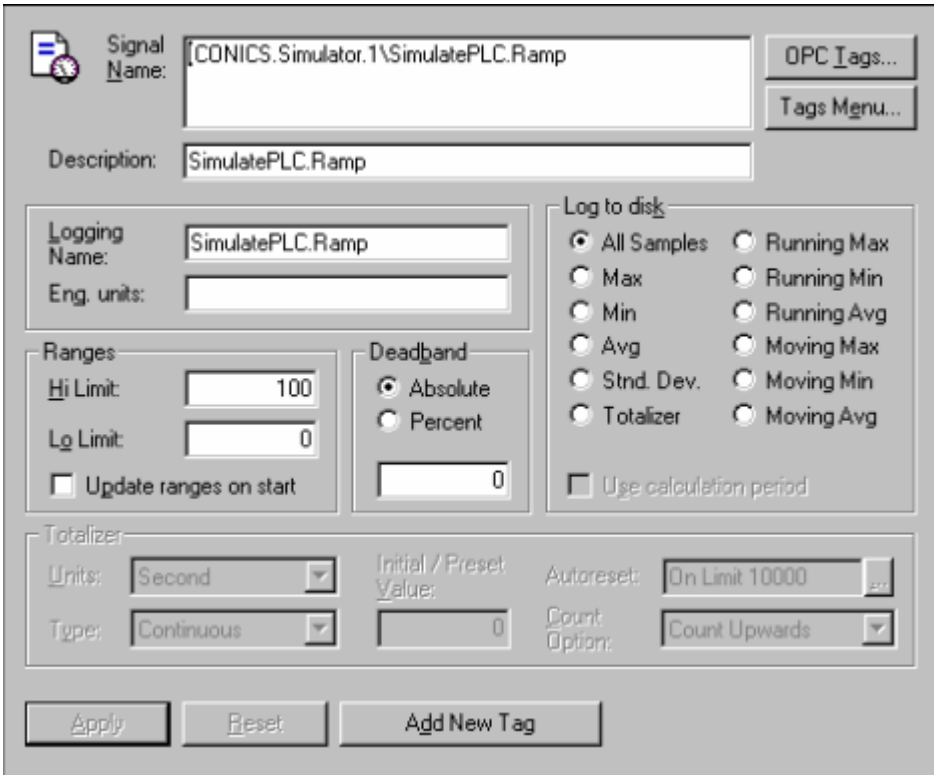
- Use as the current configuration the last-exported configuration, unless otherwise assigned by the new Configurator tool.
- Always load (upon startup) the most-recently assigned database configuration by the Configurator application, or the most-recently exported database configuration.

Upgrading From Version 5.20 to Version 6.00: Step 4

When you have finished exporting databases, shut down the TrendWorx SQL Data Logger.

Upgrading From Version 5.20 to Version 6.00: Step 5

Start the TrendWorx Configurator from the **Programs** menu in Windows. Choose **Open** from the **File** menu to select the "Twx32.mdb" file. By default, the TrendWorx Configurator will load all of the exported configurations, as shown in the figure below. When a configuration is selected, the TrendWorx Configurator will start the TrendWorx SQL Data Logger through OLE Automation.



Setting Up a Configuration Database

Note
The TrendWorx Configurator is integrated into the TrendWorx SQL Data Logger through a COM interface. This means that if the TrendWorx SQL Data Logger is started from within the TrendWorx Configurator, and if no other application is referencing the TrendWorx SQL Data Logger, the TrendWorx SQL Data Logger will shut down after stopping data logging (if it is enabled within the Configurator) once the TrendWorx Configurator is exited. The exception to this rule is when the TrendWorx SQL Data Logger is registered to run as an NT service.

Note
Since the PROCESSVIEW version 5.20 release, the database access tools used by TrendWorx (such as OLE DB and ADO) have been updated by Microsoft. PROCESSVIEW installation will always install the latest available version of these tools at the time of releasing the PROCESSVIEW product. It is recommend that, once the existing Version 5.20 TrendWorx SQL Data Logger configurations have been successfully exported to the new TrendWorx Configurator, you re-establish their connections to the databases so that any new settings on the database connections are automatically updated in the new Configurator database. In addition, you can test the new database connections both for data writes and data reads by clicking the **Perform Test** button in the TrendWorx Configurator.

Choosing a Database

The TrendWorx SQL Data Logger supports the following databases as storage media for its data:

- Microsoft Access
- Microsoft SQL Server 6.5, 7.0, and 2000
- Microsoft Data Engine (MSDE) 7.0 and 2000
- Oracle 8.0

Note
The TrendWorx SQL Data Logger support for Oracle assumes that Oracle will be running on an NT Server station and that the Data Logger will connect to an Oracle Database for data logging using the latest ODBC driver for Oracle.

Note
Microsoft SQL Server 2000 performs better than Microsoft SQL Server 7.0 and uses less memory and CPU capacity at the expense of increased use of hard-disk space. The same applies when comparing MSDE 7.0 with MSDE 2000.

Data storage requirements refer to the size of the target database once data collection and data storage begin. Again, the differences between Microsoft Access and Microsoft SQL Server arise from the fact that Microsoft Access is a file-based database engine, while Microsoft SQL Server is a server-based database. As a result, Microsoft Access databases are limited by the capacity of the hard disk on which they reside, while Microsoft SQL Server databases can expand across multiple hardware devices. In addition, Microsoft SQL Server can be configured to increase the database size automatically, if needed, while data logging is activated. The size of MSDE databases is limited to 2 GB, and the size of Microsoft Access databases is limited to 1 GB. To compute an estimate of required database size, on a per-group basis, use the following equation:

Total Number of Records = (Number of Tags x Total Logging Period (in secs)) / (36 x Data-Collection Rate (in secs)).

Required Size = (Total Number of Records) x (1024 Bytes/Record) x (1.5) for Microsoft SQL Server 7.0 or MSDE 7.0

Required Size = (Total Number of Records) x (1024 Bytes/Record) x (2.0) for Microsoft SQL Server 2000 or MSDE 2000

The above size calculation does not include the transaction log space used by Microsoft SQL Server or MSDE. Typically it should be a fraction of the data storage space.

Example
For example, assume you want to data log 100 tags with a data-collection rate of 1 second and a total data-logging period of 24 hours (converted to seconds). This will require the following storage for Microsoft SQL Server 7.0 or MSDE 7.0:

Total Number of Records = (100) x (24 hours x 60 min/hr x 60 sec/min) / (36 x 1 sec) =240,000 Records

Required Size = (240,000) x 1,024 x 1.5 = 360 MB per day

Note
When you are logging data to an Oracle database, you can expect a minimum 20 percent increase in database size because of the data types supported by Oracle.

Note, however, that the above example is a worst-case scenario that assumes all tags are updated every second from the OPC server. In reality, OPC servers are event-based, so they will update only when the value of the tag changes. The TrendWorx SQL Data Logger also supports various data-logging filters, on a per-tag basis, as well as deadband. These can be used to reduce the database-storage requirements effectively. When the targeted size of the database is more than 1 GB, it is recommended that you use Microsoft SQL Server or MSDE (for up to 2 GB) instead Microsoft Access.

To help you in maintaining the target database size and avoiding situations in which the database size grows uncontrolled, the TrendWorx SQL Data Logger supports a cyclic database table structure, which if configured will always maintain the configured number of tables into the database by overwriting existing data as it rolls over each table. Refer to the TrendWorx Configurator documentation for more information.

In addition, keep in mind that ordinary database maintenance tasks, such as defragmentation, compaction, and table index updates, may require additional space on the target device(s), which can vary depending on the database tasks under operation. It is recommended that you allow for additional device space in these cases.

The basic criteria for choosing a suitable database for the target application are:

- Data-Logging Load
- Data-Storage Requirements
- Load of Client Connections
- Database Backup and Maintenance

Data-Logging Load

The data-logging load refers to the total number of tags and the frequency of data-logging activity. The TrendWorx SQL Data Logger has a hierarchical tag organization. In this hierarchy, the tags are organized into groups, which belong to a specific database group that is logging data to a dedicated database. Each tag within a group logs data to the same table. This is a great advantage to you in terms of load-balancing a data-logging application by staggering data-collection or data-logging activities over time.

File-Based Versus Server-Based Databases

Microsoft Access is a **file-based database,** whereas Microsoft SQL Server, MSDE, and Oracle are **server-based databases.** The main difference is that Microsoft Access can handle data logging for a small-to-medium load of tags, whereas Microsoft SQL Server and MSDE can handle data logging for a much larger load of tags. When the total number of tags is less than 300, and the data-collection rates average 5 seconds or more, a Microsoft Access database can be a reasonable choice. When the total number of tags is more than 300, Microsoft SQL Server or MSDE databases are the only choice. Oracle has been shown to have less data-logging capability than Microsoft SQL Server.

Microsoft Access may also be a valid choice for noncontinuous data logging that involves a small number of tags with very fast data-collection rates. TrendWorx SQL Data Logger uses event-based updates, and will only store the samples sent by the OPC server to the target database, thereby reducing the overall data-logging load.

Microsoft SQL Server and MSDE can use hardware resources to yield great performance, even in a multiuse environment. In addition, some other load-balancing strategies include:

- Trading off slower writes to the database for a higher tag count or faster data-collection rates.
- Having one hard drive for data logging and separate one for storing operator displays, program files, and the operating system if graphics (HMI) displays are present on the actively data-logging PC.

Data-Storage Requirements

Data storage requirements refer to the size of the target database once data collection and data storage begin. Again, the differences between Microsoft Access and Microsoft SQL Server arise from the fact that Microsoft Access is a file-based database engine, while Microsoft SQL Server is a server-based database. As a result, Microsoft Access databases are limited by the capacity of the hard disk on which they reside, while Microsoft SQL Server databases can expand across multiple hardware devices. In addition, Microsoft SQL Server can be configured to increase the database size automatically, if needed, while data logging is activated. The size of MSDE databases is limited to 2 GB, and the size of Microsoft Access databases is limited to to 1 GB. To compute an estimate of required database size, on a per-group basis, use the following equation.

Total Number of Records = (*Number of Tags* x *Logging Interval*) / (36 x *Data-Collection Rate)*

Required Size = (*Total Number of Records*) x (1024 *Bytes/Record*) x (1.25)

Example
For example, assume you want to data log 100 tags with a data-collection rate of 1 second and a logging interval of 24 hours (converted to seconds). This will require the following:

Total Number of Records = (100) x (24 hours x 60 min/hr x 60 sec/min) / (36 x 1 sec) = *240,000 Records*

Required size = (240,000) x 1,024 x 1.25 = 295 MB per day

Note
When you are logging data to an Oracle database, you can expect a 20 percent increase in database size because of the data types supported by Oracle. When logging to Microsoft SQL 2000 or MSDE 2000 databases, you can expect a 20 percent increase in database size.

Note, however, that the above example is a worst-case scenario that assumes all tags are updated every second from the OPC server. In reality, OPC servers are event-based, so they will update only when the value of the tag changes. The TrendWorx SQL Data Logger also supports various data-logging filters, on a per-tag basis, as well as deadband. These can be used to reduce the database-storage requirements effectively. When the targeted size of the database is more than 1 GB, it is recommended that you use Microsoft SQL Server or MSDE (for up to 2 GB) instead Microsoft Access.

To help you in maintaining the target database size and avoiding situations in which the database size grows uncontrolled, the TrendWorx SQL Data Logger supports a cyclic database table structure, which if configured will always maintain the configured number of tables into the database by overwriting existing data as it rolls over each table. Refer to the TrendWorx Configurator documentation for more information.

In addition, keep in mind that ordinary database maintenance tasks, such as defragmentation, compaction, and table index updates, may require additional space on the target device(s), which can vary depending on the database tasks under operation. It is recommended that you allow for additional device space in these cases.

Load of Client Connections

The load of client connections refers to the capacity of the database to handle multiple users connected to the database for reading or writing data. Typically, writing to a database is a much more expensive and slower operation than reading data is. The TrendWorx SQL Data Logger uses connections to the database for logging data, previewing historical data, providing data-logging information, and performing some maintenance on the database. In addition, TrendWorx Reporting tools use connections to the database.
The TrendWorx SQL Data Logger uses by default one constantly open connection to the underlying database while the database group is in runtime mode and data collection is activated. Note that

you can modify this behavior in the TrendWorx Configurator by disabling the **Use Global Connection** option. In this case, the database connection will be opened only during the log-to-disk process. It is recommended that the **Use Global Connection** option be disabled only when the log-to-disk times are slow (e.g. about every 15 minutes) or the number of logging groups is small.

The TrendWorx SQL Data Logger will also open database connections on behalf of TrendWorx Viewer ActiveX historical clients. There will be one database connection per client Viewer while historical data are retrieved. Once the historical data read operation is completed, the TrendWorx SQL Data Logger will close this database connection.

TrendWorx SQL Tool ActiveX Control, TrendWorx Reporting, and the TrendWorx OLE DB Provider will also use database connections for configuration and data retrieval. These database connections remain open while data are retrieved, and then they are closed by the applications that created them when all historical data retrieval is completed.

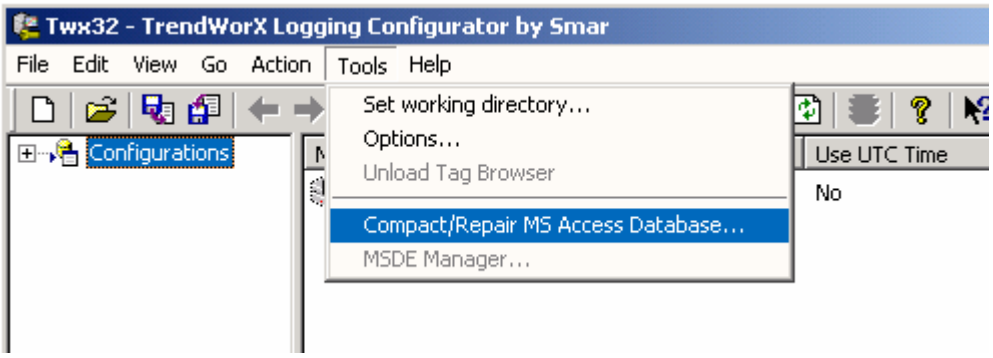
If you anticipate that more than 10 database connections will be open at any time, it is recommended that you use Microsoft SQL Server instead of Microsoft Access. Microsoft Access cannot handle a large number of simultaneous connections, whereas Microsoft SQL Server, because of its Enterprise architecture, can. In addition, remember that MSDE performance decreases with more than five active (open) connections to an MSDE database. However, both Microsoft SQL Server and MSDE offer central, **server-like memory management** of all database connections, thereby providing better system-resource management than Microsoft Access, which manages each database connection independently (on a per-client basis).

Database Backup and Maintenance

Database backup and maintenance are key factors in choosing a suitable database for the target application. You will need to back up historical data, perform periodic maintenance on the database, and defragment the database after extended periods of use. Microsoft Access does not offer most of the above while client database connections are open. In addition, it requires periodic shutdown and maintenance to deal with data fragmentation issues. In contrast, Microsoft SQL Server and MSDE are self-maintaining database engines that can accommodate scheduled backups, periodic maintenance tasks, defragmentation, and much more. Unlike Microsoft Access, Microsoft SQL Server and MSDE databases do not require stopping all database activity in order to perform these tasks.

To maintain your Microsoft Access database:

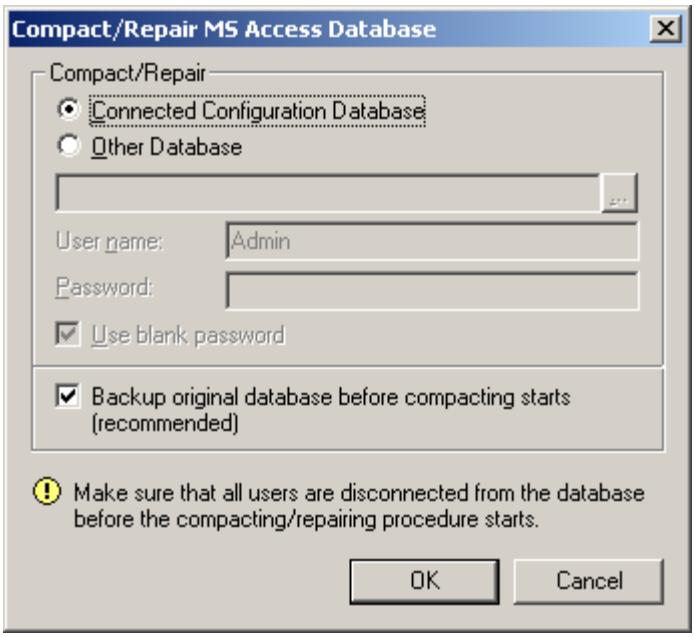
1. Shut down all data logging, data replay, and reporting applications.
2. Start the TrendWorX Configurator.
3. From the **Tools** menu choose **Compact/Repair MS Access Database,** as shown in the figure below.



Accessing Database Maintenance Tools

4. This opens the **Compact/Repair MS Access Database** dialog box, as shown in the figure below. You can choose to compact the configuration database or any other historical Microsoft Access database. Note that database compaction requires that you have available free hard disk space equal to the size of the Microsoft Access database prior to compaction. It is a good idea to always back up any database prior to compaction.

Microsoft Access database compaction should be done after several iterations through the cyclic table creation configuration of TrendWorX data logging. For example, if the data-logging configuration is set to create a new table every 1 day and maintain a total of 7 tables, a reasonable choice for Microsoft Access database compaction should be about every 1 to 6 months, depending on the volume of data logged.

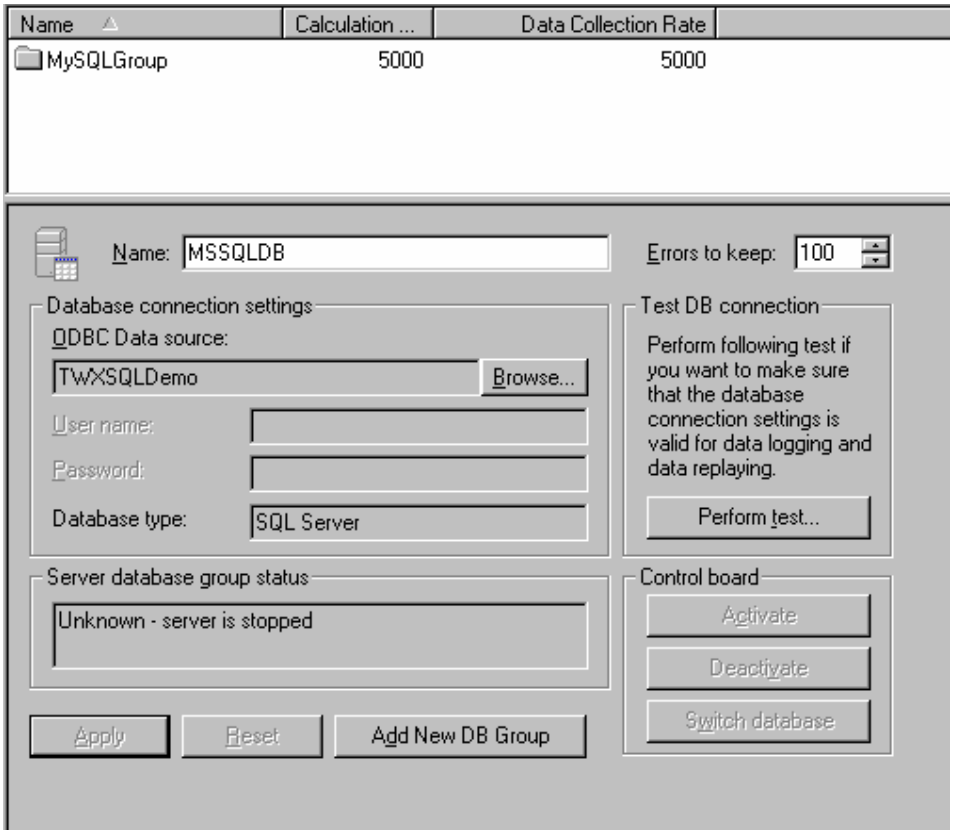


Compacting and Repairing Microsoft Access Databases

Setting Up Data Logging

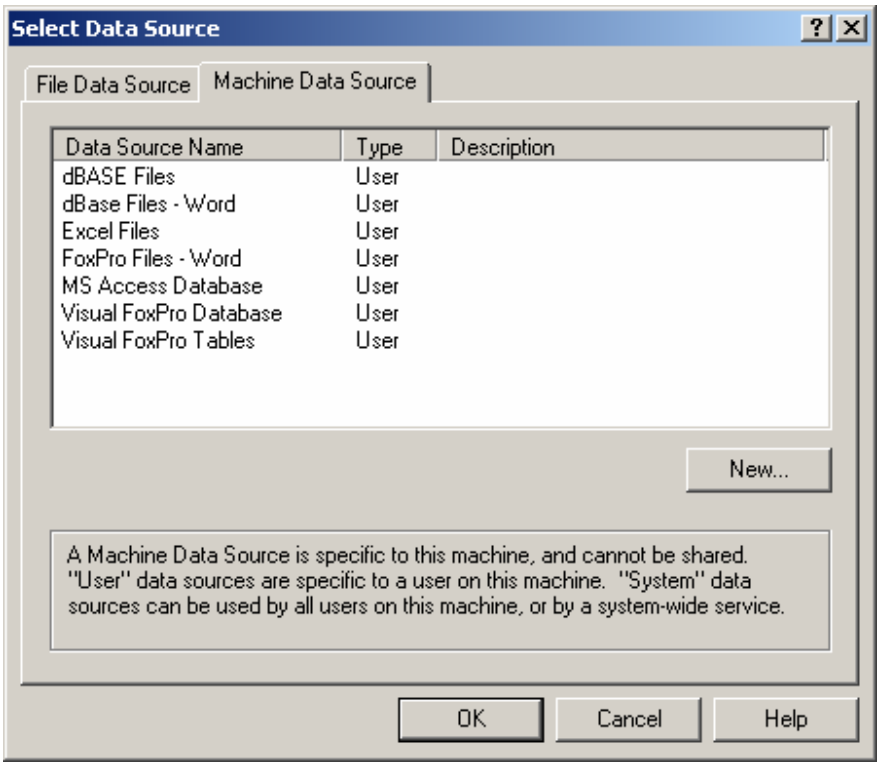
Introduction to Data Logging

To set up data logging, you must first configure the underlying database and set up ODBC data sources. This can be done within the TrendWorx Configurator by connecting a database group to an existing database or a new database. It is very critical that the PCs on which the TrendWorx SQL Data Logger resides have full access to the target database to create, add, delete, and update tables. Otherwise, data logging cannot be accomplished. To set up a data-logging source in the TrendWorx Configurator, select a database group and then click the **Browse** button in the **Data Source Name** field, as shown in the figure below.



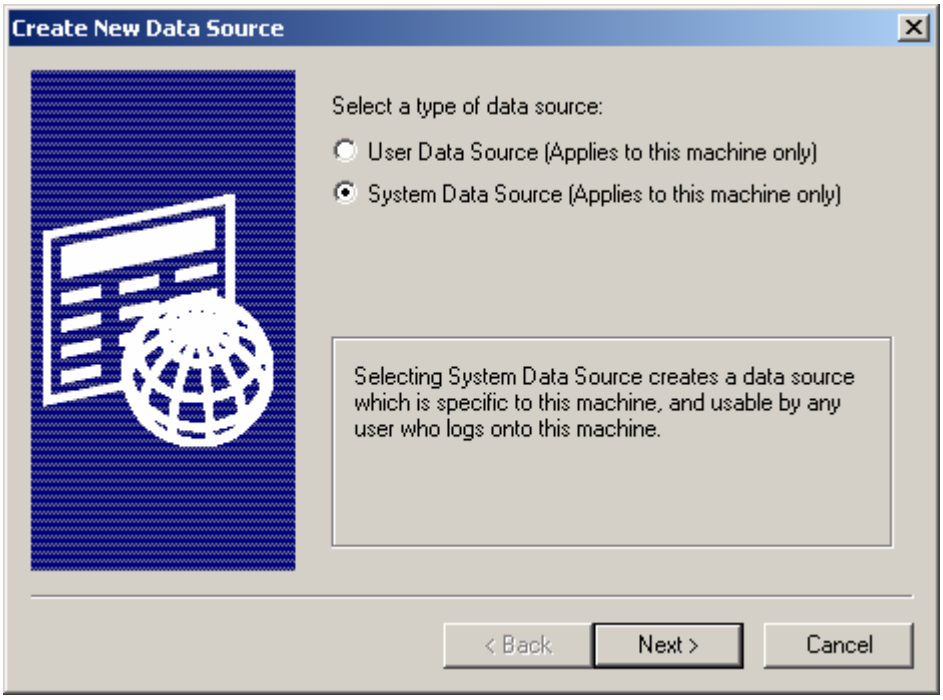
TrendWorx Configurator

This opens the **Select Data Source** dialog box, shown below. Choose the **Machine Data Source** tab and an existing database.



Select Data Source Dialog Box

Or you can create a new database by clicking **New** in the **Machine Data Source** tab of the **Select Data Source** dialog box. This opens the **Create New Data Source** wizard, shown below, which enables you to configure a new database.

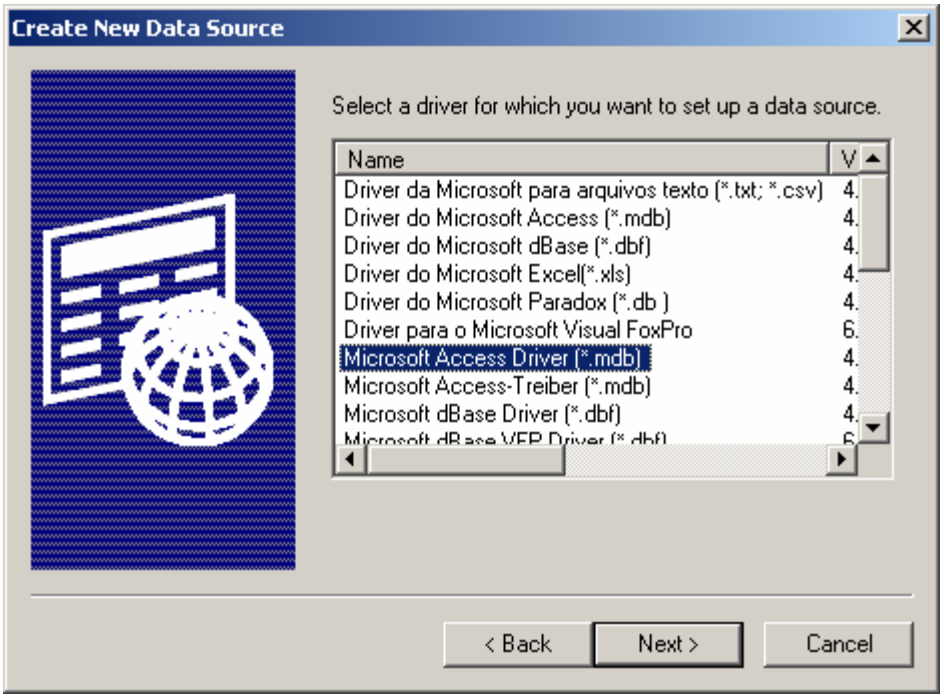


Create New Data Source Wizard

It is recommended that you configure the new database as a **System Data Source** so it is available to any user logged into the specific PC. Click **Next** to select the corresponding ODBC driver, such as Microsoft Access, Microsoft SQL Server, or Oracle. Refer to the TrendWorx Configurator Help documentation for more information on how to configure databases.

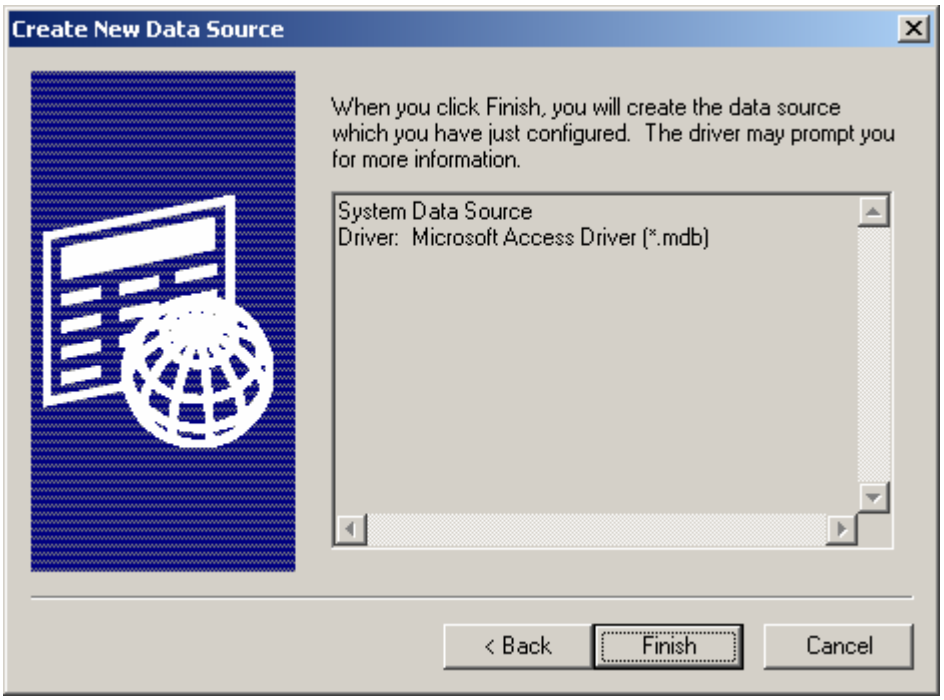
Configuring Microsoft Access Databases

To configure a Microsoft Access database, select **Microsoft Access Driver** (.mdb) in the **Create New Data Source** wizard, as shown in the figure below.



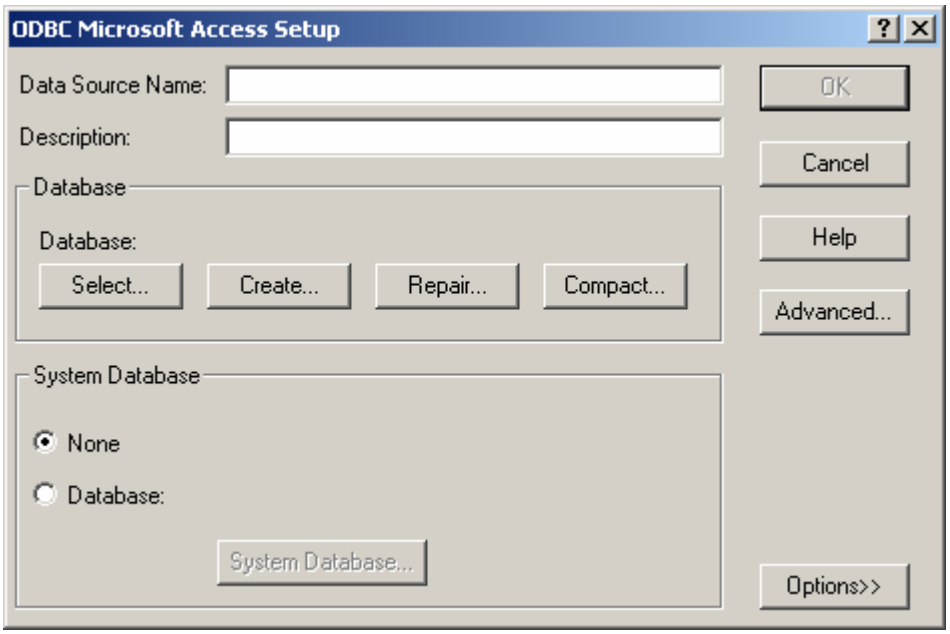
Selecting a Microsoft Access ODBC Driver

When you have selected the Microsoft Access driver, click **Next** to proceed to the final dialog box in the **Create New Data Source** wizard, shown below.



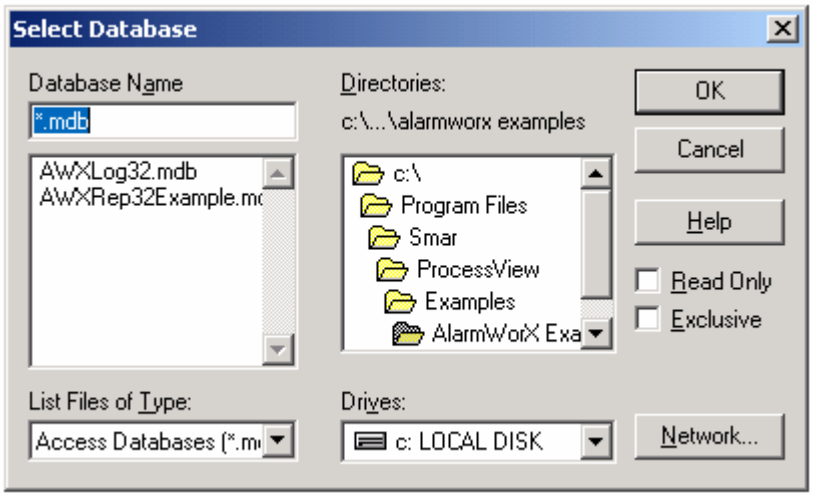
Creating a New Microsoft Access Database Connection

Click **Finish** to configure your new Microsoft Access database. This opens the **ODBC Microsoft Access Setup** dialog box, shown below. Enter the **Data Source Name** and the **Description.**



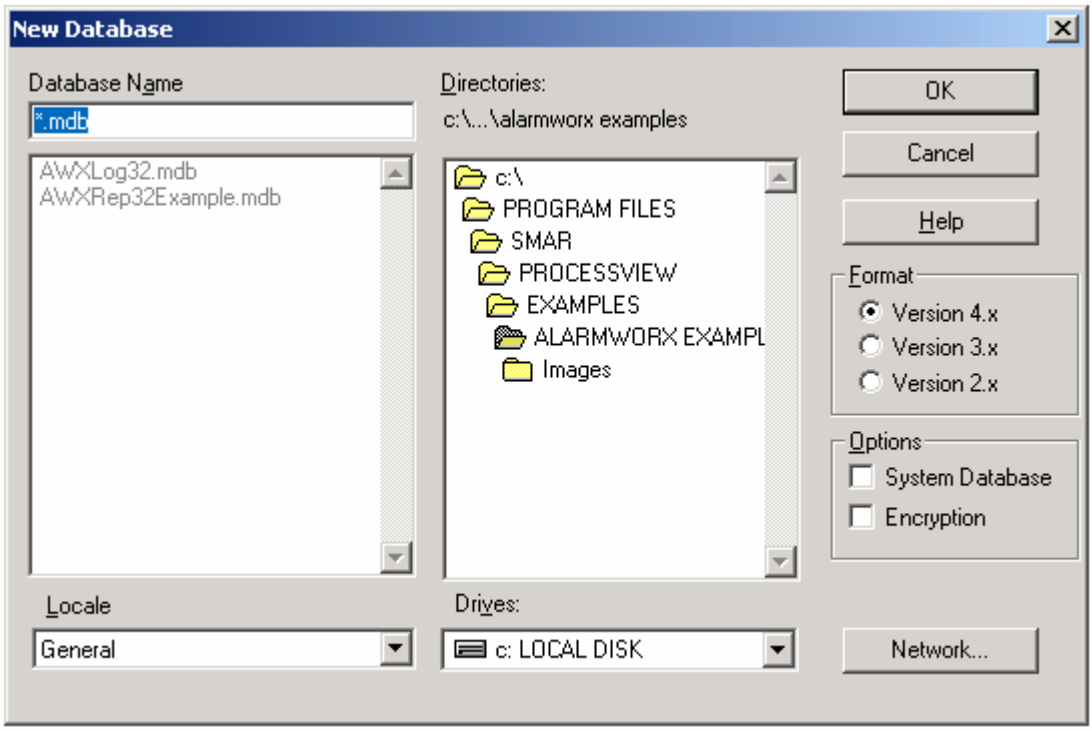
ODBC Microsoft Access Setup Dialog Box

Click **Select** to choose an existing .mdb file. This opens the **Select Database** dialog box, shown below.



Selecting an Existing Microsoft Access Database File

Click **Create** to create a new .mdb file. This opens the .mdb file directory in the **New Database** dialog box, as shown below.



Creating a New Microsoft Access Database File

You can choose a local hard disk or a networked hard disk as the location of your new .mdb file. Click **OK** to exit the configuration and establish the database connection.

Note
When creating a new .mdb file, the Microsoft Access configuration dialog box provides the options of creating a Version 4.x or a Version 3.x compatible .mdb file. By default, Version 4.x is selected, creating a Jet Engine 4.x compatible .mdb file, which can be opened *only* in Microsoft Access 2000. If you have Microsoft Access 97, select the Version 3.x compatibility. In general, Version 4.x is preferred because it offers greater functionality than the older versions.

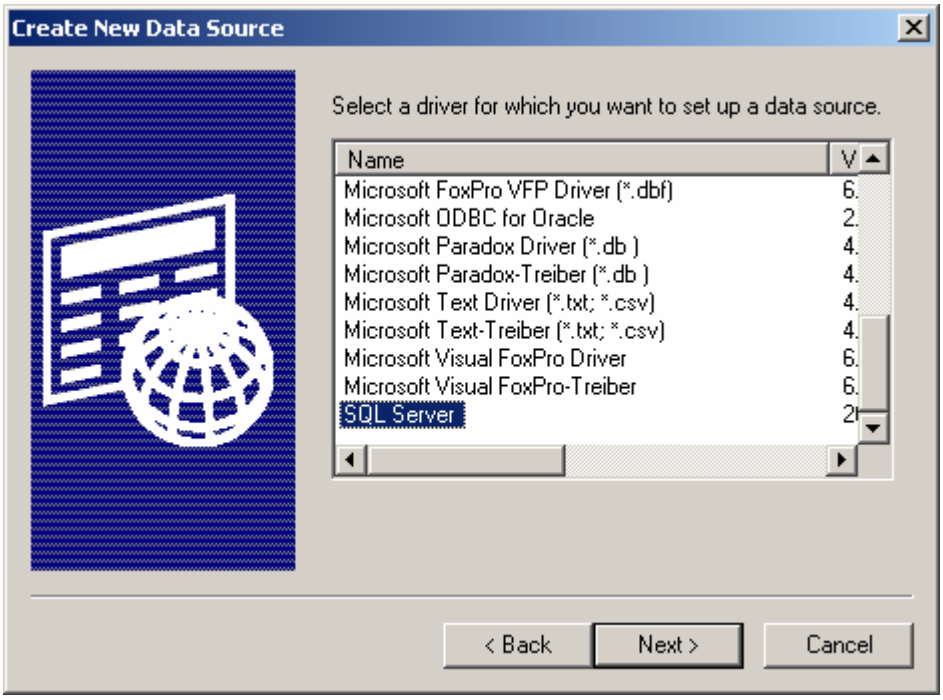
Configuring Microsoft SQL Server and MSDE Databases

The TrendWorx SQL Data Logger includes native support for MSDE (Microsoft Data Engine), which is a Microsoft SQL Server 7.0 or 2000 compatible database engine with the following limitations:

- The Maximum database size is 2 GB.
- Performance can decrease if more than five connections are open at one time.

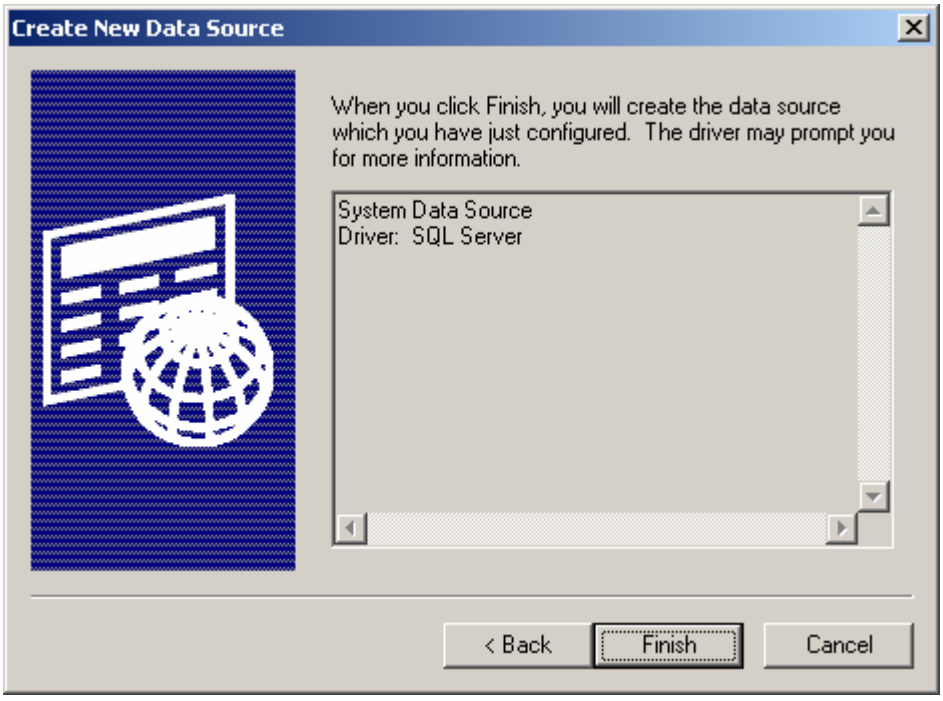
However, MSDE is a Microsoft SQL Server compatible engine that can be directly upgraded to the full Microsoft SQL Server. Thus, database connections to MSDE are identical to the database connections to Microsoft SQL Server.

To establish an ODBC connection to this database, when configuring a new ODBC data source for Microsoft SQL Server or MSDE, select the appropriate ODBC driver. To configure a Microsoft SQL Server or MSDE database, select the SQL Server driver in the Create New Data Source wizard, as shown in the figure below.



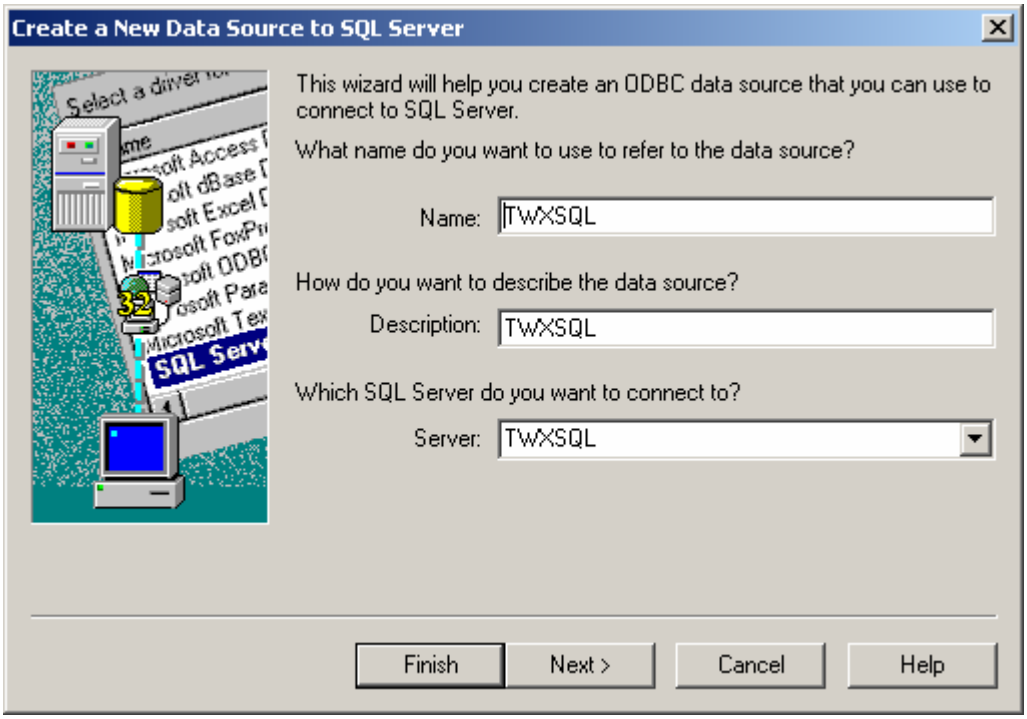
Selecting a Microsoft SQL or MSDE Server ODBC Driver

When you have selected the Microsoft SQL Server driver, click **Next** to proceed to the final dialog box in the **Create New Data Source** wizard, shown below.



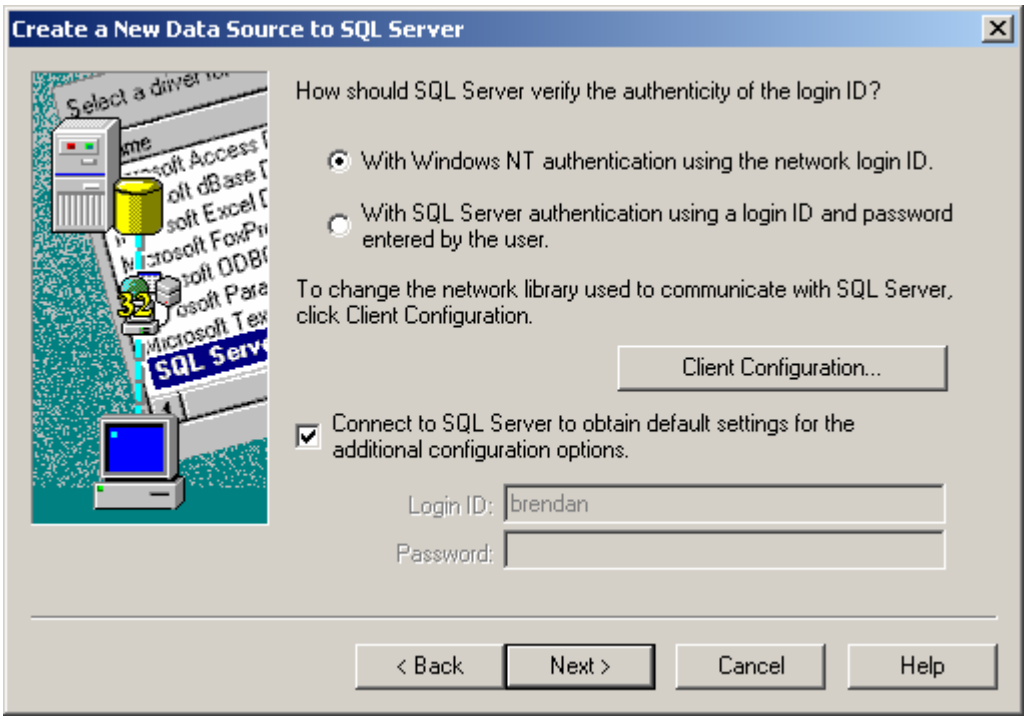
Creating a Microsoft SQL Server or MSDE Database Connection

Click **Finish** to configure your new database. This opens the **Create a New Data Source to SQL Server** dialog box, shown below. Enter the **Data Source Name,** the **Description,** and the name of the **Server** on which the Microsoft SQL Server or MSDE engine resides.



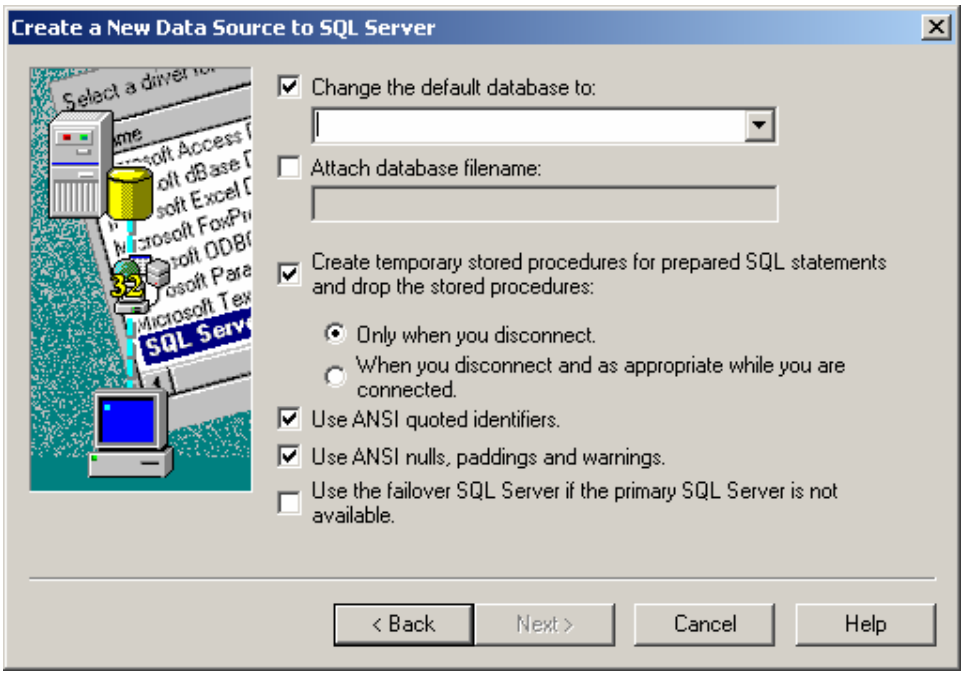
Create a New Data Source to SQL Server Dialog Box

If it the engine resides on the same PC node as the TrendWorx SQL Data Logger, select "local." Otherwise select or specify the appropriate server name. Click **Next** to continue with the Microsoft SQL Server Security configuration and Connection type. It is recommended that you use the Windows NT authentication mechanism, which eliminates the need for maintaining individual user accounts and passwords.



Configuring a Microsoft SQL or MSDE Database Connection

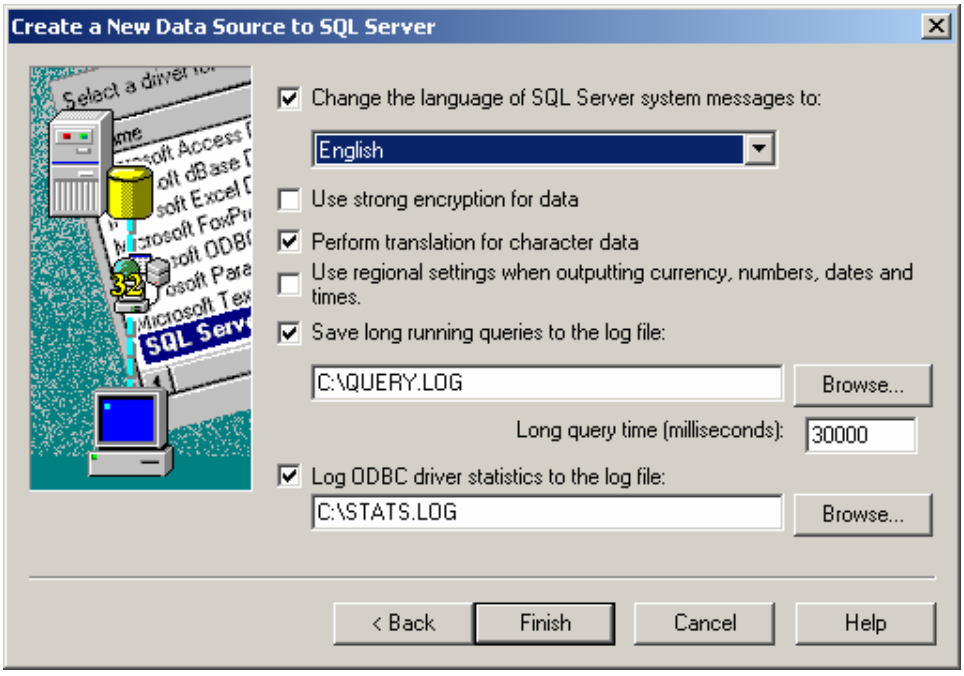
Click **Next** to continue with the selection of the default database for the connection. Make sure it is not the master database, but the one created for the purpose of data logging.



Setting the Default Microsoft SQL Server or MSDE Database

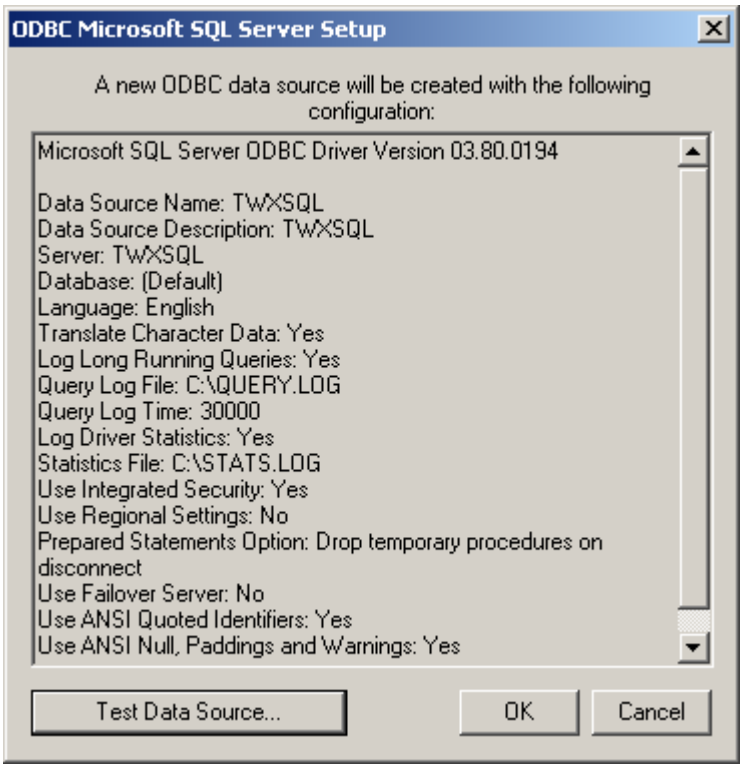
Note
When connecting to an Microsoft SQL Server or MSDE database, make sure that the desired database for historical data logging is selected in the **Change the Default Database** field, as shown in the figure above. Otherwise, you will establish a connection to the master database, which is not recommended.

Click **Next** to accept or modify the default settings, as shown in the figure below.



Configuring the Default Settings

Complete the connection configuration by clicking **Finish.** It is recommended that you test the established connection by clicking **Test Data Source,** as shown in the figure below.



Testing a Microsoft SQL Server or MSDE Database Connection

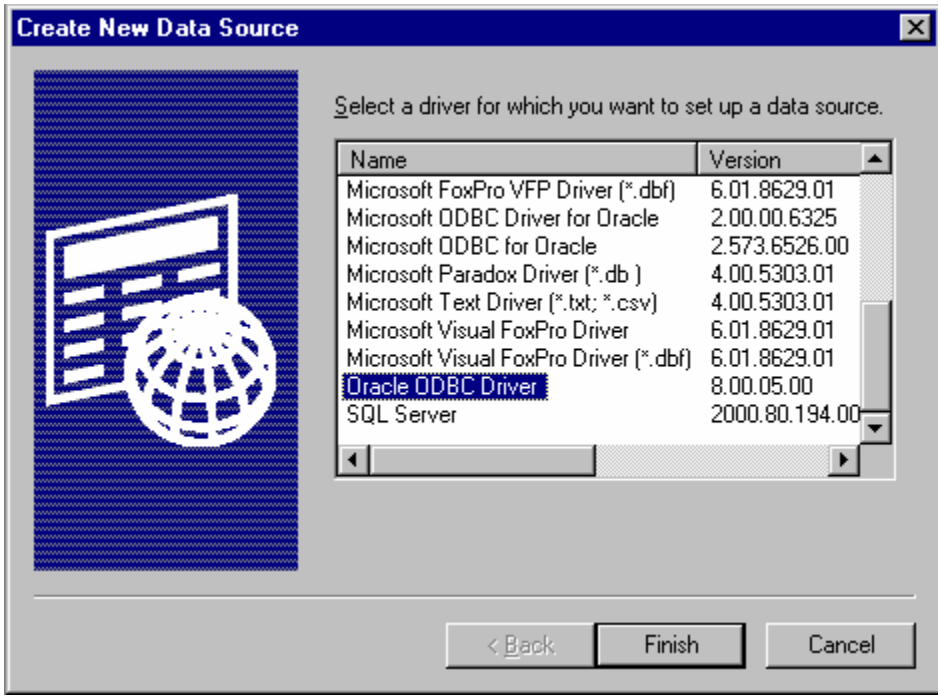
Note
Regardless of the database type, all SMAR TrendWorx modules, which interact with databases, will create, modify, drop, and update tables. Therefore, it is critical that the currently logged-in user has permission to perform these tasks.

Configuring Oracle Databases

The TrendWorx SQL Data Logger includes support for logging data as well as replaying data to and from Oracle databases. The support for Oracle was developed under the assumption that:

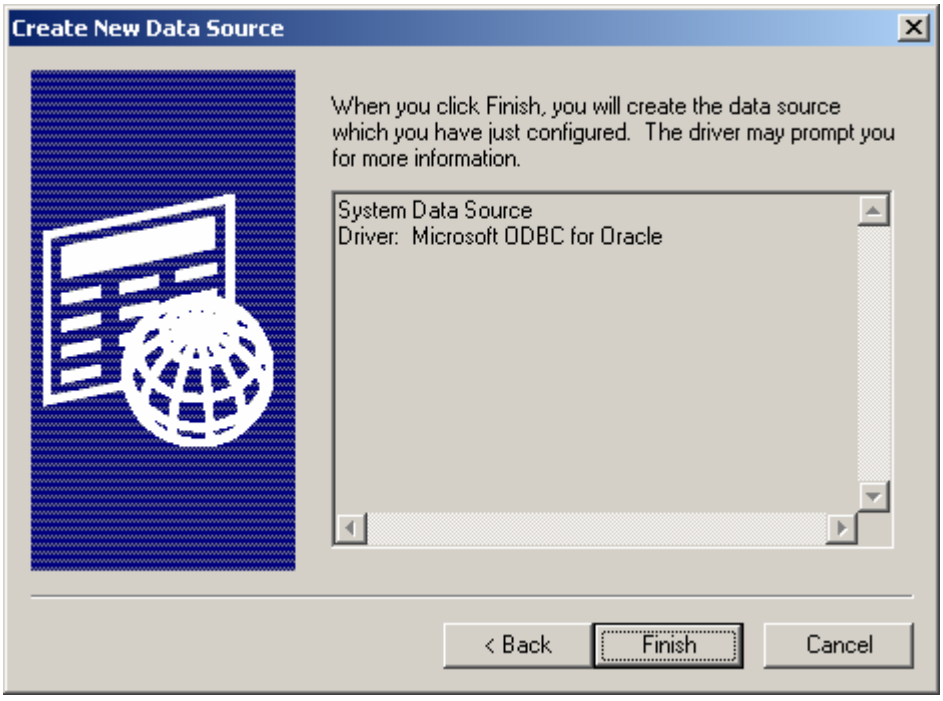
- ODBC database connections to Oracle are established using the Oracle ODBC Driver 8.05.60, which is provided by Oracle and is available on the SMAR product CD under the Tools directory.
- Oracle is running on a Microsoft Windows NT station.

To configure an Oracle database, select the **Oracle ODBC Driver** in the **Create New Data Source** wizard, as shown in the figure below.



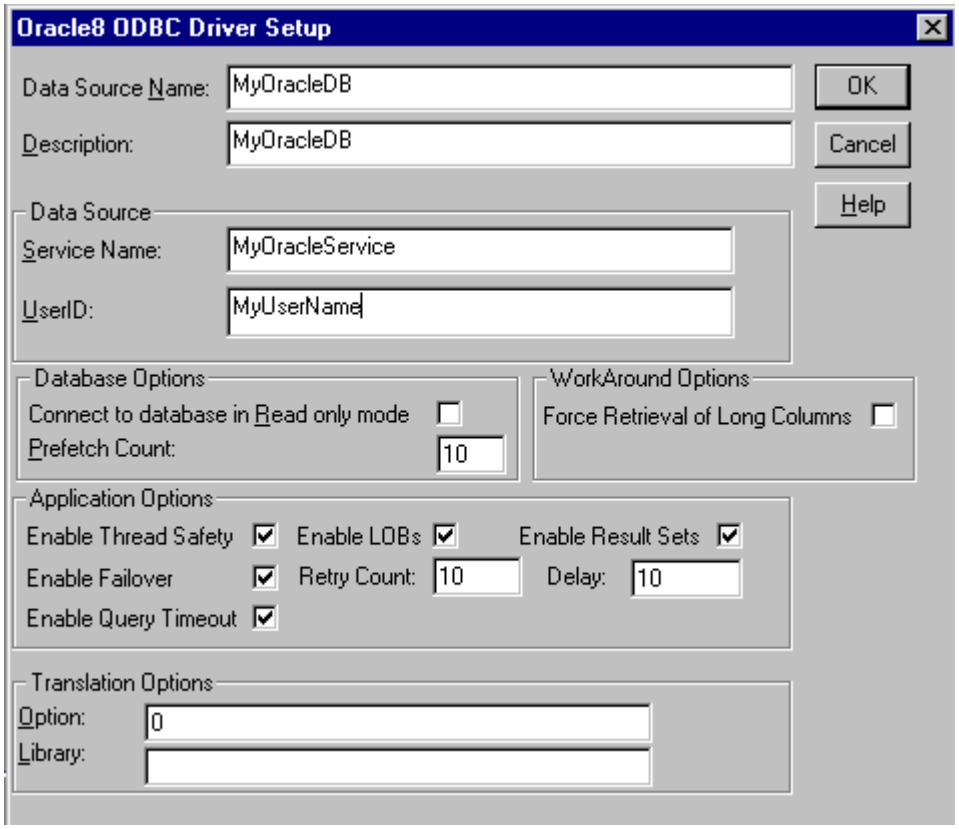
Selecting the Oracle ODBC Driver

When you have selected the ODBC for Oracle driver, click **Next** to proceed to the final dialog box in the **Create New Data Source** wizard, shown below.



Creating an Oracle Database Connection

Click **Finish** to configure your new database. This opens the **Oracle ODBC Driver Setup** dialog box, shown below. Enter the **Data Source Name,** the **Description,** the **Service Name,** and the **User ID,** and configure the other desired settings.



Configuring an Oracle ODBC Database Connection

Performance Optimization and Evaluation

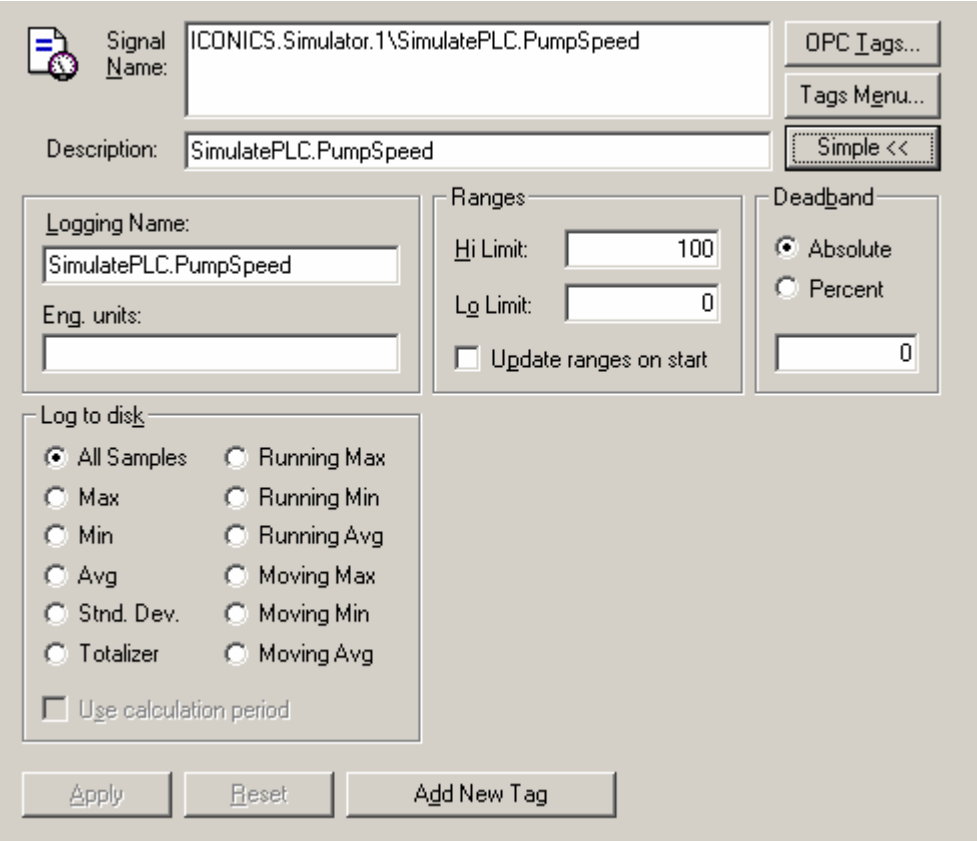
This section provides some insight into the options for optimizing a data-logging application. The biggest (and most obvious) performance booster is the hardware available. For data logging, fast processors, increased memory capacity, and fast hard disks accompanied by caching capabilities increase performance tremendously. In addition, multiprocessor servers drastically increase database performance and capacity.

Data-Compression Tools

TrendWorx SQL Data Logger supports a variety of data-compression tools, which can limit the amount of data stored in the database.

Deadband

The TrendWorx SQL Data Logger supports absolute and relative deadband on a per-tag basis. Using the TrendWorx Configurator, you can configure this individually for each tag, as shown below. Only those samples that are above the deadband will be actually data-logged.



Logging Tag Configuration Dialog Box

Data-Logging Filters

The TrendWorx SQL Data Logger supports data-logging filters based on a statistical description of the available samples. You can configure the desired filter, on a per-tag basis, by choosing the desired type:

- Min
- Max
- Avg
- Standard Deviation
- Running Min
- Running Max
- Running Avg
- Moving Avg
- Moving Min
- Moving Max
- Totalizer

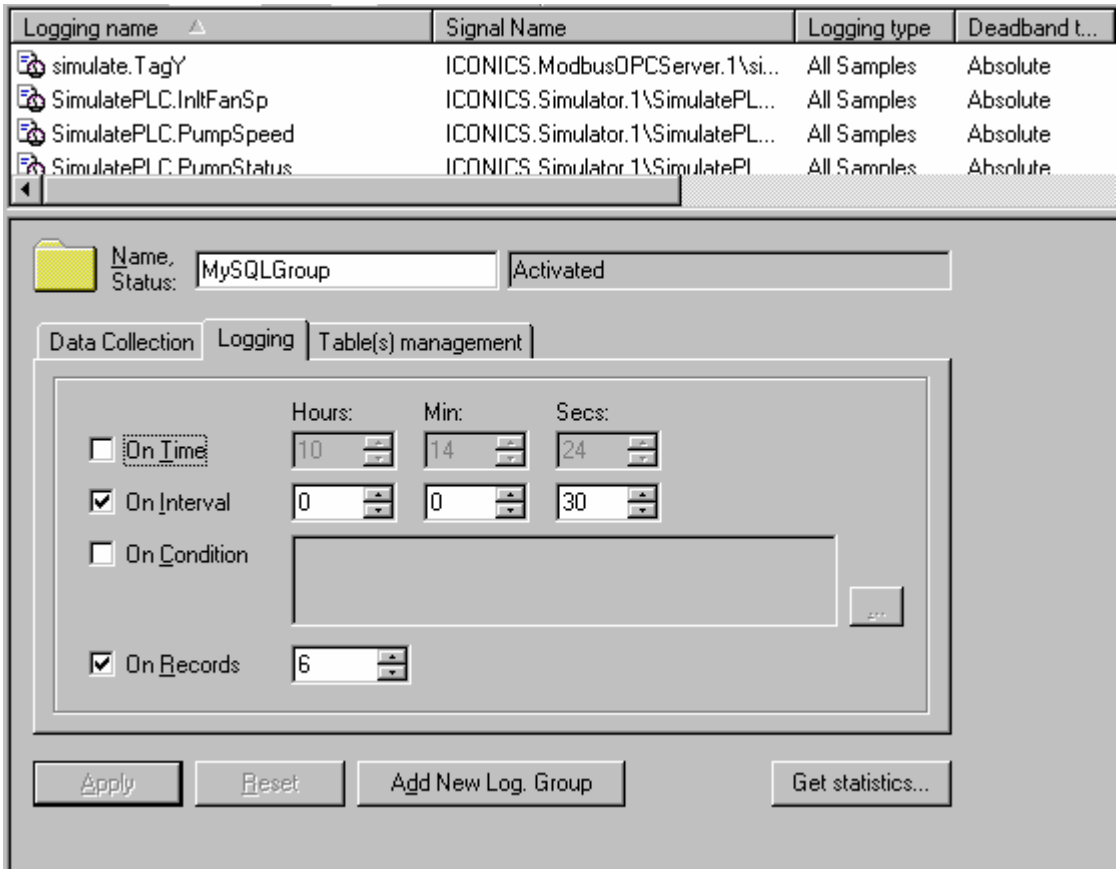
For the selected data-logging filter, TrendWorx SQL Data Logger will only log one sample to disk, which will be computed as follows:

- If the **Calculation Period** option is used, then all samples within the calculation period will be used to compute the actual sample that will be data-logged.
- If the **Calculation Period** option is *not* used, all samples within the log-to-disk interval will be used to compute the actual sample that will be data-logged.

Using the data-logging filters can greatly improve performance and historical database size requirements.

Database Access Scheduling

The TrendWorx SQL Data Logger has flexible options for controlling the frequency of data logging to the database. Using these tools, you can control the frequency of database writes and spread them in such a way that not all groups write to the database at the same time. Internally, TrendWorx SQL Data Logger tries to achieve this to a certain degree, but the configuration gives you even more flexibility in doing so. In terms of configuration, TrendWorx SQL Data Logger allows you to control the interval at which data will be logged to the database, regardless of the data-collection interval.



Scheduling Database Access for Load Balancing

Using the **Logging** tab in the TrendWorx Configurator, shown above, you can configure the system:

- On a per-group basis.
- To write to the database when a certain number of records has been collected.
- At a certain time.
- On interval.
- On a condition.
- Using a combination of options.

This way, you can "spread out" the write activity to the database and balance the data-logging load more successfully.

Note
TrendWorx SQL Data Logger can access the database for writes as fast as every 5 seconds.

Data Logging Load Distribution

The TrendWorx SQL Data Logger tag database uses a hierarchical organization, which involves database groups and logging groups within each database group. This enables you to organize data-logging activity logically, in smaller loads, and in your desired areas of interest. It is recommended that you do not add more than 500 tags per group (depending on available hardware and the overall data-logging load, as well as the database type). This way the database tables will become more manageable, and the data-logging activity will not require extensive system resources. In general, for frequent data logging it is recommended that you configure your data logging activity such that the historical tables created will not exceed a size of 80 MB.

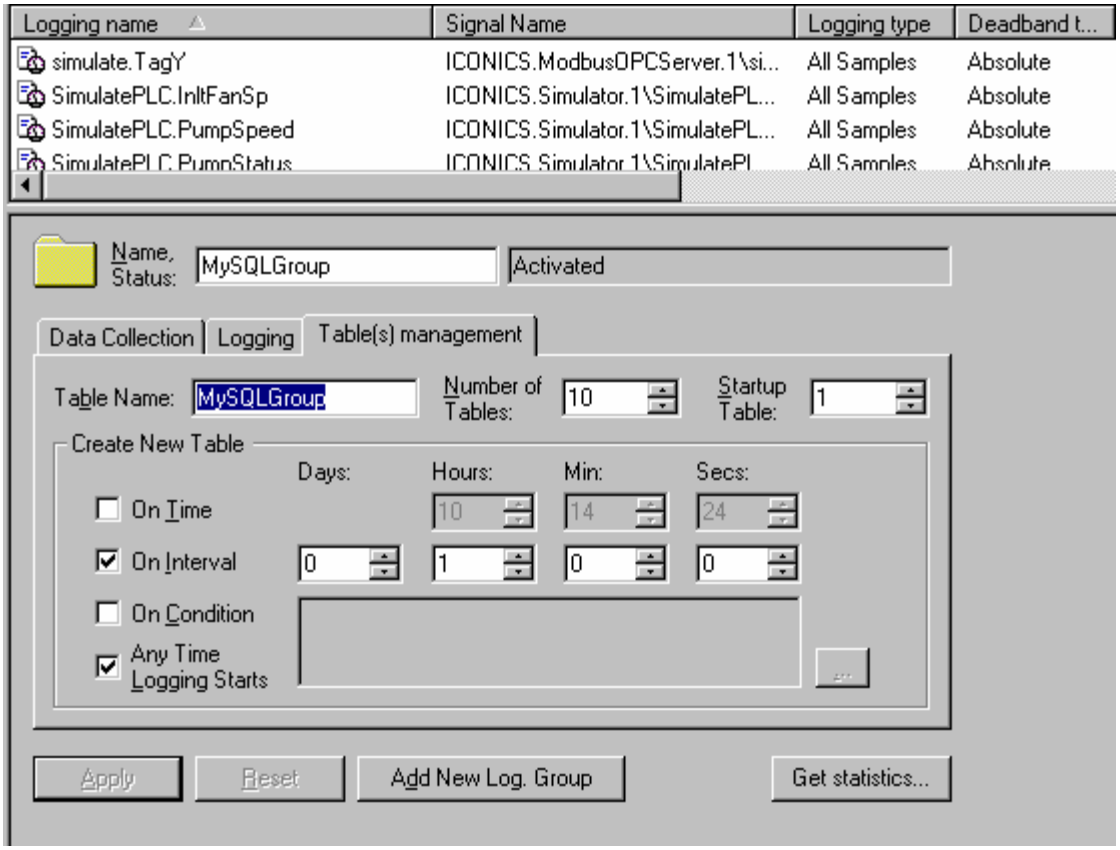
Note
Microsoft SQL Server and MSDE have database-maintenance capabilities even when active connections are open. In certain cases, for an above-average data-logging load it may be preferable to create databases with a large initial size in order to avoid frequent database expansion operations.

Multithreaded Architecture

TrendWorx SQL Data Logger has a **multithreaded** architecture. This yields more responsive single-processor systems and increases the overall system performance of multiprocessor systems. The multithreaded architecture of the TrendWorx SQL Data Logger is designed around the database group. Each database group has a set of threads to log data to disk and to share the cataloging load across multiple threads. In addition, you can have multiple database groups logging data to the same database or a different database. Distributing the data-logging load across multiple database groups can yield better performance.

Managing the Database Table Organization

TrendWorx SQL Data Logger provides a database organization and management scheme that allows you to control the database storage and table creation for better performance. The **Table Management** tab in the TrendWorx Configurator, shown below, allows you to set up an "archive" scheme, which can optimize historical replay and data logging.



Scheduling Historical Table Management for Load Balancing

For example, you could configure data-logging as follows:

- The data-logging load is 250 tags per second.
- TrendWorx Viewer ActiveX historical viewers are configured to start up with an initial display of 1 hour's worth of data.
- The historical data will be maintained for 7 days.

You can configure TrendWorx SQL Data Logger to create four tables per day by creating a new table every 6 hours and maintaining a total of 28 tables. This approach will:

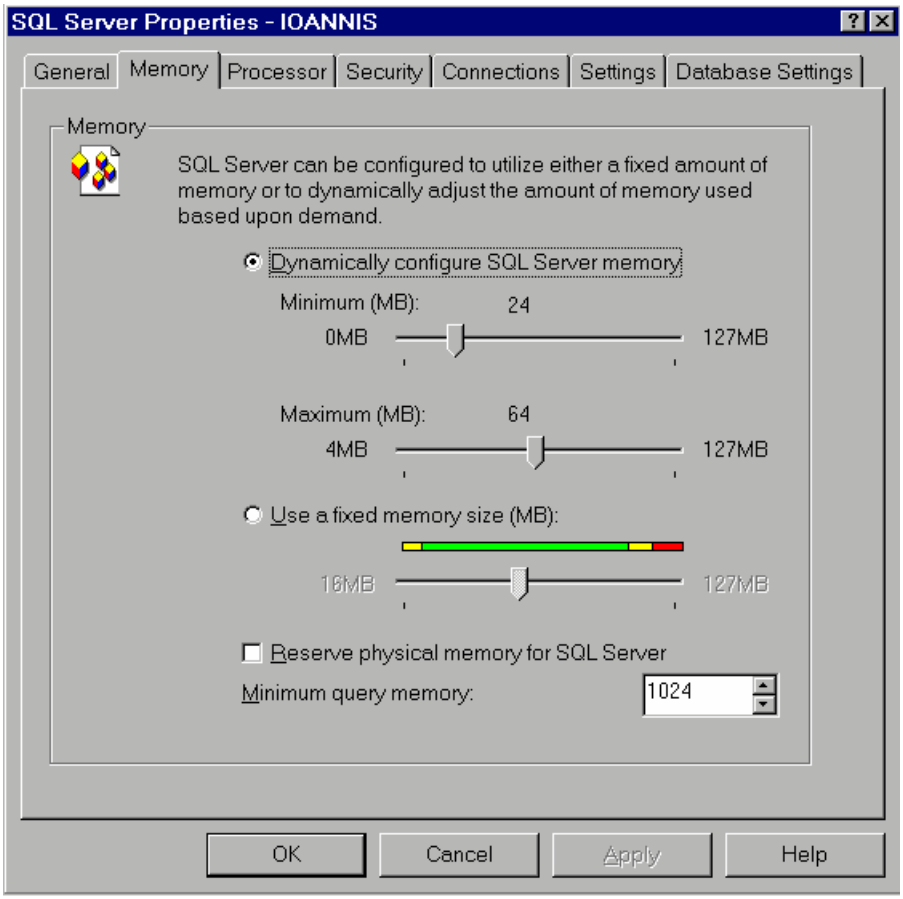
- Speed up initial historical replay, because only the most recent table will be opened and the size of each table will remain reasonable.
- Speed up data logging, because each table will be a reasonable size.
- Improve system maintenance and backup tasks by avoiding the creation of enormous database tables.

In general, for frequent data logging it is recommend that you configure the data logging activity such that the size of the historical tables will not exceed 80 MB.

Other Considerations

For non-networked applications in which all PROCESSVIEW software is running on a single node, making sure that the database is not on the same hard drive as the HMI displays can improve performance. Frequent display switching requires disk access, which can slow down data logging.

Data logging requires additional memory resources. In addition, databases allow you to control the amount of memory used. In the case of Microsoft SQL Server and MSDE memory is handled in a centralized fashion using the Microsoft SQL Server Enterprise manager for Microsoft SQL Server or the Smar MSDE Manager for MSDE.



Configuring Memory Management for Microsoft SQL Server

Microsoft SQL Server and MSDE introduce a dynamic memory-management scheme that uses system memory based on need and availability. In any case, it is recommended that for Microsoft SQL Server and MSDE data-logging applications you do not allocate more than two thirds of the total physical RAM available for database server memory usage. In addition, it is critical that the PC on which Microsoft SQL or MSDE is installed has virtual memory at least two times the total amount of physical RAM available.

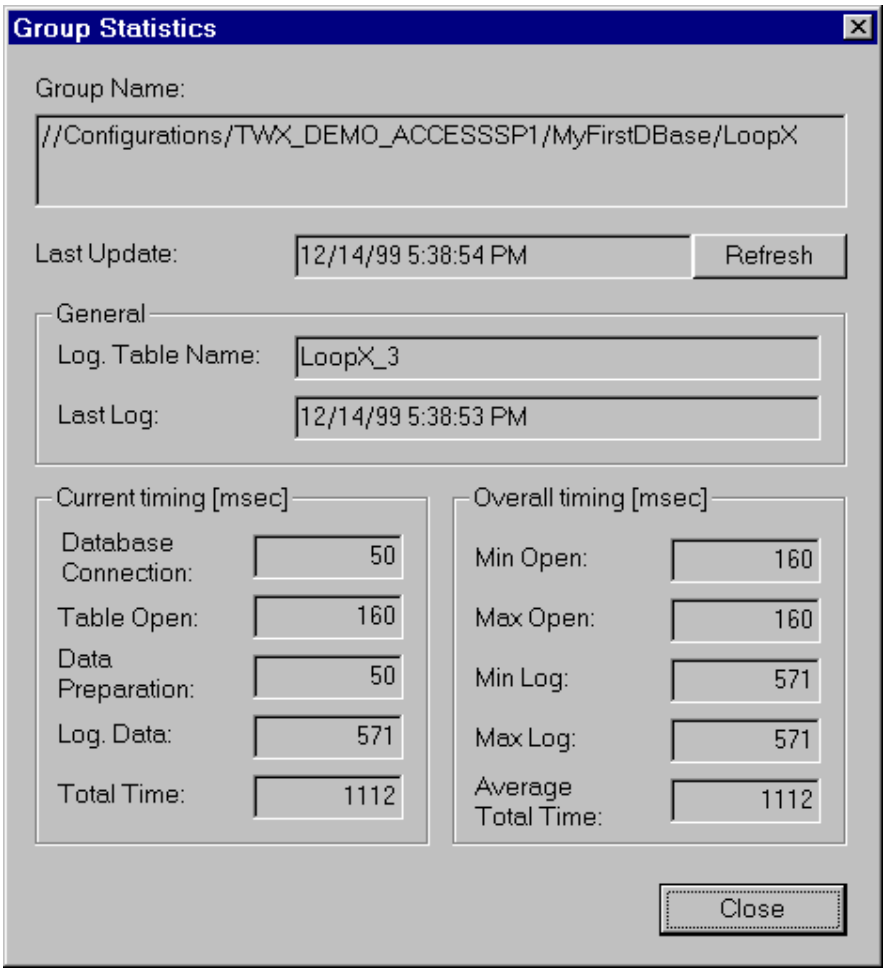
Microsoft Access is entirely different. It utilizes memory on a per-connection basis, and it can easily consume a significant amount of system resources. For version 7.0, PROCESSVIEW modules and applications will automatically adjust the Microsoft Jet Engine registry settings with default values. For data logging applications to Microsoft Access that require a high tag count, please contact Smar technical support on how to change these settings.

By setting a number other than 0 in the **MaxBufferSize** entry, you can limit the memory used by Microsoft Jet Engine on a per-connection basis. A setting of 8192 KB (in decimal form) provides a reasonable value for most Microsoft Access-based applications. Note that this setting may have to be set at all registry settings relating to Jet 3.x as well as to Jet 4.x engines.

Note
It is very critical that you adjust the default setting for **MaxBufferSize.** Many of the newer ProcessView modules use Microsoft Access (.mdb) files for configuration purposes, and they interact with Microsoft Access while in runtime mode. Adjusting the **MaxBufferSize** setting can greatly improve Microsoft Access/Jet Engine memory consumption.

Monitoring Performance

The TrendWorx Configurator has runtime tools for monitoring data-logging performance. This can help in determining whether the data-logging application is set up properly. You can view the statistics collected on a per-group basis during data logging by clicking the **Get Statistics** button in the TrendWorx Configurator under each group. This opens the **Group Statistics** dialog box, shown below.



Monitoring Data-Logging Performance

These statistics show the time to:

- Connect to the database.
- Open a table for logging data.
- Prepare data for logging.
- Log historical data.

It also shows the total time of data logging.

In addition, the TrendWorx SQL Data Logger tracks the:

- Minimum time to open the target database table.
- Maximum time to open the target database table.
- Minimum time to log data.
- Maximum time to log data.

These times will vary. However, if the total time of data logging is constantly increasing and is much larger than the configured time to access the database table for writes (set in the **Logging** tab of the data-logging group configuration) you may need to re-evaluate the data logging and hardware configuration.

Summary of Optimization for Microsoft SQL and MSDE

The TrendWorx SQL Data Logger supports data logging to Microsoft SQL Server. Support for MSDE (Microsoft Data Engine), which is a Microsoft SQL Server compatible database server, was introduced in Version 6.00. New in Version 6.10 is support for Microsoft SQL Server 2000 and MSDE 2000.

The SMAR product CD installs under the SMAR PROCESSVIEW program group a **Tools** directory, which contains the SMAR MSDE Manager. MSDE Manager is an administrative tool to be used with MSDE 2000 and 7.0 databases. It has support to install MSDE 2000 (default) or MSDE 7.0.

In terms of performance, several tests have shown the following:

- Best overall combination: Microsoft SQL Server 2000 (or MSDE 2000) and Windows 2000
- Next best: Microsoft SQL Server 7.0 (or MSDE 7.0) and Windows 2000
- Good performance: Microsoft SQL Server 7.0 (or MSDE 7.0), Win NT 4.0 with SP5 (or SP6)

Both Microsoft SQL Server 7.0 (or MSDE 7.0) and Microsoft SQL Server 2000 (or MSDE 2000) perform better using Microsoft Windows 2000. Microsoft SQL Server 2000 (or MSDE 2000) performs better than Microsoft SQL Server 7.0 (or MSDE 7.0). Data logging requires less table maintenance, and memory use overall is more reasonable (Microsoft SQL Server 7.0 utilizes much more memory). All this is done at the expense of hard disk space.

Microsoft SQL Server 2000 (or MSDE 2000) will achieve this performance by allocating much more disk space ahead of time so that it will not have to expand the database continuously. In addition, Microsoft SQL Server 2000 nor requires a minimum of 64 MB of RAM dedicated to it. However, during data logging Microsoft SQL Server 2000 (or MSDE 2000) will use much less memory than Microsoft SQL Server 7.0 (or MSDE 7.0).

Deploying Microsoft SQL Server 7.0 or Microsoft SQL Server 2000 (as well as MSDE) requires several simple steps at startup that are very important to overall data logging and system performance.

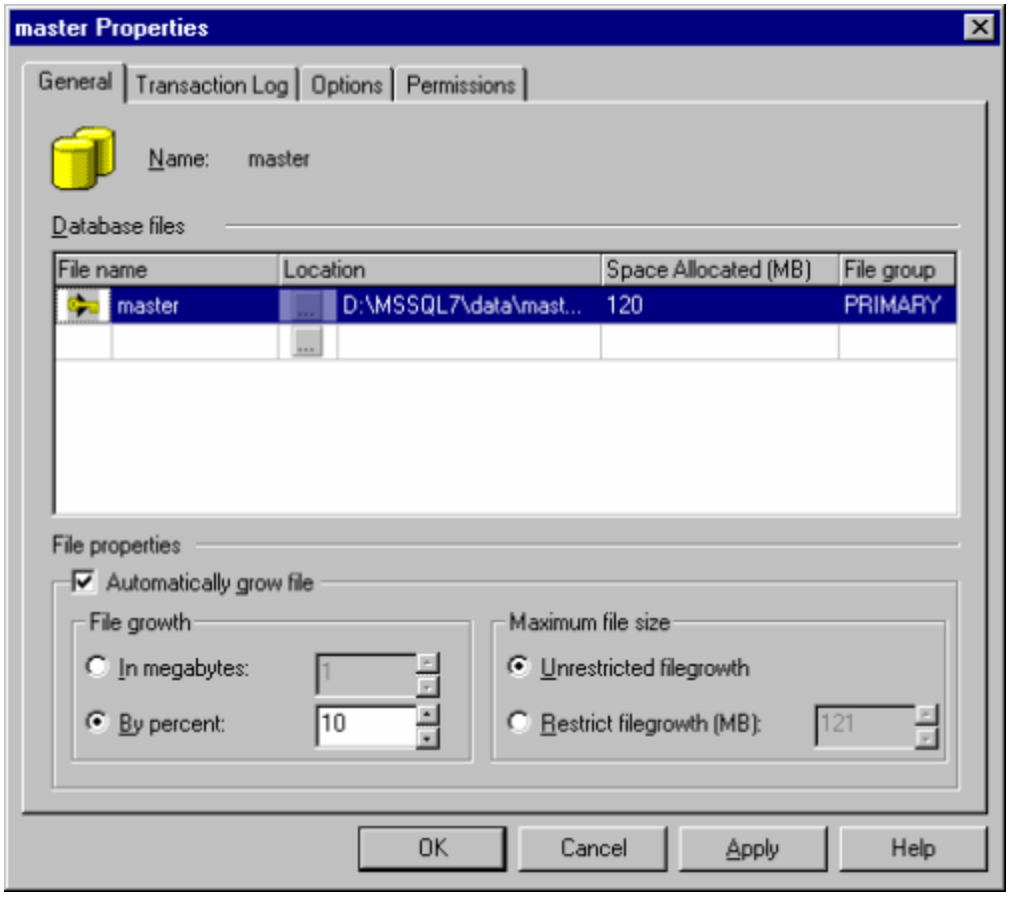
During Installation
When installing Microsoft SQL Server, (if possible) specify a different drive for the "masterdb" and "tempdb" databases of Microsoft SQL Server from the location of the actual historical database. If installing Microsoft SQL Server 7.0 or MSDE 7.0, please install the latest service pack, available on the SMAR Product CD, under the **Tools** directory.

Note
When installing Microsoft SQL Server 2000 (or MSDE 2000), remember that TrendWorx Version 6.10 works with Microsoft SQL Server 2000 in *single-instance* mode. Starting with Microsoft SQL Server 2000, you can install multiple instances of Microsoft SQL Server 2000 on the same computer. Each one is a separate install, having its own name (instance name). Thus, clients connect to it via instance name or server name. TrendWorx SQL Data Logger version 6.10 does not support this functionality yet.

After Installation
After installing Microsoft SQL Server, go to the Microsoft SQL Enterprise Manager (this does not apply to MSDE) and:

- Set the "tempdb" size to 120 MB and the transaction log to 20 MB.
- Set the "masterdb" size to 80 MB and the transaction log to 20 MB.

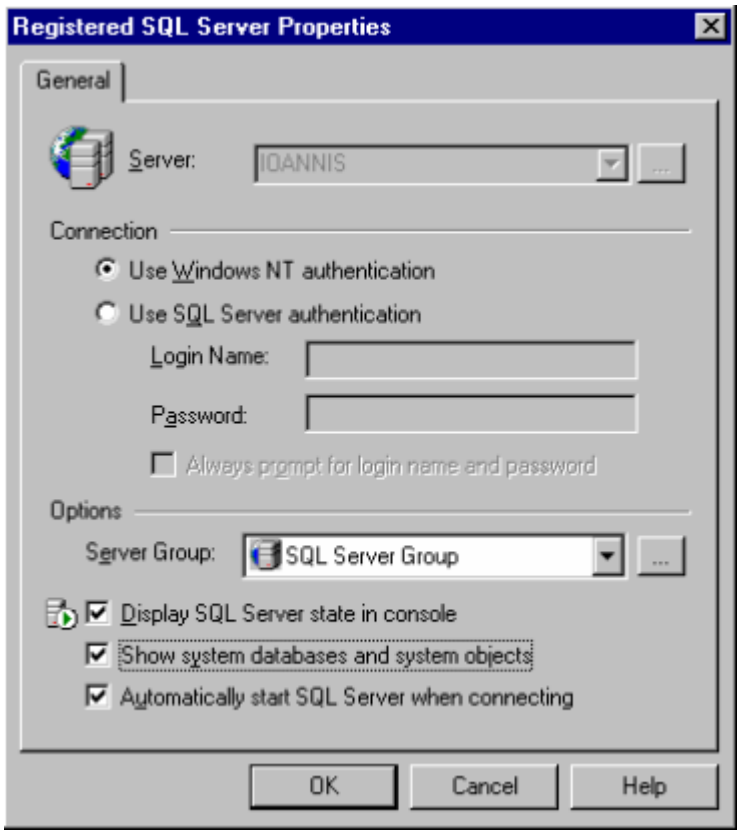
The initial sizes of "tempdb" and "masterdb" are small. Microsoft SQL Server will increase them on the fly, but it will consume resources. It is always better to start from a decent initial size. To perform this task, select each database, right-click to display the context menu, and select **Properties.** This opens the **Master Properties** dialog box, shown below, which enables you to adjust the database sizes.



Master Properties Dialog Box

Once the sizes have been modified, click **OK** to apply the changes.

Note
You may have to edit the Microsoft SQL Server registration properties inside the Microsoft SQL Enterprise manager to display all system objects so that the "masterdb" and "tempdb" are visible in the tree view. To do this, start the Microsoft SQL Enterprise manager, select the Microsoft SQL Server, right-click, and then select **Edit SQL Server Registration Properties.** This opens the **Registered SQL Server Properties** dialog box, shown below. Make sure that the **Show System Databases** option is checked.

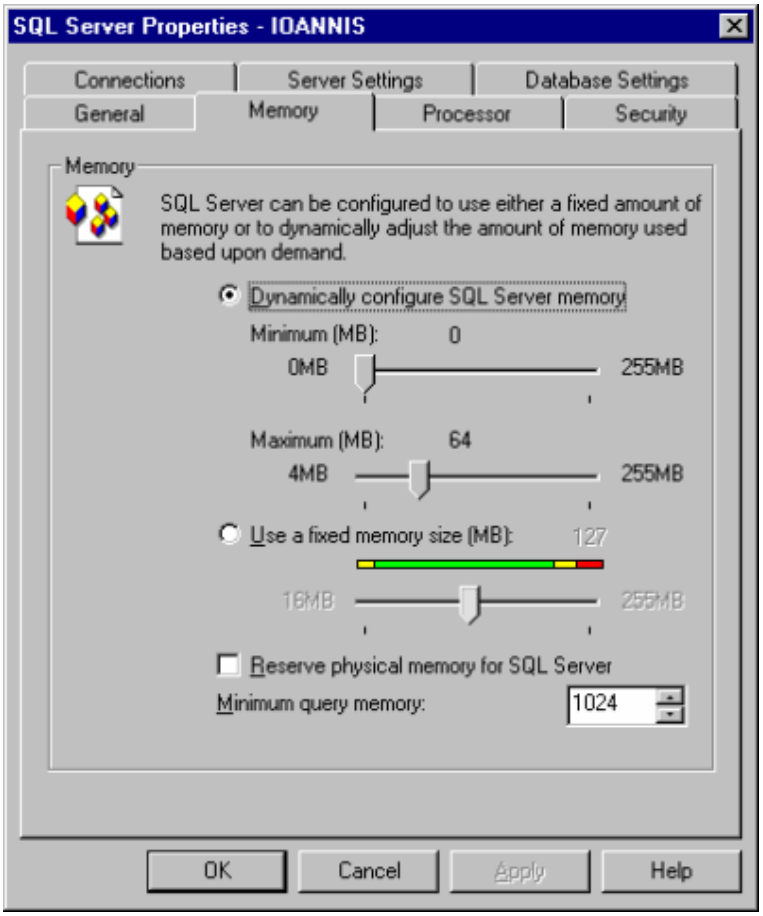


Registered SQL Server Properties

Setting Server Memory Options

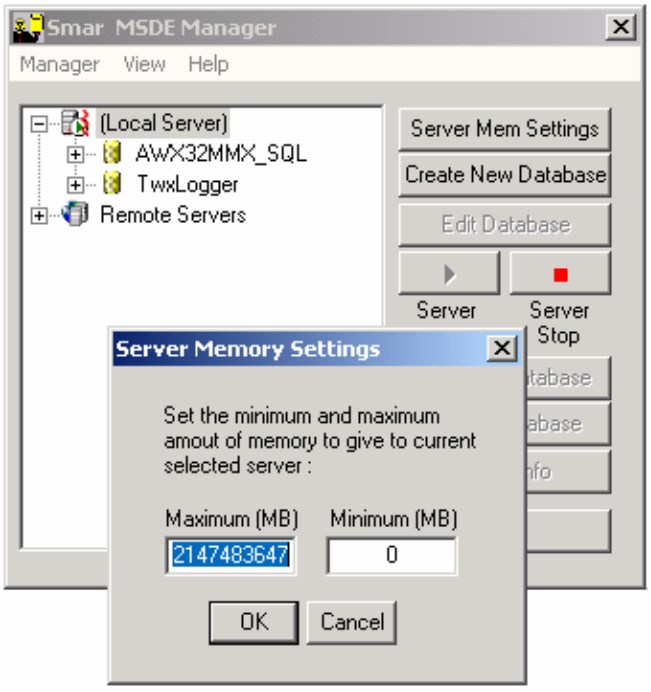
By default, Microsoft SQL Server and MSDE will be configured to use all available PC memory, which can cause problems with a heavy-duty load or an inadequately equipped PC.

You can use the Microsoft SQL Enterprise manager to adjust the server memory settings. For Microsoft SQL Server installations, start the Microsoft SQL Enterprise manager, select the Microsoft SQL Server, right-click, and then select **Properties.** This opens the **SQL Server Properties** dialog box, shown below. You can modify the server memory settings using the **Memory** tab of the **SQL Server Properties** dialog box.



SQL Server Properties

For MSDE installations, start the Smar MSDE Manager, select the MSDE server, and then click **Server Mem Settings** to adjust the current memory settings, as shown in the figure below.



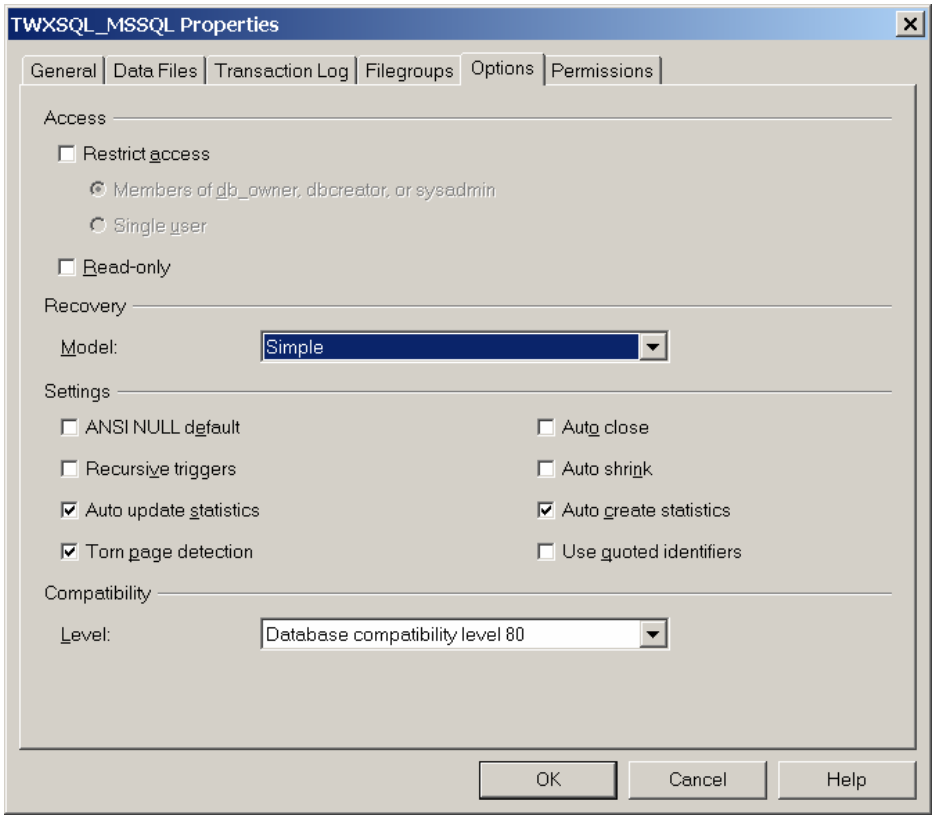
Server Memory Settings Dialog Box

It is recommended that you use as a maximum value no more than two thirds of the total physical RAM available on the PC. For example, assume that the PC has 256 MB of RAM. Set the Microsoft SQL Server (or MSDE) RAM to a maximum value of for 128-168 MB of RAM.

Note
You may have to stop and restart the Microsoft SQL or MSDE servers for these changes to be applied.

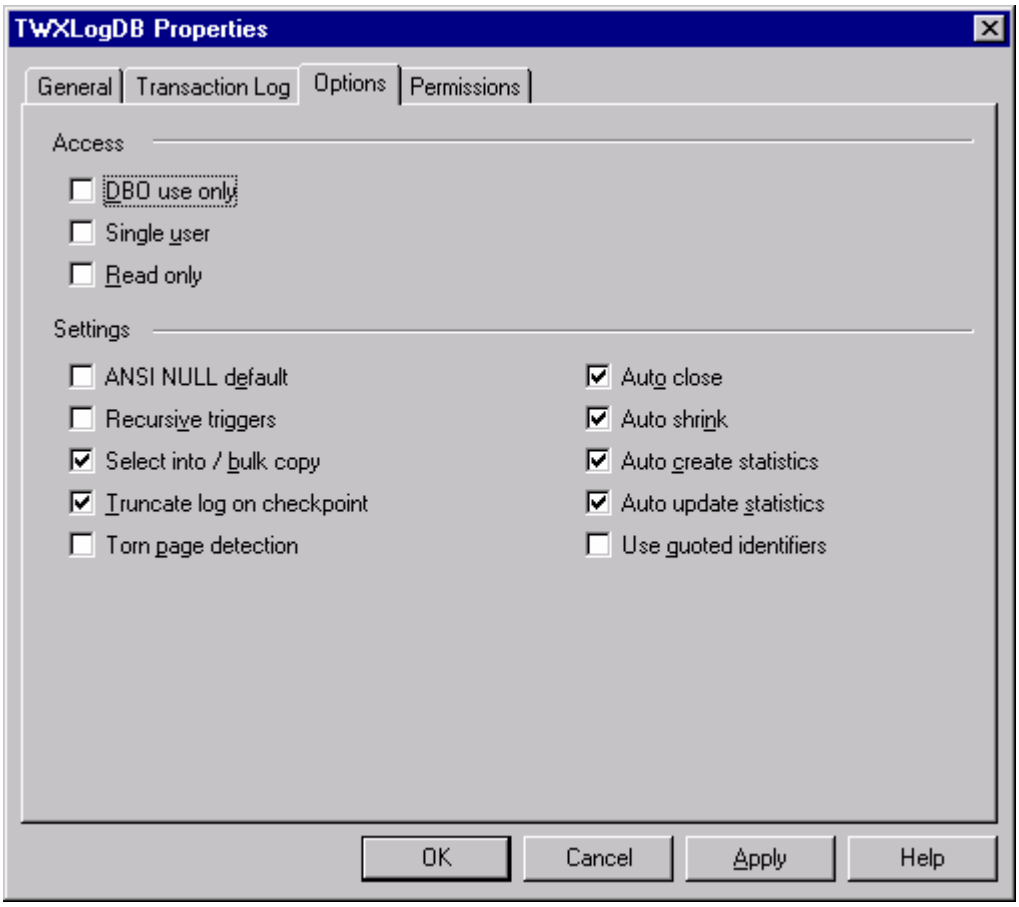
Controlling Transaction Log size

For Microsoft SQL 2000 databases, go to the historical database **Properties** dialog box and select the **Options** tab, as shown in the figure below. Under **Recovery Model,** select **Simple** from the drop-down list, as shown in the figure below. This enables Transaction Log truncation so that the log will not increase in size.



Limiting the Transaction Log Size

For Microsoft SQL 7.0 databases, make sure that the **Truncate Log on checkpoint** option is checked in the **Options** tab of the database **Properties** dialog box, as shown in the figure below. In addition, the **Auto Close, Select into / bulk copy, Auto create statistics** and **Auto update statistics** options should be enabled.

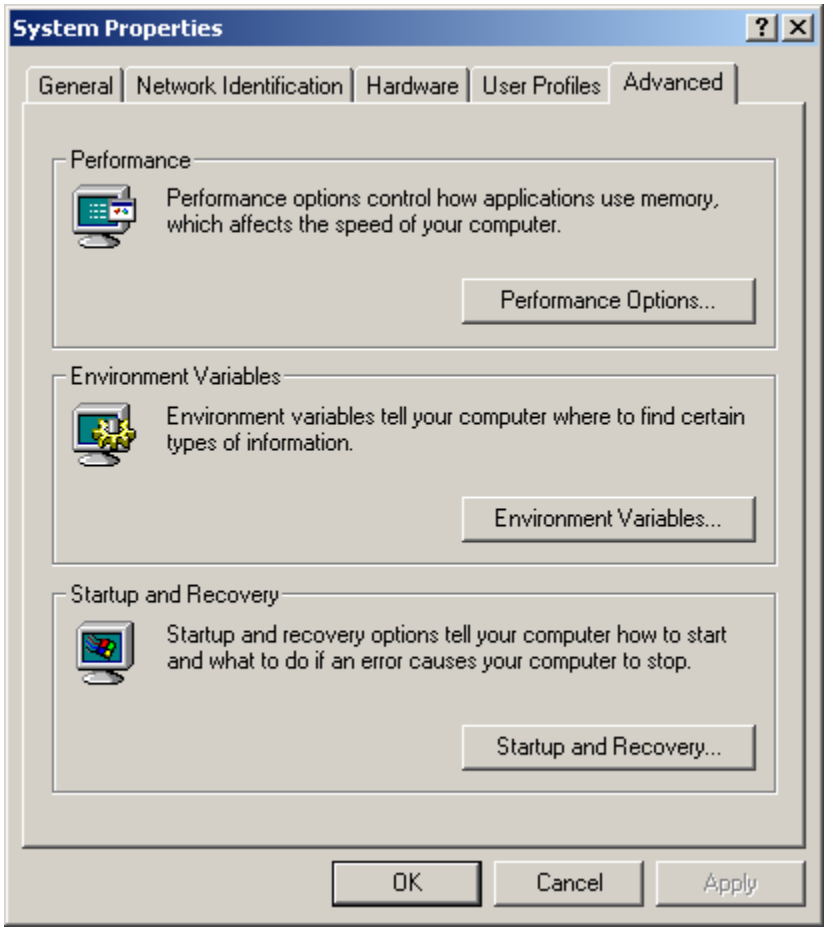


Limiting the Transaction Log Size

Adjusting Virtual Memory Settings

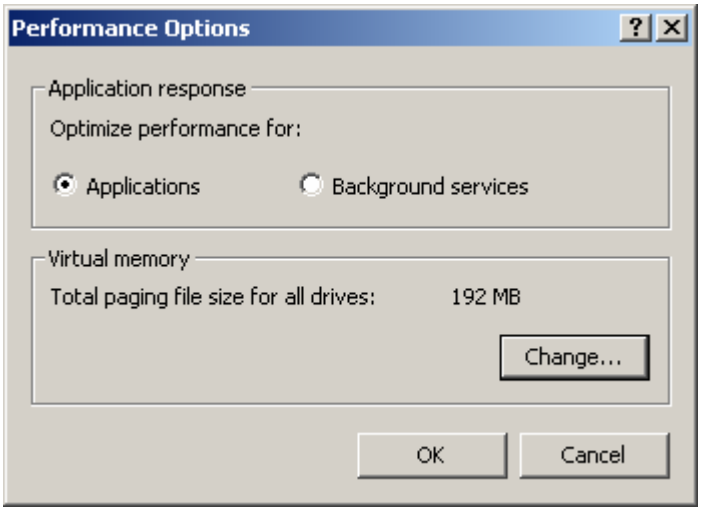
Make sure that the PC has adequate virtual memory (paging file) for Microsoft SQL Server (or MSDE) and all other Windows applications. For example, assume that the PC has a total of 256 MB of RAM. Set Microsoft SQL Server (or MSDE) to use a maximum of 128 MB RAM. Make sure the paging file is at least 256 MB.

To adjust the virtual memory settings on your PC, select the **My Computer** icon on the desktop, right-click and select **Properties** from the pop-up menu. Once the **System Properties** dialog box is displayed, open the **Advanced** tab, as shown below.



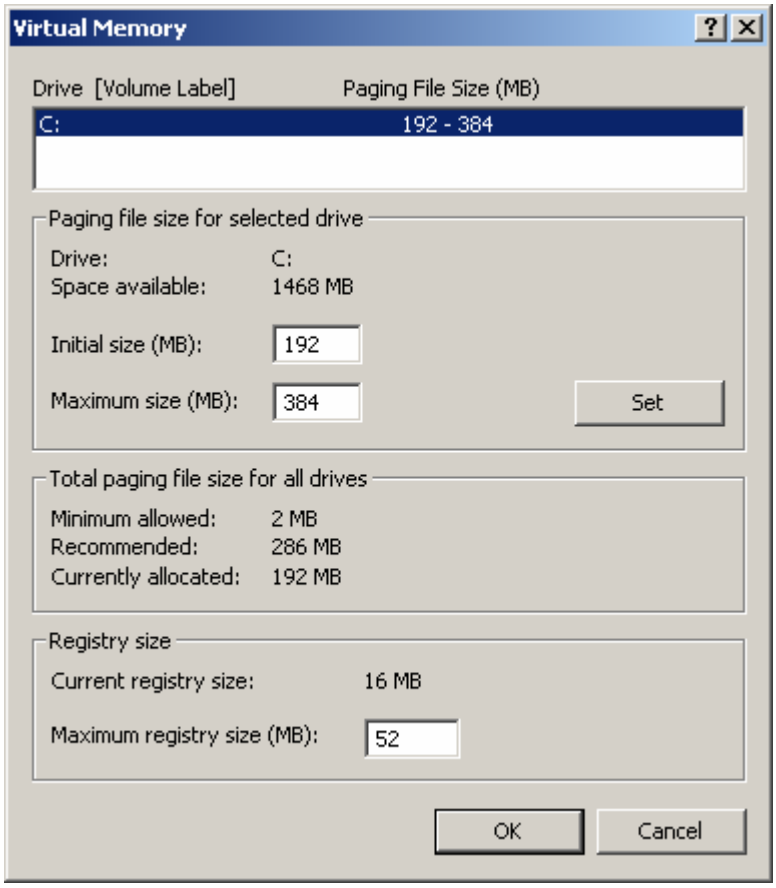
Windows System Properties Dialog Box

Then click **Performance Options** to open the **Performance Options** dialog box, shown below.



Performance Options Dialog Box

Click **Change** to display the **Virtual Memory** settings dialog box, shown below. Here you can modify your virtual memory settings.



Virtual Memory Settings Dialog Box

Microsoft SQL Server will use as much memory as it needs to boost its performance. However, if it has to give back physical RAM, it will substitute with virtual memory. In some cases, it will use more virtual memory than physical RAM. Also note that Microsoft SQL Server 2000 (or MSDE 2000) uses less memory than Microsoft SQL Server 7.0 (or MSDE 7.0) and performs better, at the expense of using more disk space.

Optimizing Data-Logging Configuration

To optimize the data-logging configuration:

- Use deadband or a data-compression filter. This can drastically improve performance while saving disk space usage
- Log to disk as slowly as possible. That is, do not write to disk every sample, unless your data-logging rate is 15 minutes or so.
- Create the historical database with a good initial size (30-50 percent of the estimated final size). Microsoft SQL Server (MSDE) will increase the size on the fly, but it will consume resources. It is always better to start from a decent initial size.
- Avoid using many database groups to log to the same database. Each database group uses an independent connection to the database, which consumes more resources.
- Use fewer logging groups (with more tags per group) rather than many logging groups (with few tags per group). Microsoft SQL Server (MSDE) will fewer tables to maintain, so performance will be better.
- Do not let the size of data-logging tables exceed 80 MB. Create a new table instead. The bigger the tables get, the slower data logging will be.
- Run Microsoft SQL Server in Windows Server rather than Windows Workstation to increase performance.

Managing Database Storage Requirements

Within Microsoft SQL Server Enterprise manager, you can set up maintenance plans that can defragment the database and optimize and recompute table index information. Ideally, these plans should be activated during inactive data-logging periods. When applied to a database on a periodic basis, they can significantly improve database performance and reduce database disk space usage.

Example Configurations

Example 1. If you wanted to data log 100 signals per second, you would write to disk every minute or 60 samples, creating a new table every 4-6 hours.

Example 2. If you wanted to data log 500 signals per minute, you would write to disk no faster than every 5 minutes or five samples, creating a new table once a day or once a week.
%IDH_Performance_Optimization_and_Evaluation IDH_Performance_Optimization_and_Evaluation

Troubleshooting

This section provides some useful tips for troubleshooting data-logging applications.

Database Driver Errors

Using a technology that has been incorporated into all Smar products, TraceWorX provides online diagnostics and tuning of applications running in the ProcessView system. TraceWorX is designed expressly for systems integrators, OEMs and customers who want to have tools for doing their own troubleshooting and diagnostics.

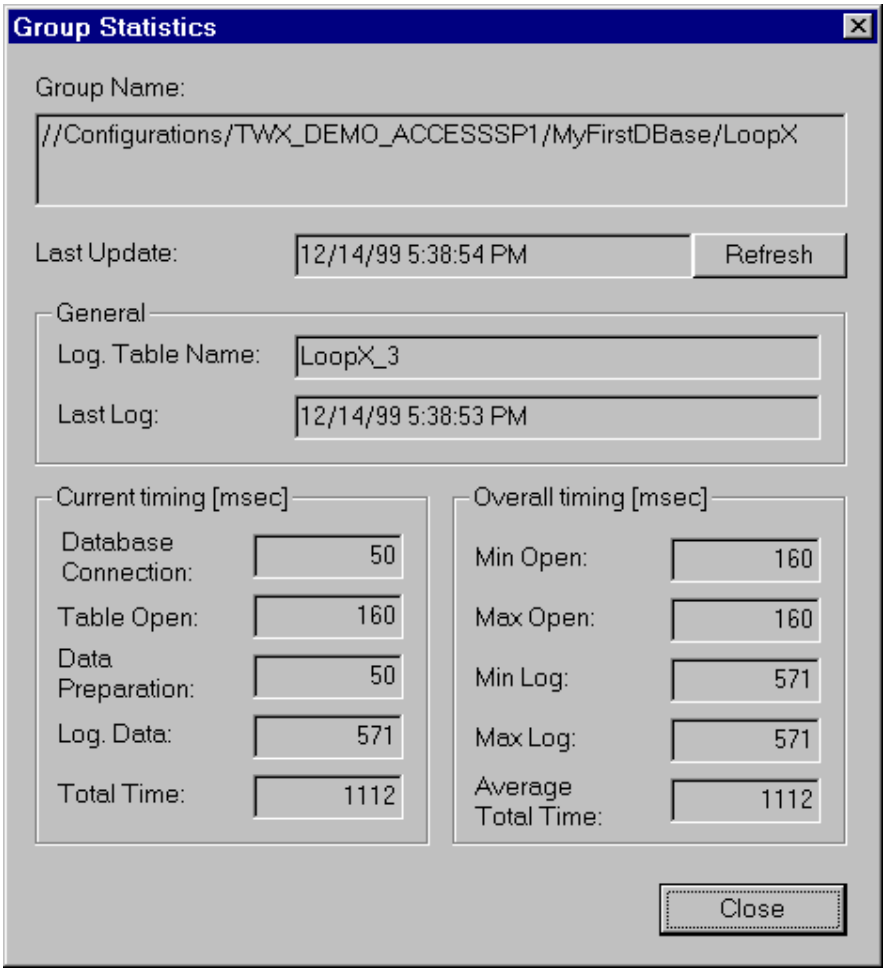
TraceWorX tracks the runtime activity for the TrendWorx SQL Data Logger and logs the runtime data to a log file based on user-configured trace levels. The log file provides a thorough, color-coded report detailing all activity for the application, including the time, the date, the severity level, and a description of the event or problem.

TraceWorX also features several options for reporting issues to technical support. If you are experiencing problems with any applications, the log file deployment options, such as compressing and e-mailing log files, are ideal for tracking and archiving data and sending detailed reports to technical support. Developers can use these reports to identify the source of the problems.

Please see the TraceWorX Help documentation for more information.

Inspecting Data-Logging Activity

The TrendWorx Configurator provides runtime information on a per-data-logging group basis, identifying the last time that historical data were logged to the disk for the selected logging group, as well as the currently active historical table for data logging. You can view the statistics collected on a per-group basis during data logging by clicking the **Get Statistics** button in the TrendWorx Configurator under each group. This opens the **Group Statistics** dialog box, shown below.



Monitoring Data-Logging Activity

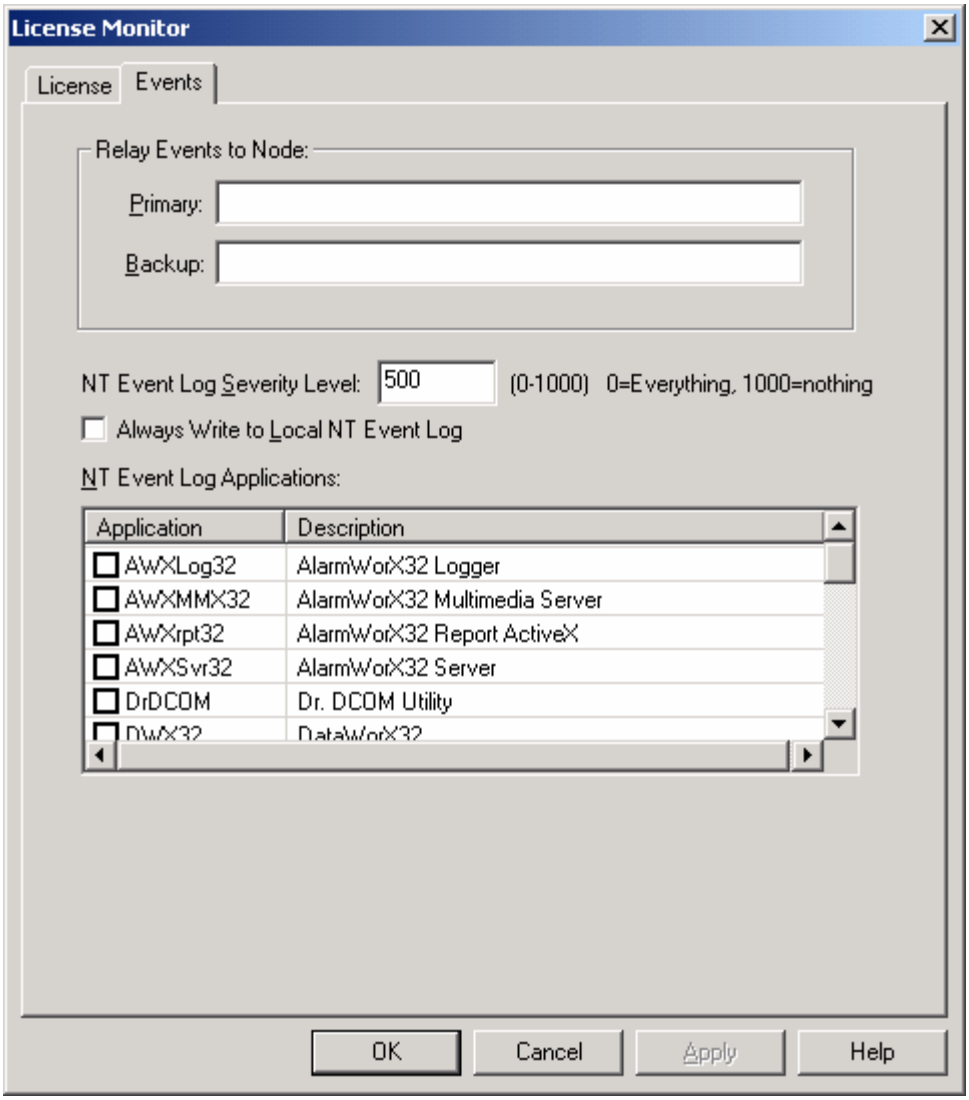
GenEvent Registrar and NT Event Logger Integration

The TrendWorx SQL Data Logger is interfaced to the Proc View Registrar Server and, subsequently, to the NT Event Logger. Currently, the following events are posted:

- Started Logging (Severity 500)
- Stopped Logging (Severity 500)
- Error Starting Data Logging (Severity 800)
- Activated Database Group (Severity 600)
- Deactivated Database Group (Severity 600)
- Activated Logging Group (Severity 600)
- Deactivated Logging Group (Severity 600)
- Switched Database Connection (Severity 650)
- Failed to Activate (Severity 750)
- Failed to Deactivate (Severity 750)
- Errors in Loading Configuration (Severity 650)
- Failed to Switch Database (Severity 750)
- Missing Logging Tag (Severity 650)
- Lost Database Connection (Severity 800)
- Got Database Connection (Severity 500)

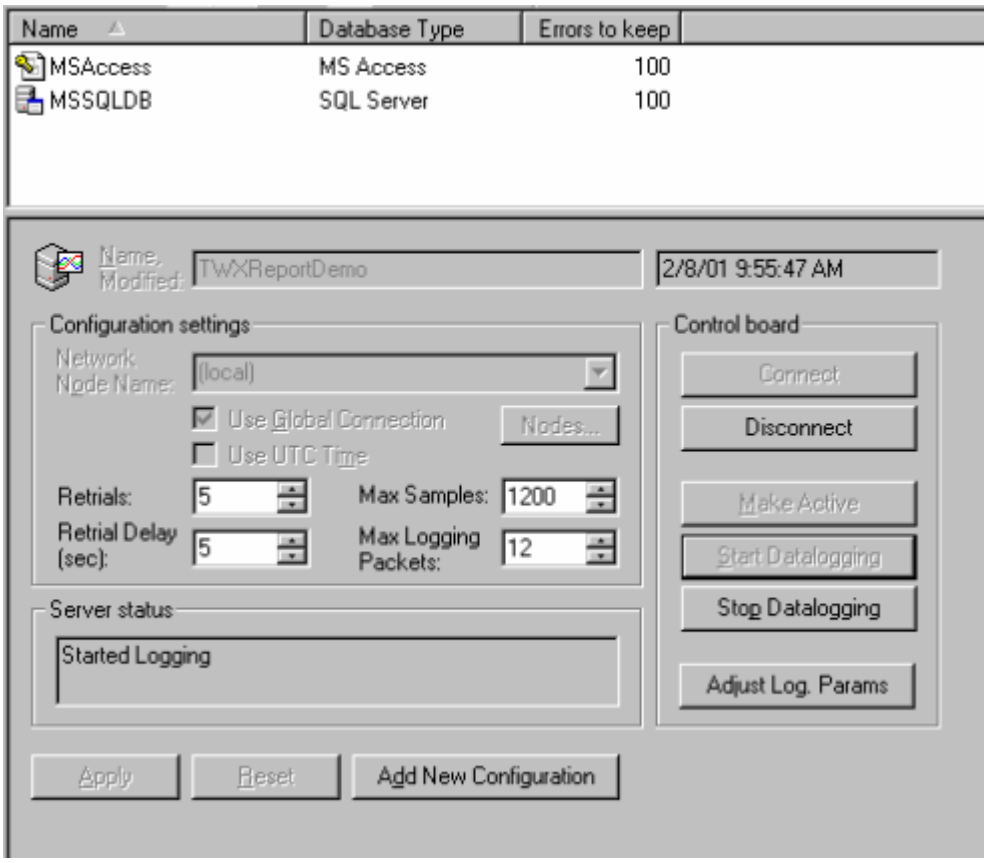
- Maximum Number of Logging Packets Reached (Severity 650)
- Lost Logging Packet (Severity 750)
- Retried to Log Data (Severity 650)
- Not Enough Client Units for Database Switching (Severity 500)

To activate the NT Event Logger, you need to enable this option under the ProcessView License Monitor, shown below, by checking **Always Write to Local NT Event Log.**



Enabling NT Event Logging for Data Logging

TrendWorx SQL Data Logger has both a data-logging retrial mechanism and a database-reconnection mechanism. If data logging fails, it puts the current data-logging packet back in the queue of packages to data log. It will retry (by default) three times to data log the packet prior to aborting. In the TrendWorx Configurator, there is a user-configurable maximum number of data-logging packets to maintain in memory for data logging on a per-group basis, as shown in the figure below. The default value is 15.



Data-Logging Retrials Settings

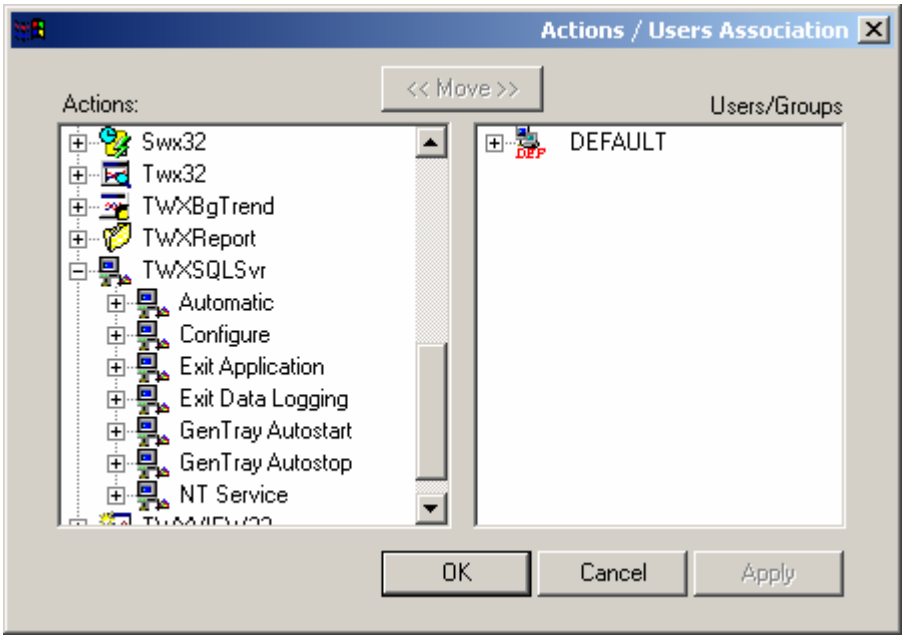
The **Max Logging Packets** value controls the maximum number of data-logging packets to maintain in memory. The **Retrials** value controls the number of times the TrendWorx SQL Data Logger will retry data logging data in case of a failure. The **Max Samples** value controls the maximum number of samples to maintain in memory on a per-data-logging tag basis. The **Retrial Delay** value is the time between successive retrials.

By default, the TrendWorx SQL Data Logger will establish a connection to the database for logging and leave that connection open for the duration of the data-logging activity. To have the TrendWorx SQL Data Logger open a database connection only for the duration of writing a new logging packet to disk, you can change the **Global Connection** setting to 0. However, this is not recommended for high volume or frequent data-logging activity.

Note
The **Max Logging Packets** default value is set to 15. This assumes a small data-logging load. For larger data-logging applications, it may have to be reduced to a lesser value.

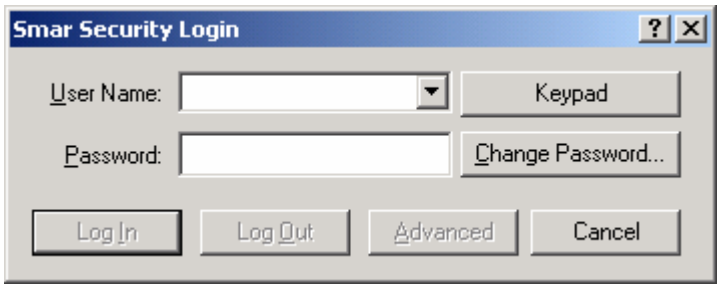
Security Integration

The TrendWorx SQL Data Logger is interfaced to the **SMAR Security Server,** and it provides support for the following security actions, as shown in the figure below.



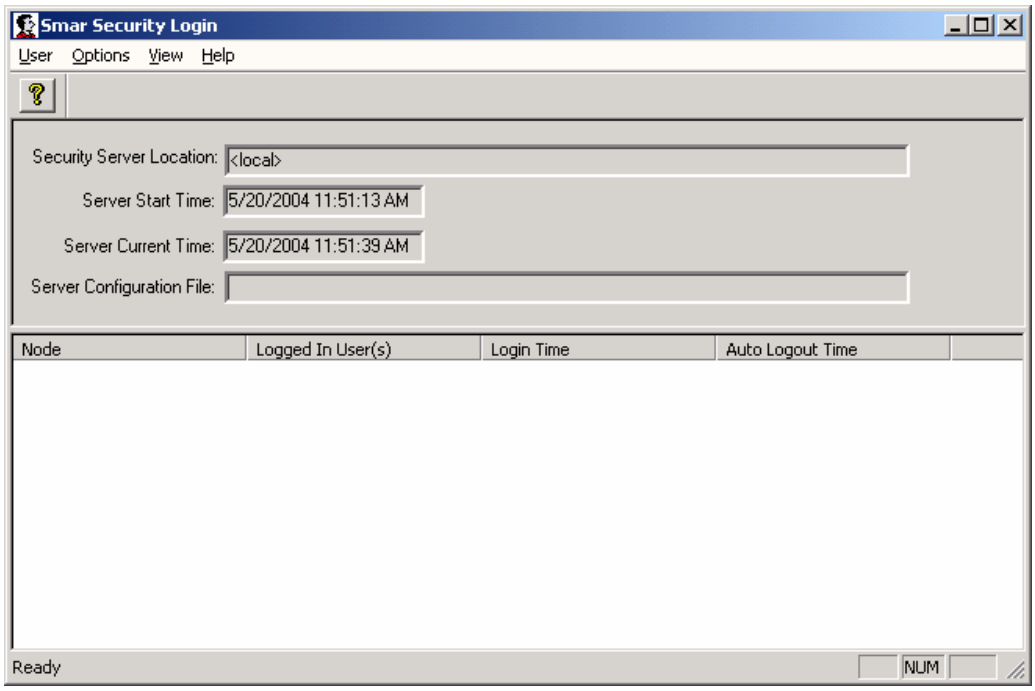
Smar Security Server

In data-logging mode, you can log in to the Smar Security Server by choosing **Login** from the **Security** submenu of the **Tools** menu. The login function is only available in data-logging mode. This opens the **Smar Security Login** dialog box, shown below.



SMAR Security Login

If you already have a user name and password, enter them and then click **OK.** Otherwise click **Cancel.** The **SMAR Security Login** window opens, as shown below.



SMAR Security Login Window

It is possible to log in from the **User** menu of the **SMAR Security Login Window.** You can also change your password and your security preferences in this window. In configuration mode, you can access the SMAR Security Server by choosing **Configuration** from the **Security** submenu of the **Tools** menu.

SMAR Security Login

To configure your security settings, you must first have SMAR security clearance. Enter an administrator user name and password, and then click **OK.**

Database Schema

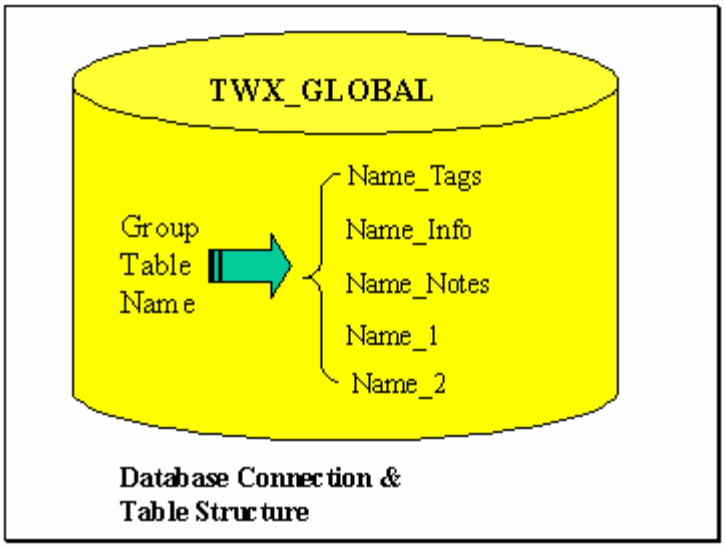
Key features of the TrendWorx SQL Data Logger data-logging engine include:

- Multiple databases support.
- Automatic data buffering.
- Extensive data-logging configuration.
- Data retrieval from OPC servers.
- Use of multithreading techniques.

For the actual data-logging mechanism, TrendWorx SQL Data Logger uses client/server database technology to perform compact batch updates to the underlying database, resulting in optimal use of available hardware and software resources. The database locks are placed in an optimal fashion, and the related tables can respond much better in multi-user scenarios.

Note
Batch updates are not currently supported for Oracle databases.

TrendWorx SQL Data Logger creates the necessary database schema to accommodate a various data-logging needs. For each physical database connection it will create the following database schema:

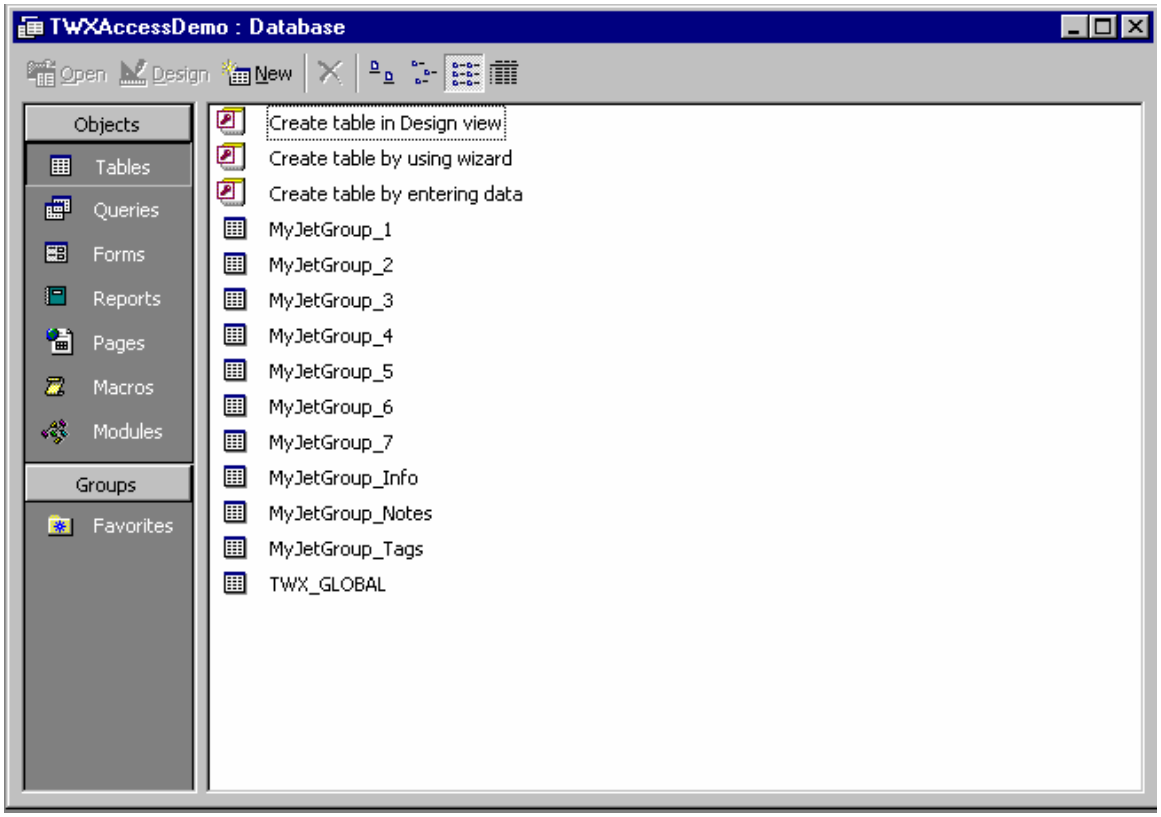


TrendWorx SQL Data Logger Database Schema

Tables

The application must have complete access to the database in order to edit or delete tables. If you change the name of the table on a per-group basis, TrendWorx SQL Data Logger will not delete the existing tables; this is left to the database administrator. In addition, under no circumstances should you change the order or the data type of the columns that are already created. With this in mind, it should be noted that you can append new columns at the end of existing ones. For each configured group, each of the tables is named after the user- selected table name.

For example, using Microsoft Access, opening the database will bring up the following list of database tables for each group of signals formed by TrendWorx SQL Data Logger:

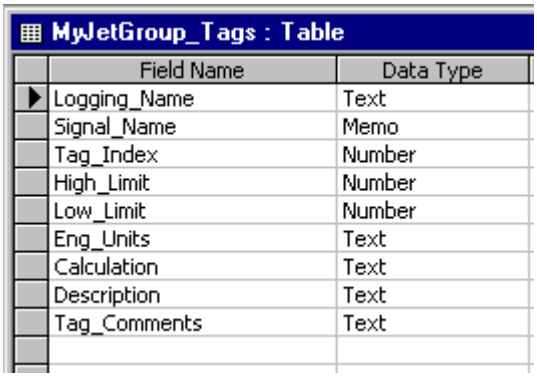


Microsoft Access Database With Tables

Notice that there are various tables for each group, which will be described later. Double-clicking any of these tables from the database list opens the actual table so that you can view all of the corresponding data.

Tags Table

The Microsoft Access database **"_Tags"** table, shown below, contains all of the information required by data logging and reporting for the tags (signals) within the data-logging group.

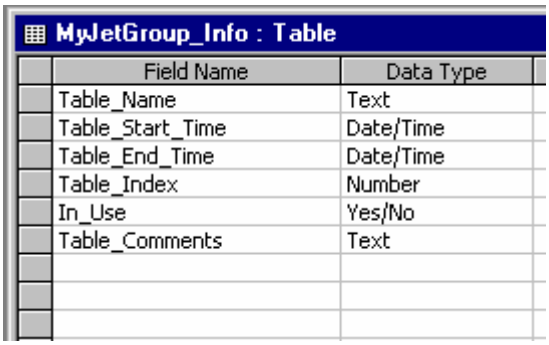


MyJetGroup_Tags : Table

Field Name	Data Type
Logging_Name	Text
Signal_Name	Memo
Tag_Index	Number
High_Limit	Number
Low_Limit	Number
Eng_Units	Text
Calculation	Text
Description	Text
Tag_Comments	Text

Tags Table

Info Table
The Microsoft Access database **"_Info"** table, shown below, contains all of the information required by data logging and reporting for the cyclic table creation of the historical data-logging process within the data-logging group.

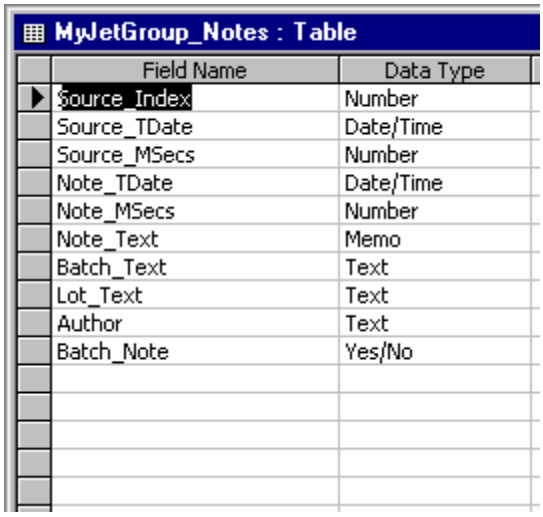


MyJetGroup_Info : Table

Field Name	Data Type
Table_Name	Text
Table_Start_Time	Date/Time
Table_End_Time	Date/Time
Table_Index	Number
In_Use	Yes/No
Table_Comments	Text

Info Table

Notes Table
The Microsoft Access database **"_Notes"** table, shown below, contains all of the operator comments and batch/lot entries within the data-logging group.

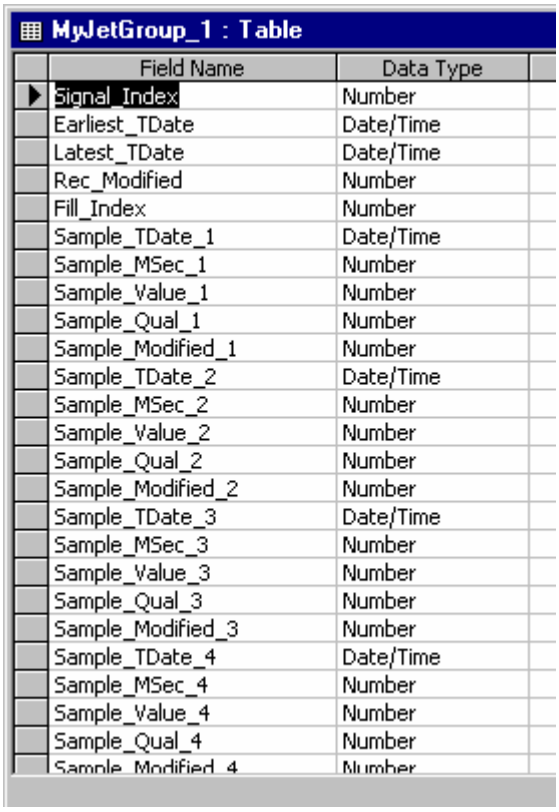


MyJetGroup_Notes : Table

Field Name	Data Type
Source_Index	Number
Source_TDate	Date/Time
Source_MSecs	Number
Note_TDate	Date/Time
Note_MSecs	Number
Note_Text	Memo
Batch_Text	Text
Lot_Text	Text
Author	Text
Batch_Note	Yes/No

Notes Table

Numbered Tables
The Microsoft Access database **Numbered** tables ("_1," "_2," etc.), shown below, are the actual data-logging tables, which contain information for up to 36 samples per second.

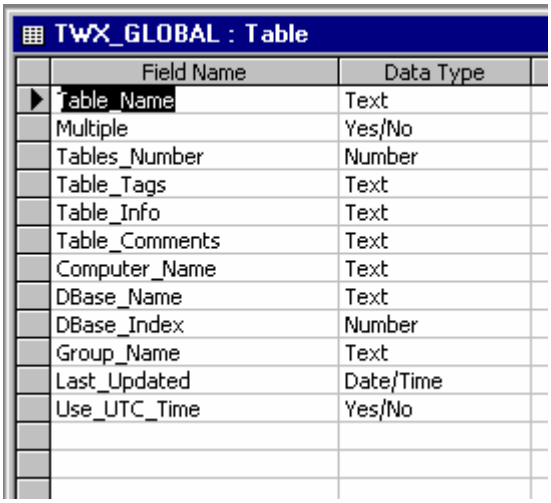


MyJetGroup_1 : Table

Field Name	Data Type
Signal_Index	Number
Earliest_TDate	Date/Time
Latest_TDate	Date/Time
Rec_Modified	Number
Fill_Index	Number
Sample_TDate_1	Date/Time
Sample_MSec_1	Number
Sample_Value_1	Number
Sample_Qual_1	Number
Sample_Modified_1	Number
Sample_TDate_2	Date/Time
Sample_MSec_2	Number
Sample_Value_2	Number
Sample_Qual_2	Number
Sample_Modified_2	Number
Sample_TDate_3	Date/Time
Sample_MSec_3	Number
Sample_Value_3	Number
Sample_Qual_3	Number
Sample_Modified_3	Number
Sample_TDate_4	Date/Time
Sample_MSec_4	Number
Sample_Value_4	Number
Sample_Qual_4	Number
Sample_Modified_4	Number

Numbered Table

Global Table
In addition, for each physical database, TrendWorx SQL Data Logger creates a Microsoft Access database **Global** table called "TWX_GLOBAL," shown below, that will be used to maintain database integrity across multiple data-logging nodes by ensuring that no two different groups will have data entered into the same table.

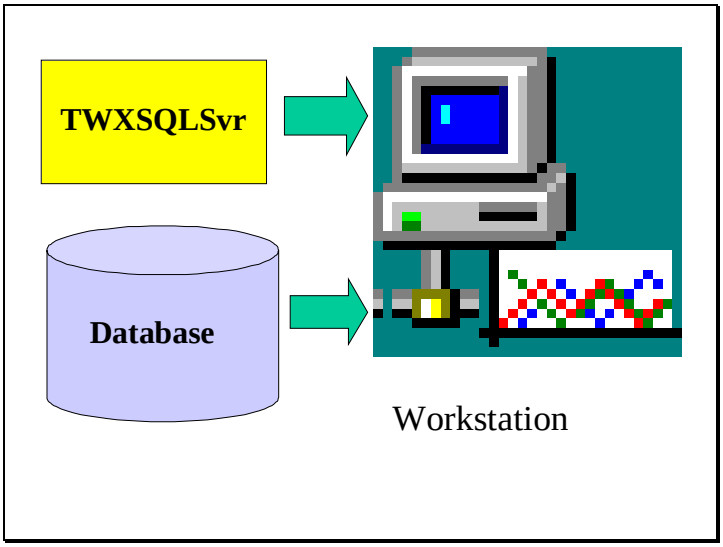


TWX_GLOBAL : Table

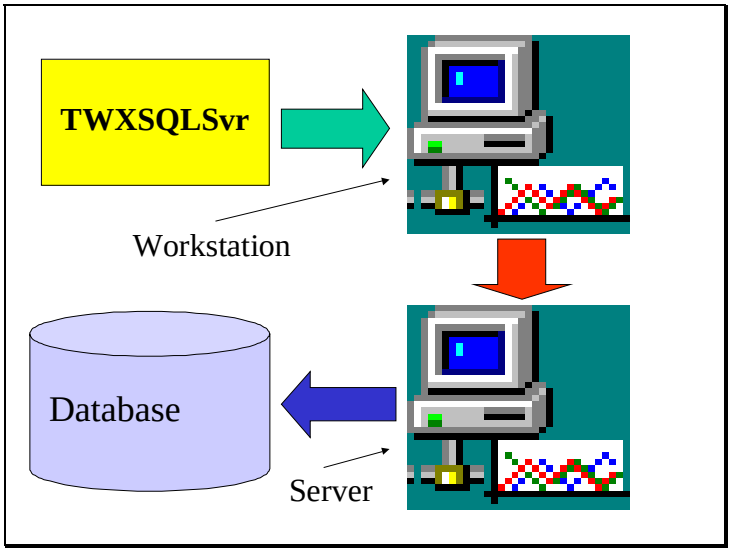
Field Name	Data Type
Table_Name	Text
Multiple	Yes/No
Tables_Number	Number
Table_Tags	Text
Table_Info	Text
Table_Comments	Text
Computer_Name	Text
DBase_Name	Text
DBase_Index	Number
Group_Name	Text
Last_Updated	Date/Time
Use_UTC_Time	Yes/No

Global Table

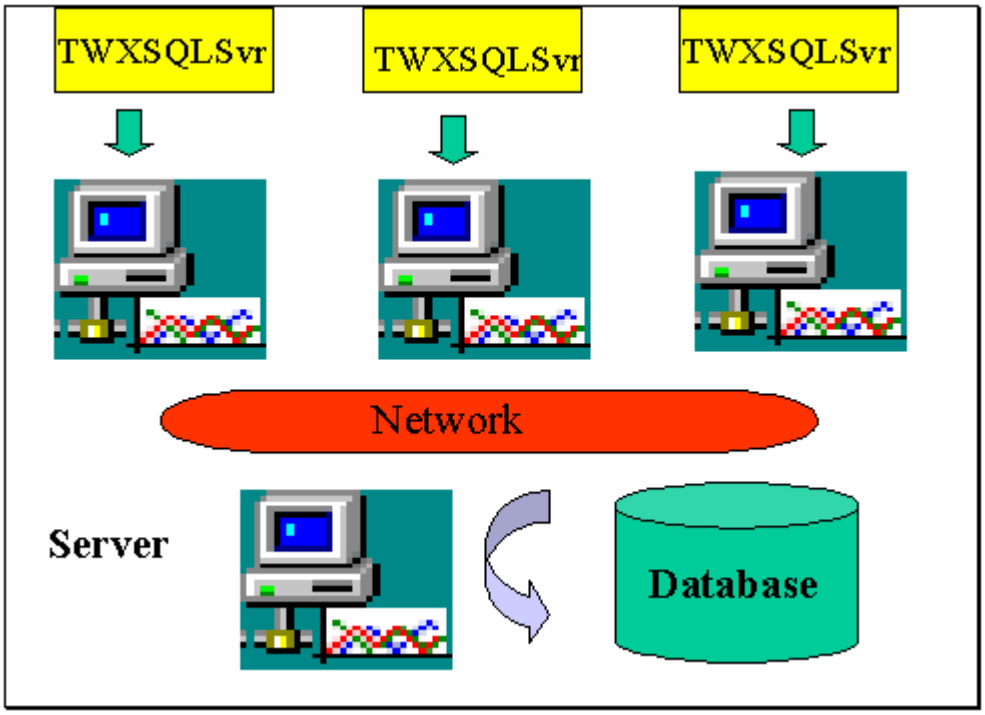
Regardless of the end database choice, the TrendWorx SQL Data Logger can be deployed in various scenarios:



TrendWorx SQL Data Logger and Physical Database Residing on the Same Node



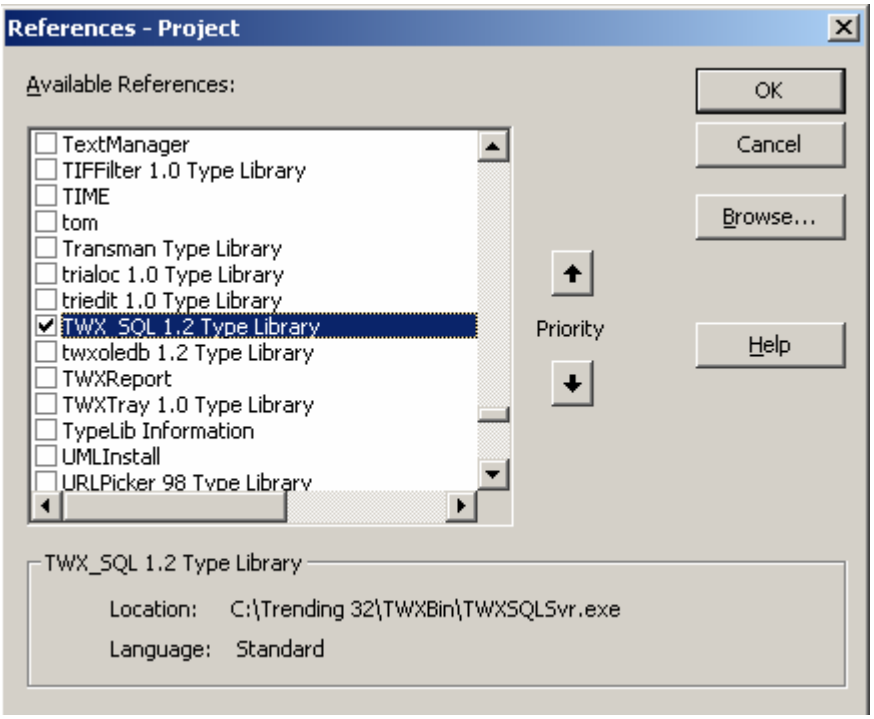
TrendWorx SQL Data Logger Residing on a Different Node From the Database Server



Distributed TrendWorx SQL Data Logger Deployment

OLE Automation Interface

The TrendWorx SQL Data Logger supports a dual COM interface for data logging manipulation through OLE Automation or DCOM. To use this new interface within a Visual Basic application (VBA), you must ensure that the VBA project has **References** to the SMAR TrendWorx SQL library, as shown below.



Adding References to the TWX_SQL Type Library

Then you can use the methods and properties exposed. A simple call to create an instance of the server object within Visual Basic is as follows:

```
Dim mylog As TWXLogger

Set mylog = CreateObject("SMAR.TWXLogger.1")
```

The Data Logger exposes the following OLE automation methods and properties:

```
 [propget, id(1), helpstring("property LoggerStatus")]

HRESULT LoggerStatus([out, retval] short *pVal);

[propget, id(2), helpstring("property CurrentTime")]

HRESULT CurrentTime([out, retval] DATE *pVal);

[propget, id(3), helpstring("property StatusString")]

HRESULT StatusString([out, retval] BSTR *pVal);

[propget, id(4), helpstring("property StartTime")]

HRESULT StartTime([out, retval] DATE *pVal);

[id(5), helpstring("method GetDatabaseGroupStatus")]

HRESULT GetDatabaseGroupStatus([in] BSTR bstrDBaseGroupName,

    [out] short * pStatus,

    [out] DATE * pCurrentTime,

    [out] BSTR * bstrStatusString      );

[id(6), helpstring("method GetGroupStatus")]

HRESULT GetGroupStatus([in] BSTR bstrDBaseGroupName,
    [in] BSTR bstrGroupName,

    [out] short * pStatus,

    [out] DATE * pCurrentTime,

    [out] BSTR * bstrStatusString);

[id(7), helpstring("method GetGroupStatistics")]

HRESULT GetGroupStatistics([in] BSTR bstrDBaseGroupName,
    [in] BSTR bstrGroupName,

    [out] long * pConnectionTime,

    [out] long * pTableOpenTime,

    [out] long * pDataPreparationTime,

    [out] long * pDataWriteTime,

    [out] long * pTotalLogTime,

    [out] long * pTotalLogMinTime,
```

```
    [out] long * pTotalLogMaxTime,
    [out] long * pTableOpenMinTime,
    [out] long * pTableOpenMaxTime,
    [out] long * pTotalAvgWriteTime,
    [out] DATE * pLastWriteTime,
    [out] BSTR * bstrTableName);

[id(8), helpstring("method LoadConfiguration")]
HRESULT LoadConfiguration([in] long lConfigID,
    [in] BSTR bstrConfigurationName);

[id(9), helpstring("method SetConfigurationDatabase")]
HRESULT SetConfigurationDatabase([in] BSTR bstrConnectionString);
[id(10), helpstring("method StartLogging")]
HRESULT StartLogging();
[id(11), helpstring("method StopLogging")]
HRESULT StopLogging();
[id(12), helpstring("method ActivateDatabaseGroup")]
HRESULT ActivateDatabaseGroup([in] BSTR bstrDBaseGroupName);
[id(13), helpstring("method DeActivateDatabaseGroup")]
HRESULT DeActivateDatabaseGroup([in] BSTR bstrDBaseGroupName);
[id(14), helpstring("method ActivateGroup")]
HRESULT ActivateGroup([in] BSTR bstrDBaseGroupName,
    [in] BSTR bstrGroupName);

[id(15), helpstring("method DeActivateGroup")]
HRESULT DeActivateGroup([in] BSTR bstrDBaseGroupName,
    [in] BSTR bstrGroupName);

[id(16), helpstring("method Switch Database")]
HRESULT SwitchDatabase([in] BSTR bstrDBaseGroupName,
    [in] BSTR bstrODBCConnString,
    [in] BSTR bstrOLEDBConnString,
    [in] short nDBType,
    [in] BOOL bReDirect);

[id(17), helpstring("method ReloadConfiguration")]
HRESULT ReloadConfiguration([in] long lConfigID,
```

```
    [in] BSTR bstrConfigurationName);

 [id(18), helpstring("method AdjustLoggingParameters")]
HRESULT AdjustLoggingParameters([in] DWORD dwMaxRetrials,
    [in] DWORD dwMaxPackets);

[id(19), helpstring("method GetCurrentConfiguration")]

HRESULT GetCurrentConfiguration([out] long * lConfigID,
    [out] BSTR * bstrConfigurationName,

    [out] BSTR * bstrConnectionString);

[id(20), helpstring("method ResetConfiguration")]

HRESULT ResetConfiguration();

[id(21), helpstring("method TestConnection

HRESULT TestConnection([in] BSTR bstrConnectionString);

[id(22), helpstring("method AdjustLoggingParameters2")]

HRESULT AdjustLoggingParameters2(
    [in] DWORD dwMaxRetrials,

    [in] DWORD dwMaxPackets,

    [in] DWORD dwMaxSamples,

    [in] DWORD dwRetrialDelay,

    [in] BOOL  bUseGlobalConnection);

[id(23), helpstring("method QueryLoggingParameters")]

HRESULT QueryLoggingParameters(
    [out] DWORD * dwMaxRetrials,

    [out] DWORD * dwMaxPackets,

    [out] DWORD * dwMaxSamples,

    [out] DWORD * dwRetrialDelay,

    [out] BOOL  * bUseGlobalConnection);
```

In addition, the following enumerations are used:

Data Logger status:

- **TWXSQL_UP = 1**
- **TWXSQL_DOWN**
- **TWXSQL_INDETERMINATE**

Database group status:

- **TWXSQL_DBASEGROUP_ACTIVATED = 1**
- **TWXSQL_DBASEGROUP_DEACTIVATED**
- **TWXSQL_DBASEGROUP_INDETERMINATE**

Logging group status:

- **TWXSQL_GROUP_ACTIVATED = 1**
- **TWXSQL_GROUP_DEACTIVATED**
- **TWXSQL_GROUP_STANDBY**
- **TWXSQL_GROUP_EXITING**
- **TWXSQL_GROUP_INDETERMINATE**

Database connection type:

- **TWXSQL_DBASE_NONE = 1,**
- **TWXSQL_DBASE_ACCESS**
- **TWXSQL_DBASE_SQLSVR**
- **TWXSQL_DBASE_ORACLE**

In the method calls listed above:

- **bstrDBaseGroupName:** Refers to the database group name, as it would appear in the Configurator database.
- **bstrGroupName:** Refers to the logging group name, as it would appear in the Configurator database.
- **lConfigID:** Refers to the configuration ID, as it would appear in the Configurator database.
- **bstrConfigurationName:** Refers to the configuration name, as it would appear in the Configurator database, corresponding to the "lConfigID."
- **bstrODBCConnString:** Refers to the ODBC connection string passed to the OLE DB provider for ODBC, as it would appear in the Configurator database.
- **bstrOLEDBConnString:** Refers to the OLE DB connection string passed to the OLE DB provider for Microsoft Access, Microsoft SQL Server (MSDE), or Oracle, as it would appear in the Configurator database.
- **bstrConnectionString:** Refers to the OLE DB connection string passed to the OLE DB provider for Microsoft Access used in establishing a configuration database connection for the TrendWorx SQL Data Logger.

Note
The "SwitchDatabase" method call can be used while during data logging to perform a hot database switch operation with the option to redirect pending writes to the new database connection. If the Data Logger cannot establish a database schema information on the new database, or the new database type requires more Client Units, which are not available due to the current level of SMAR Licensing, this operation will fail.

OPC HDA COM Interface

The TrendWorx SQL Data Logger Version 7.0 has been updated to be compliant with the latest OPC HDA specification 1.2. In general, the OPC HDA specification is an extended OPC specification, which includes an increased number of interfaces and methods, not all of them being mandatory.

In addition to the Data Logger interface, the TrendWorx SQL Data Logger also implements the OPC Historical Data Access (HDA) interface. The following interfaces and methods are supported, including connection point support.

New for version 7.0 is an enhanced data-retrieval system, which utilizes a new approach to creating historical reports. The following is a summary of the changes for version 7.0:

- Data filter selection other than Raw will result in data time stamped at the beginning of each subinterval.
- When retrieving data using data filters other than Raw, subintervals for which there are no data because of no data-logging activity will be marked as “empty” slots at the corresponding time with an empty (VT_EMPTY) value. You can check the returned qualities for further processing.
- The historical qualities supported are as follows:

o OPCHDA_EXTRADATA 0x0001

❑ More data may exist

o OPCHDA_INTERPOLATED 0x0002

❑ Interpolated data value

o OPCHDA_RAW 0x0004

❑ Raw data value

o OPCHDA_CALCULATED 0x0008

❑ Calculated data value

o OPCHDA_NOBOUND 0x0010

❑ No data found to provide upper or lower bound

o OPCHDA_NODATA 0x0020

❑ No data collected. Archiving not active

o OPCHDA_DATALOST 0x0040

❑ Calculation started/stopped/lost

o OPCHDA_CONVERSION 0x0080

❑ Scaling / conversion error

o OPCHDA_PARTIAL 0x0100

❑ Aggregate value is for an incomplete interval

Critical Note
Because of the new compliance changes in historical replay and reporting, a version 7.0 historical replay or reporting may not produce identical results to existing 6.1x version reports and or historical replay screen captures for the same signals and time periods.

Interfaces

The following OPC HDA COM interfaces are supported:

- interface IOPCHDA_Server
- interface IOPCHDA_Browser
- interface IOPCHDA_SyncRead
- interface IOPCHDA_AsyncRead
- interface IOPCHDA_SyncAnnotations

Methods

The TrendWorx SQL Server supports the following OPC HDA Interfaces and methods:

- interface IOPCHDA_Server

✓ HRESULT GetItemAttributes
✓ HRESULT GetAggregates
✓ HRESULT GetHistorianStatus
✓ HRESULT GetItemHandles
✓ HRESULT ReleaseItemHandles
✓ HRESULT ValidateItemIDs
✓ HRESULT CreateBrowse

- interface IOPCHDA_Browser

✓ HRESULT GetEnum
✓ HRESULT ChangeBrowsePosition
✓ HRESULT GetItemID
✓ HRESULT GetBranchPosition

- interface IOPCHDA_SyncRead

✓ HRESULT ReadRaw
✓ HRESULT ReadProcessed
✓ HRESULT ReadAtTime
✓ HRESULT ReadModified
✓ HRESULT ReadAttribute

- interface IOPCHDA_AsyncRead

✓ HRESULT ReadRaw
✓ HRESULT ReadProcessed
✓ HRESULT ReadAtTime
✓ HRESULT ReadModified
✓ HRESULT ReadAttribute
✓ HRESULT Cancel

- **interface IOPCHDA_SyncAnnotations**

✓ HRESULT QueryCapabilities
✓ HRESULT Read
✓ HRESULT Insert

MSDE Support

TrendWorx SQL Data Logger supports MSDE (Microsoft Data Engine), which is a fully compatible Microsoft SQL Server engine, with the following limitations:

- The maximum database size is 2 GB.
- Performance may decrease if more than five connections are open to the database.

MSDE has the full core server functionality of Microsoft SQL Server, and MSDE databases can easily be upgraded to full Microsoft SQL Server databases. To install MSDE, you can use the Smar MSDE Manager or browse the Smar ProcessView CD to get to the **Tools** folder, which has both MSDE 7.0 and MSDE 2000 installations.

The "setup.exe" can be used to install MSDE, create an empty database, and verify installation. Once you install MSDE, you should create an ODBC data source associated with this database. The key advantages of MSDE include:

- Fully compatible Microsoft SQL Server database engine
- Central and dynamic memory management across all database connections
- On-the-fly index maintenance and management
- Optimized query processing
- Automatic database space management
- Microsoft SQL Server database upgrade path
- Ability to use Microsoft Access 2000 as a front-end configuration tool

Note
Since MSDE has intelligent online maintenance features, including database expansion and contraction, it is recommended that physical writes to the database be spread over time to allow for better performance. For example, when the data-collection rate is 5 seconds, writing to disk can be set to 30 seconds (or every six samples).

Refer to the Smar MSDE Manager Help documentation for additional information.

Running TrendWorx SQL Data Logger As an NT Service

You can register and run the TrendWorx SQL Data Logger as an NT Service. When TrendWorx SQL Data Logger is installed and running as a service, its functionality is modified with respect to the case where it is registered as a stand-alone COM server.

In general, TrendWorx SQL Data Logger can be registered and run as an NT service (under Windows NT and Windows 2000) as well as a stand-alone COM server. However, the following differences apply:

1. There will be *only* one instance (per node) of TrendWorx SQL Data Logger running under any condition.

2. If TrendWorx SQL Data Logger runs as stand-alone COM server:

- If it is started from the desktop and clients are connected to it, and if the user (through the application menus) chooses to exit, TrendWorx SQL Data Logger will "hide" its window, but will keep serving its clients. When the last client goes away, TrendWorx SQL Data Logger will shut down.
- If you try to double-click on TrendWorx SQL Data Logger executable from the Windows desktop while its application window is not visible and clients are connected to it, TrendWorx SQL Data Logger will *not* launch a second application instance, but it will show the existing window and, from there, it will close *only* from the menus.

3. If the TrendWorx SQL Data Logger is registered and running as an NT service:

- It will use as the service display name the "OEM" product name (if available).
- If you double-click on TrendWorx SQL Data Logger executable, it will not launch a second instance.
- Once TrendWorx SQL Data Logger starts as an NT Service, it will go into runtime (data logging) mode.

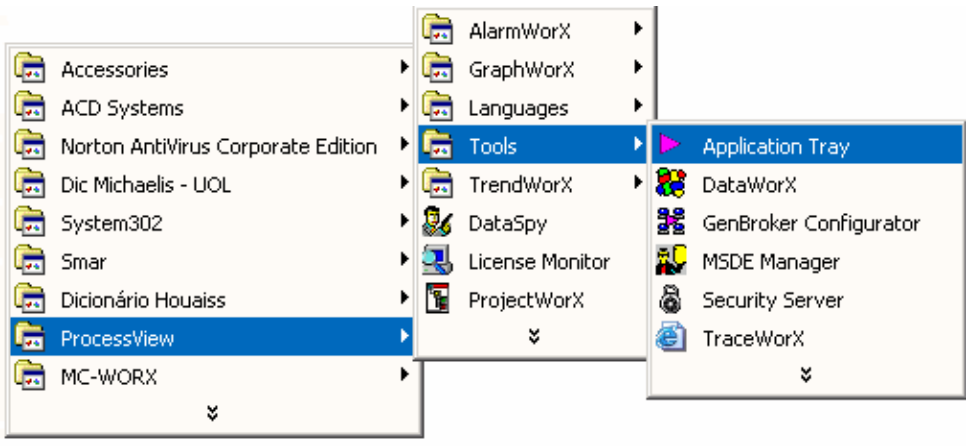
To configure TrendWorx SQL Data Logger to run as an NT Service, do the following:

1. Install PROCESSVIEW or TrendWorx.

2. Use the TrendWorx Configurator to configure your data-logging application.

3. Use the TrendWorx Configurator to test data logging.

4. Once the application setup is completed, use the ProcView Tray register to TrendWorx SQL Data Logger as an NT Service. To do this, start ProcView Tray from the SMAR PROCESSVIEW program group, under the **Tools** menu, as shown below.



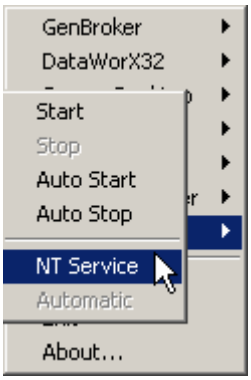
Starting ProcessView Tray from the Programs Menu

A purple triangle appears in the task bar, as shown below.

Task Bar

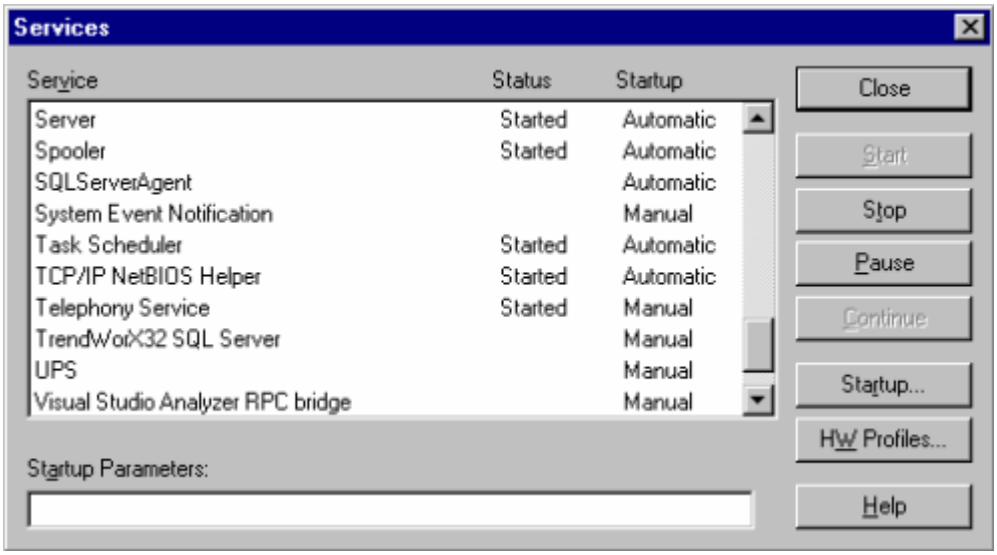
Place the mouse pointer within the triangle, and then right-click to open the ProcView Tray menu. Then, do the following:

1. Register TrendWorx SQL Data Logger to run as an NT Service by clicking the purple triangle. Select **TrendWorx > SQL Server > NT Service** from the pop-up menu, as shown in the figure below.



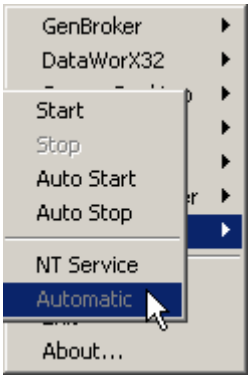
Registering the Data Logger As an NT Service

2. TrendWorx SQL Data Logger will appear in the Services window, as shown below.



Services Window

3. Use ProcView Tray to set TrendWorx SQL Data Logger to start automatically as an NT service the next time the PC is rebooted. Click the purple triangle in the task bar. This opens a pop-up menu, as shown below. Select **TrendWorx > SQL Server > Automatic** from the pop-up menu, as shown in the figure below.



Automatic Setting in ProcView Tray

When running the TrendWorx SQL Data Logger as an NT Service, special consideration must be given to ensure that, when it starts up as an NT service, TrendWorx SQL Data Logger has rights to access the database where the historical data logging will take place. When using ProcView Tray to register TrendWorx SQL Data Logger as an NT Service, it is configured to run under the local system account. If remote historical replay is to be used, it may require adjusting DCOM settings for the account under which TrendWorx SQL Data Logger will run as an NT Service, as well as adding rights to the historical database for the specific account. This can be done by having TrendWorx SQL Data Logger run in the context of a dedicated account and making sure that the same account has access to the database. (In the case of Microsoft SQL it will need to have database administrator rights to the historical database). The above account also must have rights to log in to the target client PC, where the historical replay will take place.

Chapter 04

Examples

Introduction to TrendWorx Examples

The Smar ProcessView Version 6.1 installation includes a new set of examples for the TrendWorx Viewer ActiveX. The examples are located in the "Smar/ProcessView/Examples/TrendWorx Examples" directory. The "TrendWorx Examples" directory contains the following folders:

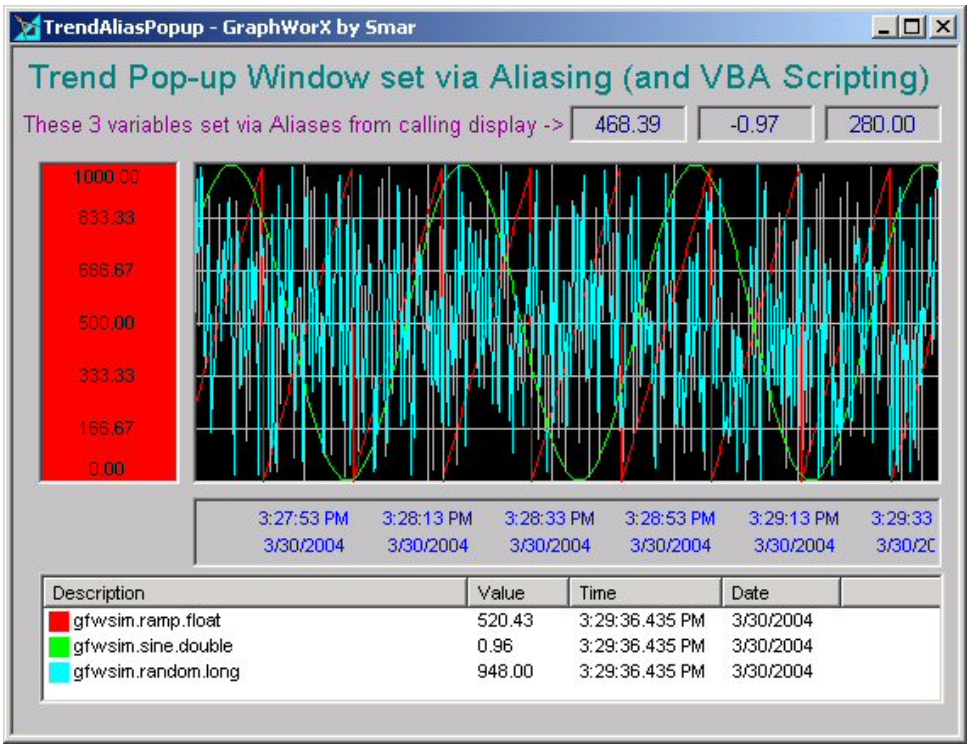
- Aliasing
- EXCEL Templates
- Real-Time Trend Configuration
- TrendWorx Data Logging and Reporting
- TrendWorx VBA Examples

Note
Each of these folders contains a "Readme.txt" file that provides a quick reference to the examples in the folders.

Aliasing

The files in the "Aliasing" folder are example files that demonstrate the use of the OLE Automation interface of the TrendWorx Viewer ActiveX within a VBA-enabled application, such as GraphWorx, to do aliasing. To use this demo, do the following:

1. Open GraphWorx from the Windows **Programs – Smar ProcessView** menu.
2. Open the "TrendAliasMain.gdf" display in the "Aliasing" folder.
3. Enter the display into runtime mode.
4. Click on the buttons in the GraphWorx display to see the effects of aliasing.



Aliasing Example

Excel Templates

The "EXCEL Templates" folder contains the following sample MS Excel 2000 templates to be used with the TrendWorx Reporting tool:

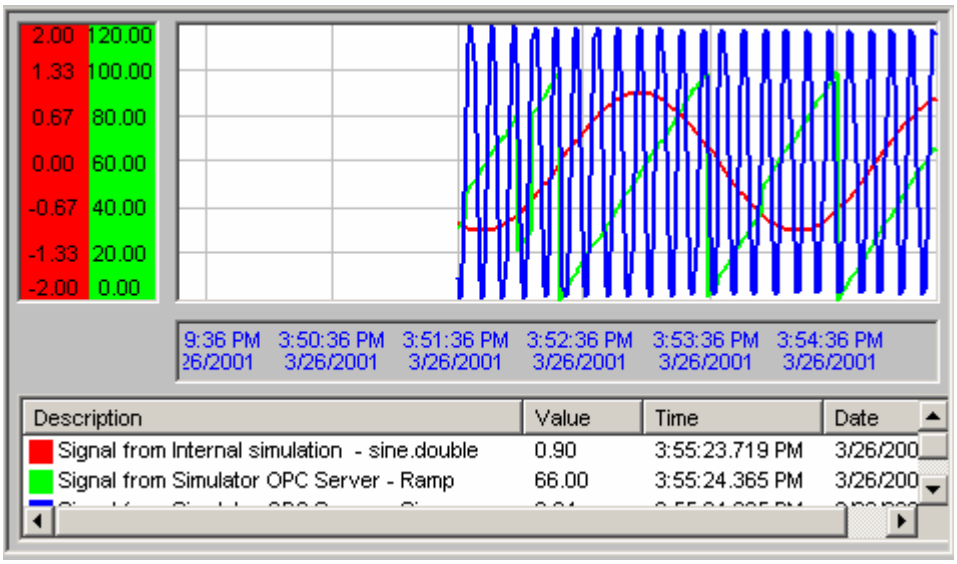
- Production Daily Yield
- Production Down Time
- Production Schedule

Real-Time Trend Configuration

The files in the "Real-Time Trend Configuration" folder demonstrate the use of the OLE Automation interface of the TrendWorx Viewer ActiveX within a VBA-enabled application, such as GraphWorx. It demonstrates how to add pens "on the fly" by reading the pen configuration from a Microsoft Access database (.mdb) file and utilizing the OLE Automation properties of the TrendWorx ActiveX through VBA scripts.

To use this demo:

1. Make sure that none of the files in this folder has a read-only attribute.
2. Open GraphWorx from the Windows **Programs - SMAR PROCESSVIEW** menu.
3. Load the "StartDemo.gdf" display.
4. Enter the display into runtime mode.
5. Click on the buttons in the GraphWorx display to switch displays and dynamically configure trend displays.



Real Time Trend Configuration Example

TrendWorx Data Logging and Reporting

The "TrendWorx Data Logging and Reporting" folder contains a sample TrendWorx data-logging configuration, a sample historical database, as well as sample reporting and historical replay displays.

To prepare for the examples, you must:

- Set the ProcessView working directory to be "TrendWorx Examples\TrendWorX Data Logging and Reporting," where the examples are installed. (For example, you can use the **Set Working Directory** command in the **Tools** menu of the TrendWorx Container.
- Make sure that none of the files in this folder has a read-only attribute.

To use the data-logging example, do the following:

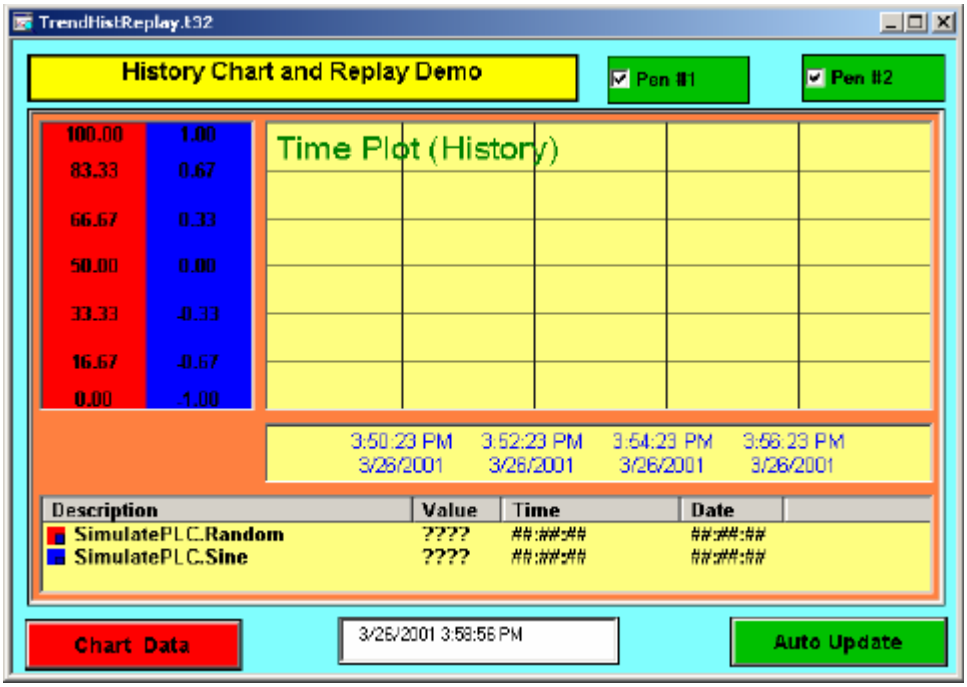
1. Create an ODBC MS Access system data source called "TWX32DEMO," and select the "Twx32demo.mdb" file in this folder without specifying any password or login ID.
2. Start the TrendWorx Configurator.
3. Select **Open** from the **File** menu and load the "Twx32DemoCfg.mdb" in this folder. TrendWorx will try to start the Data Logger, and a message box may appear.
4. Select **Cancel.**
5. In the TrendWorx Configurator, set the Computer Node Name to your Computer Name or leave it set as "local."
6. Click on the **Connect** button to connect to the Data Logger.
7. Click on the **Download Configuration** button to download the demo configuration to the Data Logger.
8. From here, you can start data logging, stop data logging, modify the sample configuration, etc.

Note
The sample data-logging configuration is configured so that a new data table is created every hour or whenever data logging starts with a maximum of 12 historical tables. The sample historical database has data between 12/1/2000, 9:15:00 AM and 12/1/2000, 10:10:00 AM.

Historical Replay Demo

To use the TrendWorx historical replay demo:

1. Start the TrendWorx Container.
2. Load the "TrendHistReplay.t32" display.
3. Enter the display into animation mode.
4. Click on the various buttons to retrieve TrendWorx historical data.
5. You can now start data logging, stop data logging and do historical replay.

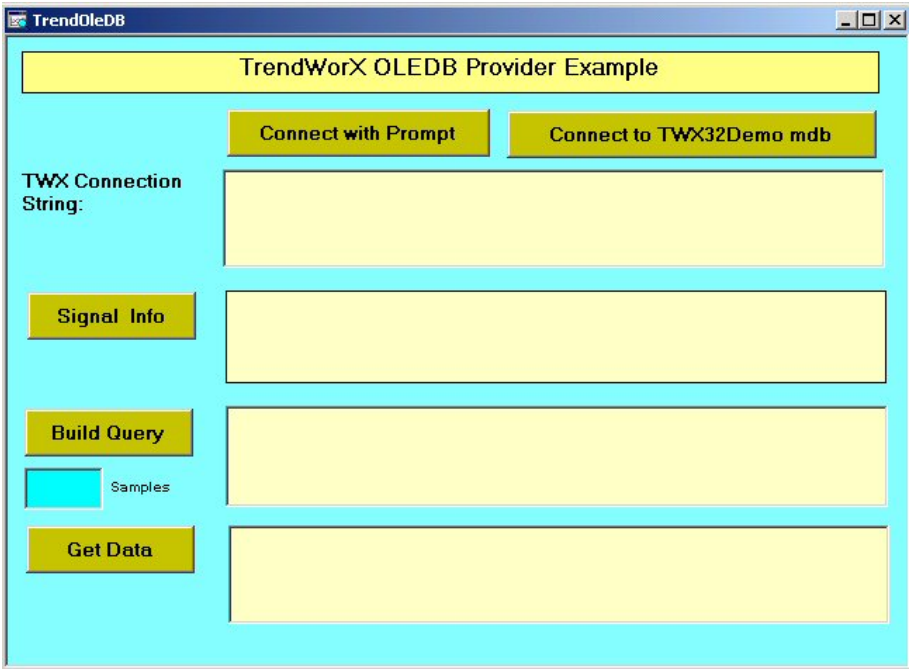


Historical Replay Demo

TrendWorx OLE DB Provider Demo

In order to provide a sample application using the Smar TrendWorx OLE DB Provider, SMAR has created a sample VBA application to demonstrate its use. It is located in the "TrendWorx Data Logging and Reporting" folder, and it is called "TrendOleDB.t32." This file consists of a main form, which is shown below. Click **Connect** to connect to a TrendWorx SQL Server historical database. Click **Signal Info** to retrieve the data-logged signal for a particular group. You can also build a trend query and execute it to retrieve historical data.

1. Start the TrendWorx Container.
2. Load the "TrendOleDB.t32" display.
3. Enter the display into animation mode.
4. Click the various buttons to retrieve TrendWorx historical data using the SMAR TrendWorx OLE DB Provider.
5. When prompted, you can select MS Access as the historical database type and enter "Twx32Demo.mdb."
6. You can now start data logging, stop data logging, and retrieve historical data.

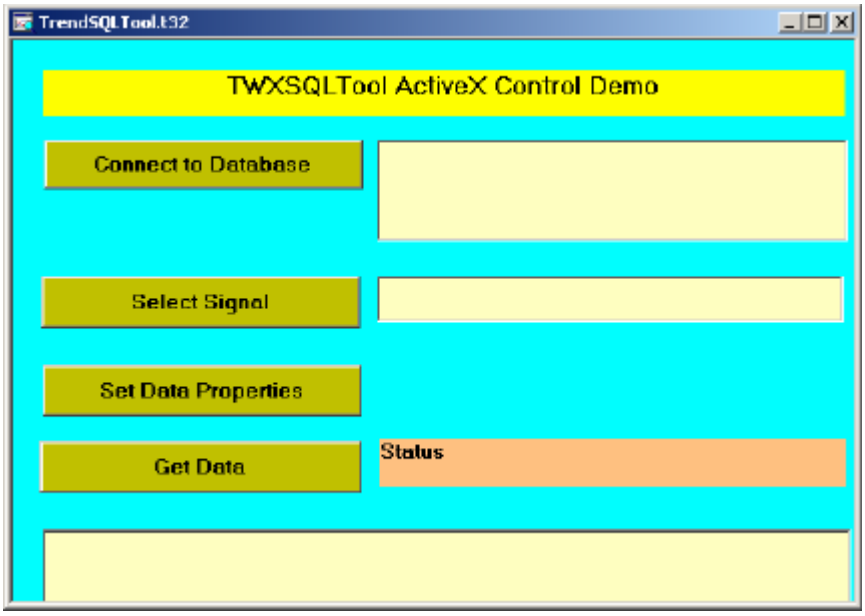


OLE DB Provider Example

Reporting Tools Examples

TrendWorx Version 6.10 includes new VBA-based examples to demonstrate the use of the Reporting tools. In the "TrendWorx Data Logging and Reporting" folder, there is a new TrendWorx display called "TrendSQLTool.t32," shown in the figure below, which uses VBA forms to demonstrate the use of the TrendWorx SQL Tool ActiveX control.

1. Start the TrendWorx Container.
2. Load the "TrendSQLTool.t32" display.
3. Enter the display into animation mode.
4. Click on the various buttons to retrieve TrendWorx historical data using the TrendWorx SQL Tool ActiveX control.
5. When prompted, you can select MS Access as the historical database type and enter "Twx32Demo.mdb."



TWXSQLTool ActiveX Control Demo

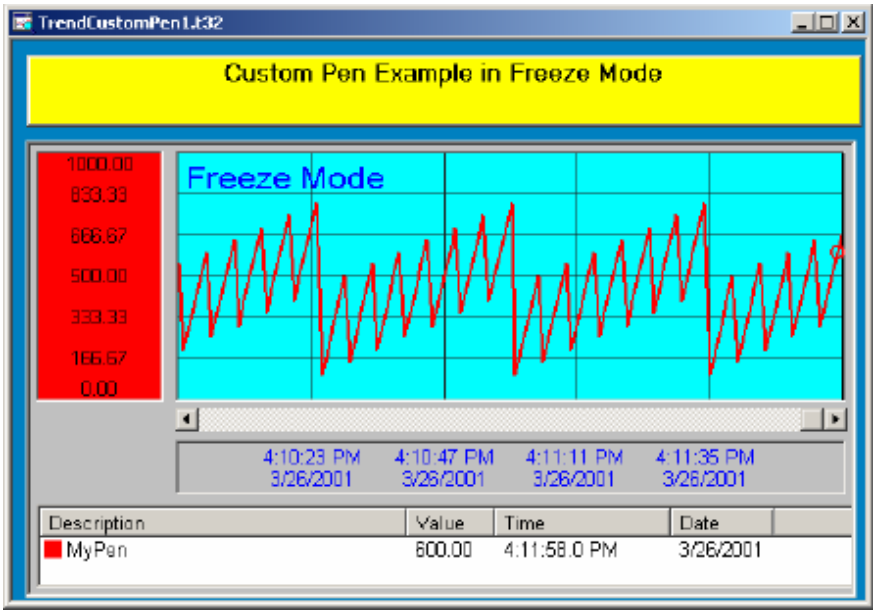
TrendWorx VBA Examples

The "TrendWorx VBA Examples" folder contains various examples that demonstrate the use of the OLE Automation interface of the various TrendWorx modules and components. To use these examples, do the following:

1. Start the TrendWorx Container.
2. Load each TrendWorx display in the folder.
3. Enter the display into animation mode.
4. Click on the various buttons of each display to run the examples.

TrendCustomPen1.t32

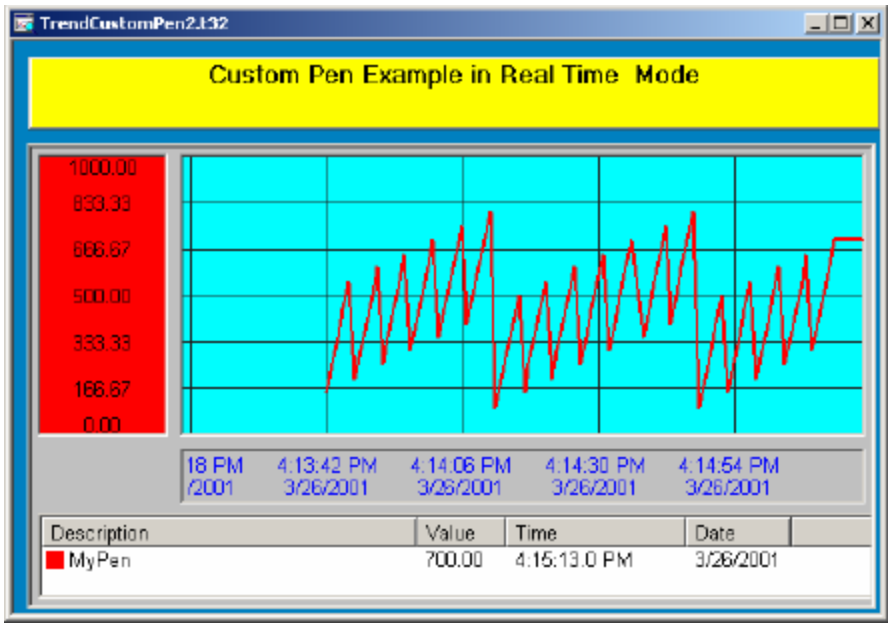
This example display uses VBA code to add a custom pen to a Trend ActiveX. The custom pen is updated via timer-based calls to the Trend ActiveX to add new samples to the pen's buffer. The Trend ActiveX is used in freeze mode.



Custom Pen Example in Freeze Mode

TrendCustomPen2.t32

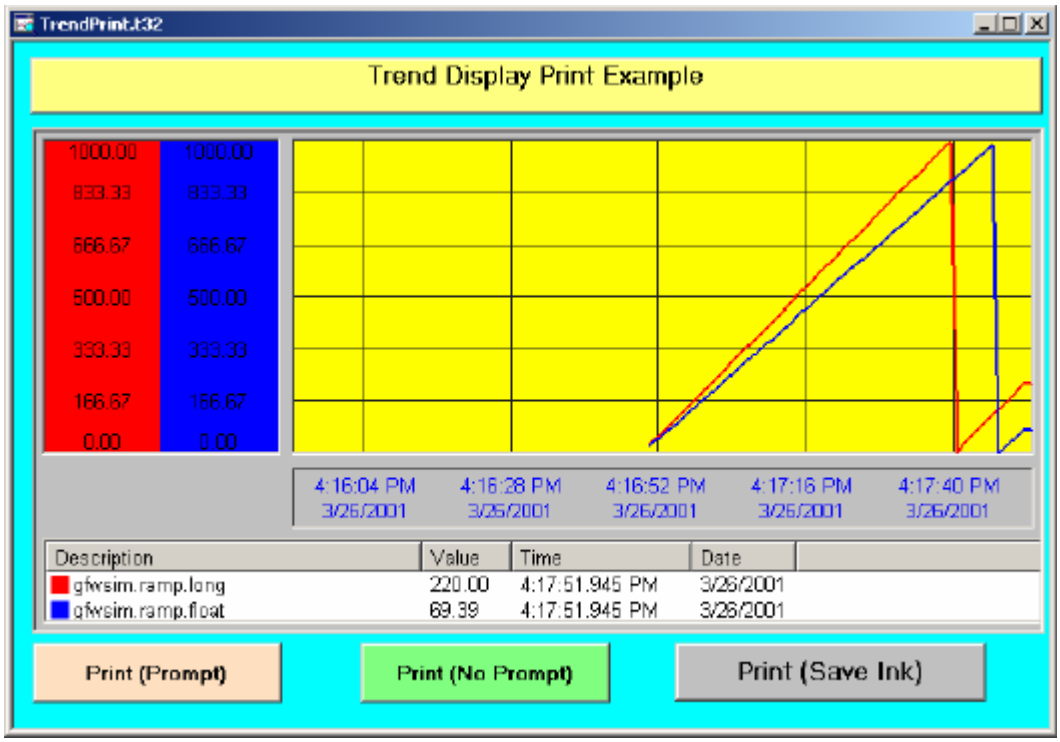
This example display uses VBA code to add a custom pen to a Trend ActiveX. The custom pen is updated via timer-based calls to the Trend ActiveX to add new samples to the pen's buffer. The Trend ActiveX is used in auto-update mode.



Custom Pen Example in Real Time Mode

TrendPrint.t32

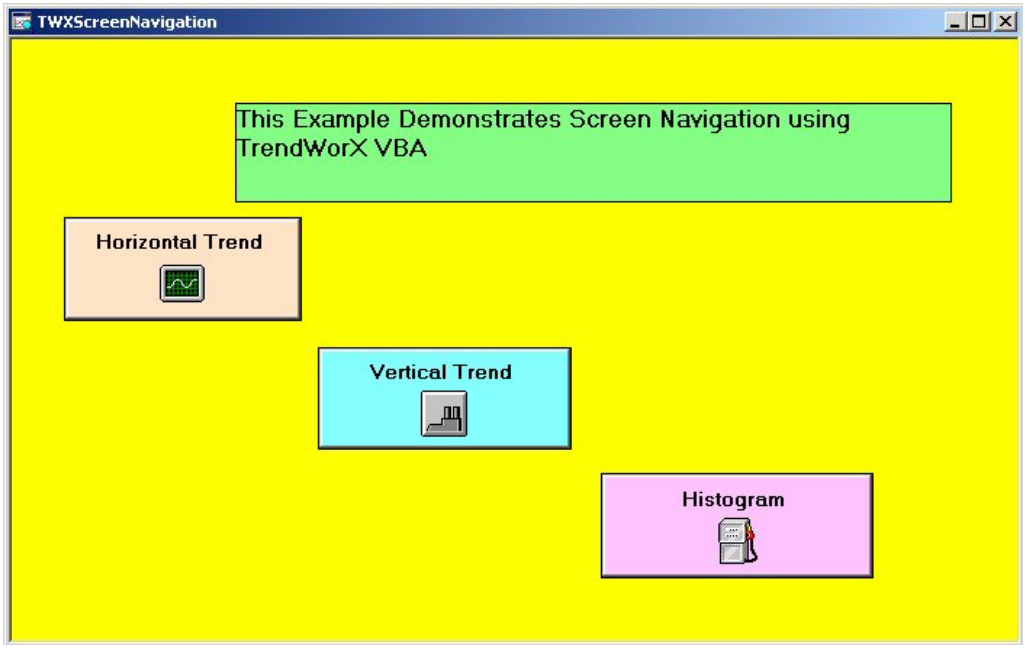
This example display uses VBA code to print just the Trend ActiveX utilizing various options. In addition, it shows how to do a print while saving ink by not filling the background color of the Trend ActiveX area.



Trend Display Print Example

TWXScreenNavigation.t32

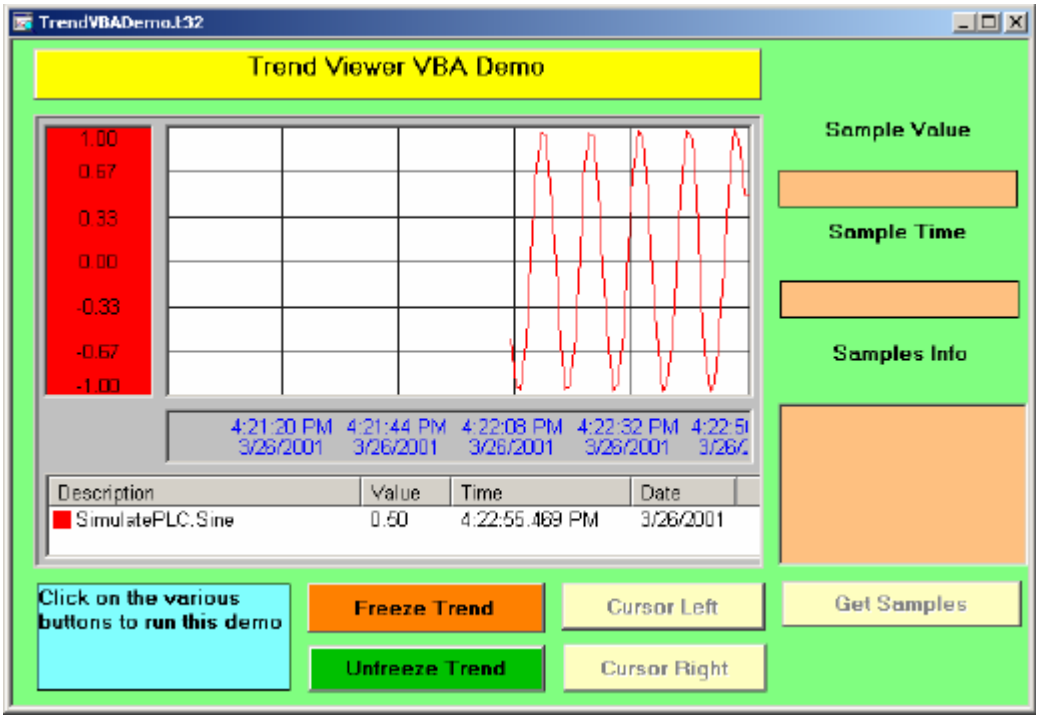
This example display demonstrates how to create a Trend Navigation screen within a TrendWorx display and how to dynamically configure Trend ActiveXs. It also demonstrates how to navigate between the various displays.



Screen Navigation

TrendVBADemo.t32

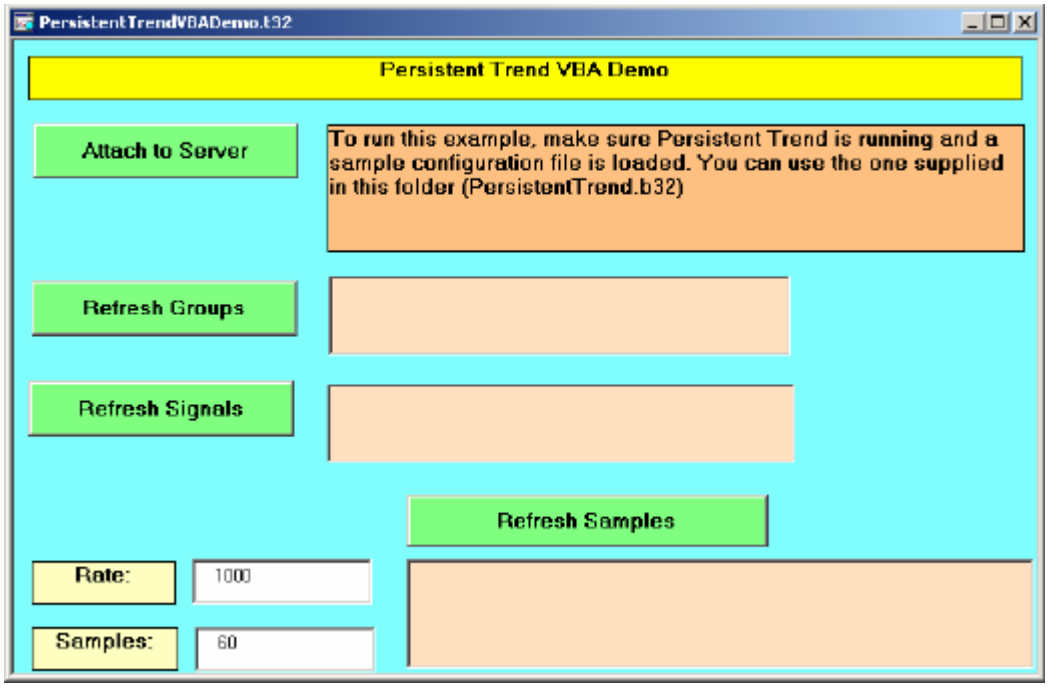
This example display demonstrates some of the new OLE automation methods of the Trend ActiveX for version 6.10. It shows sample code on providing a user interface for the Trend ActiveX via VBA calls. It also shows how to retrieve individual sample information directly from the pen buffers or the trend cursor in freeze mode.



Trend Viewer VBA Demo

PersistentTrendVBADemo.t32

This example display demonstrates how to interface to the Persistent Trend OLE Automation server from any VBA-capable application. It demonstrates how to build a user interface and a browsing interface, as well as how to retrieve individual samples for a signal from Persistent Trending.



Persistent Trend VBA Demo

Chapter 05

Persistent Trending

New Features in TrendWorx Persistent Trending

TrendWorx contains many new features that make the use of Persistent Trending much easier. These features include:

- Improved buffering management for load balancing.
- Faster client data-retrieval mechanism.
- Support for the Unicode version.
- New OLE automation methods to retrieve data in universal time coordinates (UTC) time format.
- Enhanced expression support
- Daylight savings time switch-over support

Note
NoteTrendWorx up to and including Version 6.1x is using the Windows-based APIs for converting a time from local time to UTC or from UTC to local time. The Windows APIs do not correctly adjust the conversion for the daylight savings time if the timestamp to be converted was obtained from a different time period (i.e. it was obtained in "summer" time but now we have "winter" time). TrendWorx Version 7.0 has new time conversion utilities that account for this discrepancy. There are, however, some things to consider:

- These functions are used by default (no user enabling is required).
- This is what they do in order to convert each time stamp:

o They check Windows for the PC Time Zone Settings and to see if automatic daylight savings is enabled.

o They also obtain from Windows the times/dates for switching over. (These dates do not change; they are in the form of, e.g., the first Sunday of April.)

o Depending on the previous information, the new functions properly adjust the conversion times to compensate for daylight savings time.

Persistent Trending

The primary purpose of Persistent Trending is to provide a real-time OLE Automation server for data collection in memory (RAM) with simultaneous data-logging capability to a user-defined CSV file. Client applications can request access from the Persistent Trending server (through OLE Automation) to its buffered data in order to enhance their functionality. The SMAR TrendWorx Viewer ActiveX is already interfaced to the Persistent Trending server, and (if the server is installed on the client PC and is running) it TrendWorx Viewer will connect to it Persistent Trending to initialize its pens. Persistent Trending targets small to medium load applications, which require trending displays to be populated with available data upon initialization.

In general, Persistent Trending is responsible for:

- Collecting real-time data from OPC Servers in memory (RAM).
- Supplying Automation clients with the above buffered data.
- Logging data to a user-configurable .csv or .txt file.
- Managing a sophisticated **multithreaded** data-buffering system to guarantee data integrity with support for customer-configurable data-collection rates.

In terms of implementation, the Persistent Trending OLE Automation server's main features include:

- A highly customizable server.
- Fast data retrieval from memory buffers.
- Independent data collection rates for each group of points.
- A full set of exposed OLE automation methods.
- Built-in buffering system.
- Security integration.
- Support for calculated variables.
- Interface to OPC real-time servers.
- Easy Visual Basic integration.
- Embedded signal simulator.

The internal architecture of Persistent Trending allows the data to be collected at a different rate and logged to disk at a multiple of the data-collection rate in order to minimize the overall system load. Currently the minimal scan rate is set to be 10 milliseconds, and all data-collection rates that you set must be an integer multiple of the minimal scan rate. In addition, you can configure the desired number of samples to buffer (up to a maximum of 12,000) and the desired logging-to-disk interval. In addition, you can configure the file-management system for logging to disk.

Persistent Trend Automation Object Design

The Persistent Trending application exposes, through OLE Automation, its document as a single-instance shared object. The object's name is "TWXBgTrend.Document," and it is registered in the system Registry. Once launched, the Persistent Trending server will register its document as the Active Object with the OLE Running Object Table (ROT), and therefore all client applications can access this instance rather than create a new instance each time they desire to connect to the Persistent Trending server.

In Visual Basic code, this is equivalent to:

```
Dim myTWXServer As Object
' get running object
Set myTWXServer = GetObject(, ''TWXBgTrend.Document'')
```

Every client application should always try to get the running instance of the server rather than create a new instance (except for the first time connection). The ''TWXBgTrend.Document'' OLE automation object supports the following OLE Automation properties and methods:

PropertiesIDH_Properties_Persistent

OLE Automation Methods

Properties

BOOL Visible	TRUE if the application window is visible; supports SET/GET
BSTR FullName	Returns the Full path and file name of the currently loaded file in TWXBgTrend; supports GET only
BOOL Maximized	TRUE if the application is maximized; supports GET/SET
BSTR Name	Returns the file name of the current file loaded in Persistent Trending; supports GET only
BSTR Path	Returns the path for the currently loaded Persistent Trending file; supports GET only
BOOL ReadOnly	Returns TRUE if the application does not allow any modifications; supports GET only
BOOL Runtime	Returns TRUE if the application is in runtime mode; supports GET only
BOOL Saved	Returns TRUE if all pending changes are saved or no new changes have been made; supports GET only
long GroupCount	Returns the number of groups configured in Persistent Trending; supports GET only

OLE Automation Methods

1. void Close(BOOL SaveChanges, BSTR File)

Call this method to shut down the application. If "SaveChanges" is TRUE, the last changes made will be saved to the user-supplied file.

2. void Open(BSTR File)

Call this method to open the user-supplied File in Persistent Trending.

3. void SaveAs(BSTR File)

Call this method to save the current Persistent Trending configuration file in "File."

4. void EnterRuntime()

Call this method to commit the Persistent Trending server into runtime mode. Data collection will start (if desired) automatically for the group, and data logging (if configured) will also be enabled.

5. void ExitRuntime()

Call this method to exit runtime mode.

6. void ActivateGroup(BSTR GroupName)

Call this method to activate a specific group (i.e. start data collection and data logging if configured). Note that each group configured in the Persistent Trending server can start data collection automatically upon entering runtime mode or when you desire by using this OLE automation method.

7. void DeActivateGroup(BSTR GroupName)

Call this method to deactivate a group. This will stop data collection and buffering in memory. If data logging is enabled for this group, all collected data up to the time of application of this method will be logged to disk.

8. long GetGroupRate(BSTR GroupName)

Call this method to obtain the data-collection rate for a specific group.

9. long GetGroupSamples(BSTR GroupName)

Call this method to obtain the number of samples the group is currently buffering in memory.

10. BOOL GetGroupActivate(BSTR GroupName)

Call this method to find out if the specific group has been configured to activate data collection and buffering upon Persistent Trending entering runtime mode.

11. long GetGroupPointCount(BSTR GroupName)

Call this method to obtain the number of signals configured for the specific group.

12. BOOL GetPointData(BSTR PointName, long Rate, long Samples, BOOL Stamp, VARIANT* Values, VARIANT* TDates, VARIANT* MSecs, VARIANT* Quality)

Call this method to retrieve buffered data in memory from Persistent Trending for a specific signal ("PointName"). "Rate" is the desired time resolution of the returned samples. "Samples" is the desired number of samples to be returned. The variants "Values," "TDates," "MSecs," and "Quality" represent variant arrays (of element types VARIANT), which contain the values, time and date stamps, millisecond resolution, and quality information about the retrieved samples.

"Values" variants utilize double values (VT_R8), and "TDates" variants utilize "DATE" types (VT_DATE). "Msecs" and "Quality" variants utilize VT_I4 types.

The Persistent Trending will allocate memory for these arrays, and the caller of this method must always FREE the associated memory. Also, if no samples are retrieved, the method will return FALSE and the variants will be empty.

Upon executing this method, the Persistent Trending server will search *all* groups configured, for the first group, which has the "PointName" signal configured. Once found, it will perform a time-stamped search to retrieve all values buffered in memory that satisfy the desired data-collection rate and number of returned samples, starting from the most current one. Persistent Trending will search for the requested data at time intervals reflecting the desired data resolution. The last valid sample within each search interval will be returned to the caller. If "bStamp" is set to TRUE, the actual time and date stamp of the retrieved sample will be modified to reflect the time and date stamp of the search interval.

13. BOOL GetGroups(VARIANT* GroupNames)

Call this method to obtain all the group names configured in the Persistent Trending server. They are returned in the array of BSTR's "GroupNames," as before Persistent Trending will allocate memory for these arrays, the caller of this method must always FREE the associated memory. If no groups are configured, the method returns FALSE.

14. BOOL GetGroupPoints(BSTR GroupName, VARIANT* GroupPoints)

Call this method to retrieve the signal names configured for a given group. They are returned in the array of BSTR's "GroupPoints," and before Persistent Trending will allocate memory for these arrays, the caller of this method must always FREE the associated memory. If no signals are configured, the method returns FALSE.

15. BOOL GetGroupLogging(BSTR GroupName)

Call this method to find whether data logging has been enabled for a specific group. The method returns TRUE if data logging is enabled.

16. BSTR GetGroupFile(BSTR GroupName)

Call this method to retrieve the current "FileName" to which a specific group is data logging.

17. BOOL GetGroupPointData(BSTR GroupName, BSTR PointName, long Rate, long Samples, BOOL Stamp, VARIANT* Values, VARIANT* TDates, VARIANT* MSecs, VARIANT* Quality)

Call this method to retrieve buffered data in memory from Persistent Trending for a specific signal ("PointName"). "Rate" is the desired time resolution of the returned samples. "Samples" is the desired number of samples to be returned. The variants "Values," "TDates," "MSecs," and "Quality" represent variant arrays (of element types "VARIANT"), which contain the values, time and date stamps, millisecond resolution, and quality information about the retrieved samples. "Values" variants utilize double values (VT_R8), "Tdates" variants utilize "DATE" types (VT_DATE), and "Msecs" and "Quality" utilize VT_I4 types.

Persistent Trending will allocate memory for these arrays, and the caller of this method must always FREE the associated memory. Also, if no samples are retrieved, the method will return FALSE and the variants will be empty.

Upon executing this method, the Persistent Trending server will search all Persistent Trend groups for a group called "GroupName," and then it will search for the "PointName" signal in the requested group. Then it will perform a time-stamped search to retrieve all values buffered in memory that satisfy the desired data-collection rate and the number of returned samples, starting from the most current one. Persistent Trending will search for the requested data at time intervals reflecting the desired data resolution. The last valid sample within each search interval will be returned to the caller. If "bStamp" is set to TRUE, the actual time and date stamp of the retrieved sample will be modified to reflect the time and date stamp of the search interval.

18. BOOL GetPointStat(BSTR GroupName, BSTR PointName, VARIANT* StatValues)

Call this method to retrieve statistical information about a specific signal belonging to a specific group. The returned array of variants "StatValues" will have the following as "VARIANT" elements:

- Min value
- Max value
- Average value
- Standard deviation
- Starting time for statistics
- Ending time for statistics

Persistent Trending will allocate memory for these arrays, and the caller of this method must always FREE the associated memory. Also, if no samples are retrieved, the method will return FALSE and the variants will be empty.

19. BOOL GetGroupPointAt(BSTR GroupName, BSTR PointName, DATE TDateAt, VARIANT* Value, VARIANT* TDateFound, VARIANT* Qual)

Call this method to retrieve a sample for a given time and date from Persistent Trending. All the returned information is in variants, and if the method succeeds, it returns TRUE.

20. BOOL GetGroupPointDataAt(BSTR GroupName, BSTR PointName, long Rate, long Samples, BOOL Stamp, DATE TDateFrom, VARIANT* Values,VARIANT* TDates, VARIANT* MSecs, VARIANT* Quality)

This method is the same as "GetGroupPointData," with the exception that now you can specify a starting time and date stamp in "TDateFrom" to retrieve data from Persistent Trending's memory buffers.

21. BOOL GetPointDataAt(BSTR PointName, long Rate, long Samples, boolean Stamp, DATE TDateFrom, VARIANT* Values, VARIANT* TDates, VARIANT* MSecs, VARIANT* Quality)

This method is the same as "GetPointData," with the exception that now you can specify a starting time and date stamp in "TDateFrom" to retrieve data from Persistent Trending's memory buffers.

22. void Refresh()

Call this method to refresh the **Persistent Trending** window. This method should be called only once.

23. boolean GetPointDataUTC(BSTR GroupName, BSTR PointName, long Rate, long Samples, BOOL Stamp, VARIANT* Values, VARIANT* TDates, VARIANT* MSecs, VARIANT* Quality)

Call this method to retrieve buffered data in memory from Persistent Trending for a specific signal ("PointName"). "Rate" is the desired time resolution of the returned samples. "Samples" is the desired number of samples to be returned. The variants "Values," "TDates," "MSecs," and "Quality" represent variant arrays (of element types "VARIANT"), which contain the values, time and date stamps, millisecond resolution, and quality information about the retrieved samples. "Values" variants utilize double values (VT_R8), "Tdates" variants utilize "DATE" types (VT_DATE), and "Msecs" and "Quality" utilize VT_I4 types.

Persistent Trending will allocate memory for these arrays, and the caller of this method must always FREE the associated memory. Also, if no samples are retrieved, the method will return FALSE and the variants will be empty.

Upon executing this method, the Persistent Trending server will search all Persistent Trend groups for a group called "GroupName," and then it will search for the "PointName" signal in the requested group. Then it will perform a time-stamped search to retrieve all values buffered in memory that satisfy the desired data-collection rate and the number of returned samples, starting from the most current one. Persistent Trending will search for the requested data at time intervals reflecting the desired data resolution. The last valid sample within each search interval will be returned to the caller. If "bStamp" is set to TRUE, the actual time and date stamp of the retrieved sample will be modified to reflect the time and date stamp of the search interval. Time stamps are returned in UTC time format.

24. boolean GetGroupPointDataUTC(BSTR GroupName, BSTR PointName, long Rate, long Samples, BOOL Stamp, VARIANT* Values, VARIANT* TDates, VARIANT* MSecs, VARIANT* Quality);

Call this method to retrieve buffered data in memory from Persistent Trending for a specific signal ("PointName"). "Rate" is the desired time resolution of the returned samples. "Samples" is the desired number of samples to be returned. The variants "Values," "TDates," "MSecs," and "Quality" represent variant arrays (of element types "VARIANT"), which contain the values, time and date stamps, millisecond resolution, and quality information about the retrieved samples. "Values" variants utilize double values (VT_R8), "Tdates" variants utilize "DATE" types (VT_DATE), and "Msecs" and "Quality" utilize VT_I4 types.

Persistent Trending will allocate memory for these arrays, and the caller of this method must always FREE the associated memory. Also, if no samples are retrieved, the method will return FALSE and the variants will be empty.

Upon executing this method, the Persistent Trending server will search all Persistent Trend groups for a group called "GroupName," and then it will search for the "PointName" signal in the requested group. Then it will perform a time-stamped search to retrieve all values buffered in memory that satisfy the desired data-collection rate and the number of returned samples, starting from the most current one. Persistent Trending will search for the requested data at time intervals reflecting the desired data resolution. The last valid sample within each search interval will be returned to the caller. If "bStamp" is set to TRUE, the actual time and date stamp of the retrieved sample will be modified to reflect the time and date stamp of the search interval. Time stamps are returned in UTC time format.

25. boolean GetPointStatUTC(BSTR GroupName, BSTR PointName, VARIANT* StatValues);

Call this method to retrieve statistical information about a specific signal belonging to a specific group. The returned array of variants "StatValues" will have the following as "VARIANT" elements:

- Min value

- Max value
- Average value
- Standard deviation
- Starting time for statistics
- Ending time for statistics

Persistent Trending will allocate memory for these arrays, and the caller of this method must always FREE the associated memory. Also, if no samples are retrieved, the method will return FALSE and the variants will be empty. Time stamps are returned in UTC time format.

26. boolean GetGroupPointAtUTC(BSTR GroupName, BSTR PointName, DATE TDateAt, VARIANT* Value, VARIANT* TDateFound, VARIANT* Qual)

Call this method to retrieve a sample for a given time and date from Persistent Trending. All the returned information is in variants, and if the method succeeds, it returns TRUE. Time stamps are returned in UTC time format.

27. boolean GetGroupPointDataAtUTC(BSTR GroupName, BSTR PointName, long Rate, long Samples, boolean Stamp, DATE TDateFrom, VARIANT* Values, VARIANT* TDates, VARIANT* MSecs, VARIANT* Quality)

This method is the same as "GetGroupPointData," with the exception that now you can specify a starting time and date stamp in "TDateFrom" to retrieve data from Persistent Trending's memory buffers. Time stamps are returned in UTC time format.

27. boolean GetPointDataAtUTC(BSTR PointName, long Rate, long Samples, boolean Stamp, DATE TDateFrom, VARIANT* Values, VARIANT* TDates, VARIANT* MSecs, VARIANT* Quality)

Call this method to retrieve buffered data in memory from Persistent Trending for a specific signal ("PointName"). "Rate" is the desired time resolution of the returned samples. "Samples" is the desired number of samples to be returned. The variants "Values," "TDates," "MSecs," and "Quality" represent variant arrays (of element types VARIANT), which contain the values, time and date stamps, millisecond resolution, and quality information about the retrieved samples.

"Values" variants utilize double values (VT_R8), and "TDates" variants utilize "DATE" types (VT_DATE). "Msecs" and "Quality" variants utilize VT_I4 types.

The Persistent Trending will allocate memory for these arrays, and the caller of this method must always FREE the associated memory. Also, if no samples are retrieved, the method will return FALSE and the variants will be empty.

Upon executing this method, the Persistent Trending server will search *all* groups configured, for the first group, which has the "PointName" signal configured. Once found, it will perform a time-stamped search to retrieve all values buffered in memory that satisfy the desired data-collection rate and number of returned samples, starting from the most current one. Persistent Trending will search for the requested data at time intervals reflecting the desired data resolution. The last valid sample within each search interval will be returned to the caller. If "bStamp" is set to TRUE, the actual time and date stamp of the retrieved sample will be modified to reflect the time and date stamp of the search interval. Time stamps are returned in UTC time format.

29. boolean GetGroupPointInfo(BSTR GroupName, BSTR PointName, VARIANT* HighRange, VARIANT* LowRange, VARIANT* EngUnits, VARIANT* Description);

This method returns point information for a given signal, such as "HighRange" and "LowRange," "EngUnits," and "Description," given a Persistent Trend "GroupName."

30. boolean GetPointInfo(BSTR PointName, VARIANT* HighRange, VARIANT* LowRange, VARIANT* Description, VARIANT* EngUnits);

This method returns point information for the first signal, such as "HighRange" and "LowRange," "EngUnits," and "Description," that matches "PointName."

ProjectWorx Support

Several new OLE Automation methods have been added to facilitate ProjectWorx deployment and WebHMI enhanced support:

1. **ReplaceStringInString(**
   StringToReplace as String,
   OldSubstring as String,
   NewSubstring as String
) as String

2. **ReplaceHost(**
   OldHostName as String,
   NewHostName as String
) as Long

3. **ReplaceFilePath(**
   OldSubstring as String,
   NewSubstring as String
) as Long

4. **ReplaceTag(**
   OldSubstring as String,
   NewSubstring as String
) as Long

5. **ReplaceHostEx(**
   OldHostNameSubstring as String,
   NewHostNameSubstring as String
   MatchCase as Boolean,
   MatchWholeWord as Boolean
) as Long

The **ReplaceHostEx** with parameters **MatchCase=False & MatchWholeWord=True** works exactly the same as the **ReplaceHost()** function.

Configuring the Persistent Trending OLE Automation Server

The Persistent Trending OLE Automation server can be easily configured to request data from various OPC servers, and can evaluate expressions as well as internal simulation points.

TrendWorx Persistent Trending

Menus

The **Menu Bar** in Persistent Trending contains the following menus:

- **File menu**
- **Edit menu**
- **View menu**
- **Actions menu**
- **Tools menu**
- **Help menu**

File Menu

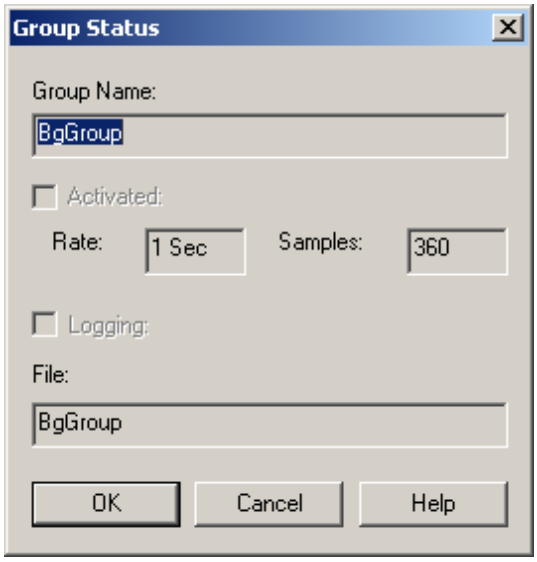
The **File** menu contains the following commands:

Command	Shortcut Key	Function
New	CTRL+N	Opens a new **Persistent Trending** window.
Open	CTRL+O	Opens an existing **Persistent Trending** window.
Save	CTRL+S	Saves the open **Persistent Trending** window.
Save As		Allows you to select the name under which the open **Persistent Trending** window should be saved.
Exit		Closes Persistent Trending.

Edit Menu

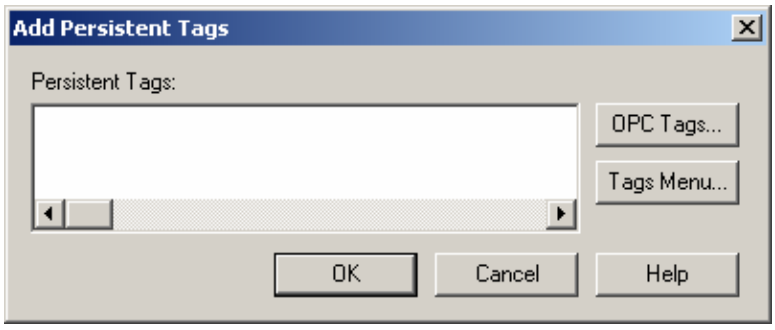
The **Edit** menu contains the following commands:

Command	Shortcut Key	Function
Duplicate	CTRL+D	Duplicates a Persistent Trending group. Persistent Trending will duplicate the group by inserting a new group and appending _x to the group's name, in addition to duplicating all of the signals that are already configured.
Delete	DEL	Deletes a Persistent Trending group.
Group Status		Displays the **Group Status** dialog box information for a selected group. Right-clicking a group and selecting **Group Status** from the menu also opens this dialog box.



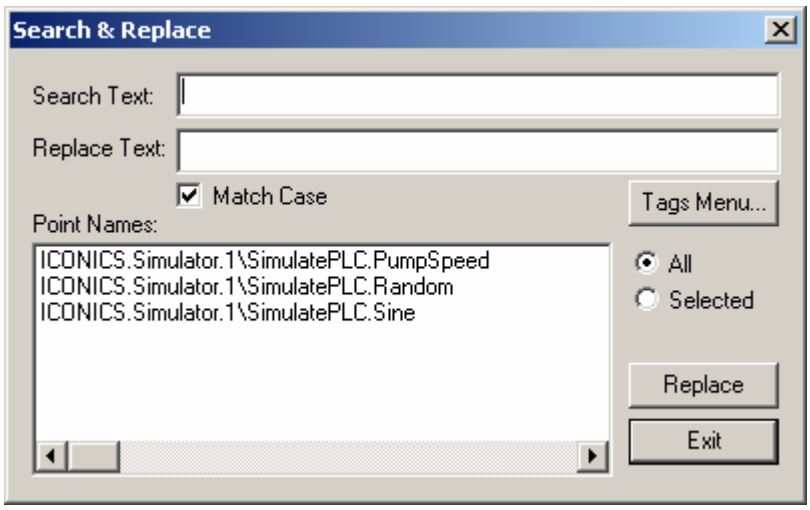
Group Status Dialog Box

Add Group	CTRL+G	Adds a group to the opened Persistent Trend.
Edit Group	CTRL+E	Opens the **Persistent Trending** dialog box for the group, which enables you to change any of the original configuration settings.
Add Tags	CTRL+P	Enables you to create **signal connections** to already configured Persistent Trending groups. From the **Add Persistent Tags** dialog box, you can add OPC tags by clicking **OPC Tags,** or add expressions and simulated variables by clicking **Tags Menu.** Once you add all the tags you wish to configure, click **OK** to add these tags to the selected Persistent Trending group.



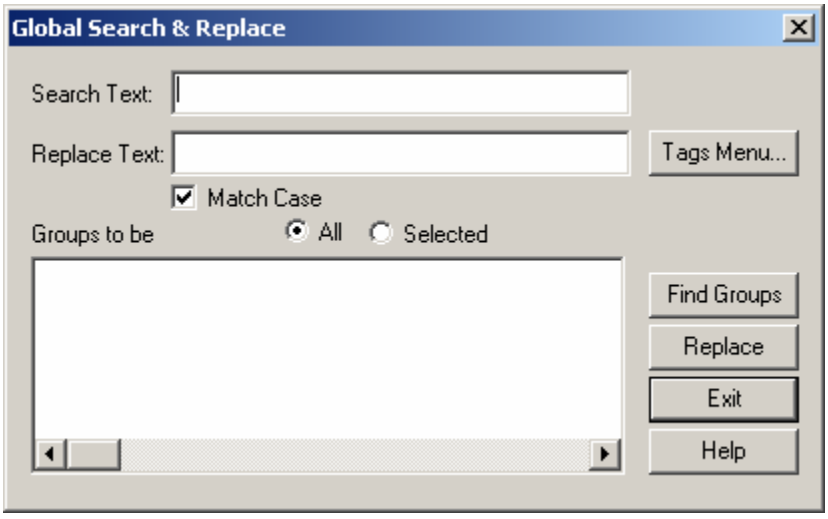
Add Persistent Tags Dialog Box

Delete Tags	CTRL+SHIFT+P	Enables you to delete **signals** from already configured Persistent Trending Groups. From the **Delete Persistent Tags** dialog box, you can choose which signals to delete. Clicking **OK** to remove these tags from the selected Persistent Trending group.
Copy Tags		Opens the **Copy Tags** dialog box, which lists all of the tags available in the selected group. After you select tags, they are copied to be pasted into another group.
Paste Tags		Pastes all tags existing on the clipboard in the selected group.
Group Search	CTRL+H	Opens the **Search and Replace** dialog box. You can select all the tags to which you want to apply the search and replace. Define a search string (which can be the fully configured tag or a portion of it), define a replacement string, and then click **Replace.**



Search and Replace Dialog Box

Global Search	CTRL+F	Activates the **Global Search and Replace** dialog box. You can search for a given string across all or selected configured groups by clicking **Find Groups.** Select a replacement string and the groups to which you want to apply the new string, and then click the **Replace** to continue.



Global Search and Replace Dialog Box

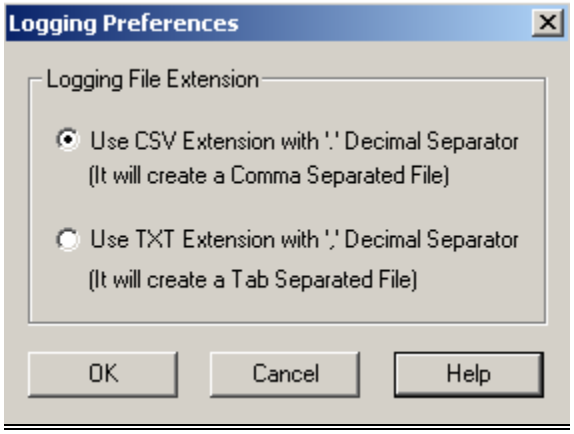
View Menu

The **View** menu contains the following commands:

Command	Shortcut Key	Function
Toolbar	CTRL+T	When checked, shows the **Persistent Trending** toolbar as shown below.

Toolbar

Status Bar	CTRL+B	When checked, shows the status bar, which indicates the status of the application, the number of groups, and the time and date.
Select Language	CTRL+SHIFT+U	Opens the **Select Language** dialog box, which enables you to select a language that TrendWorx will automatically load if the corresponding language resource .dll is present in the TrendWorx Bin directory. Persistent Trending will automatically switch its menus and dialogs to the selected language, and it will also start up in that language.
Logging Preferences	SHIFT+L	Enables you to log to a .csv file or a .txt file. When using the .csv file, decimal places will be indicated by the '.'.When using the .txt file, decimal places will be indicated by the',', This is useful for those using Persistent Trending on systems set up for European standards (using ',' as a decimal separator).



Logging Preferences Dialog Box

Actions Menu

The **Actions** menu contains the following commands:

Command	Shortcut Key	Function
Start Logging	CTRL+R	Starts logging. This command is only available when the Persistent Trend is not logging.
Stop Logging	CTRL+L	Stops logging. This command is only available when the Persistent Trend is currently logging.
Activate Group	CTRL+A	Depending on the current state of a particular group, activates it or deactivates the selected group. This will start or stop all data collection and logging for the selected group. A check mark indicates that the group is activated.

Tools Menu

The **Tools** menu contains the following commands:

Command	Shortcut Key	Function
Security Login	F6	Prompts for login to the SMAR Security Server.
Security Configuration	F7	Configures the setup for the SMAR Security Server.
Working Directory	F8	Sets the working directory where all files associated with Persistent Trending are kept.

Help Menu

The **Help** menu contains the following commands:

Command	Shortcut Key	Function
Help Topics	F1	Launches the online **Help** tutorial for Persistent Trending.
About Application		Displays both technical support information and the SMAR About Box, which contains registration and serial number information as well as system resource information, such as memory and disk space available.

Groups

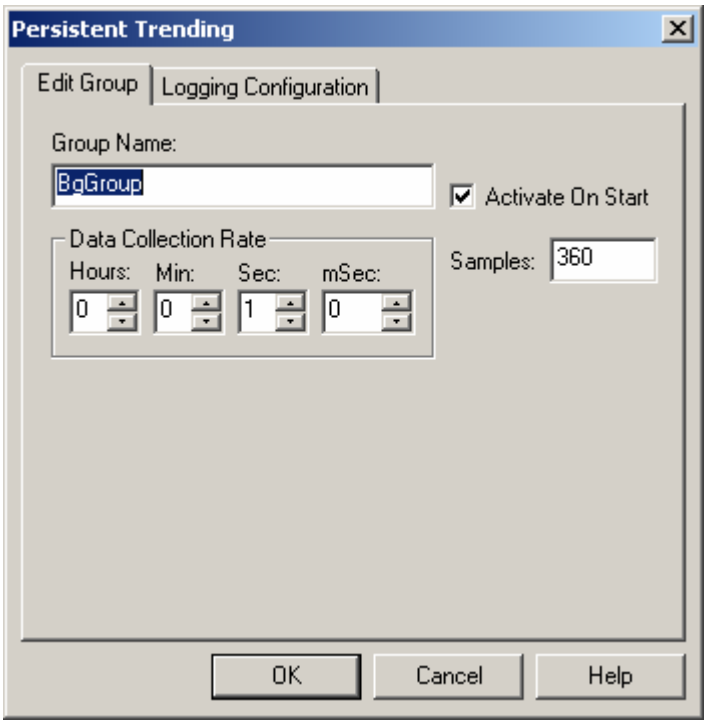
The key concept in the configuration of the Persistent Trending server is the **Group.** A group represents a logical collection of signals for common processing and buffering.

Adding and Configuring a Group

To add a group, choose **Add Group** from the **Edit** menu, or press the shortcut keys **CTRL+G.** This opens the **Persistent Trending** dialog box, which enables you to configure a new Persistent Trending group and (optionally) data logging for that group to a .csv or .txt file. The **Persistent Trending** dialog box contains two tabs: the **Group Configuration** tab and the **Logging Configuration** tab.

Group Configuration Tab

The **Group Configuration** tab of the **Persistent Trending** dialog box, shown in the figure below, allows you to configure a name for the new Persistent Trending, the desired data-collection rate, and the number of samples to buffer in memory for each signal of the group. The **Activate On Start** option, if enabled, automatically starts data collection for the specific group, when the Persistent Trending is committed to runtime mode. Otherwise, you can start data collection by activating the group during runtime mode through the Persistent Trending User Interface or through OLE Automation.



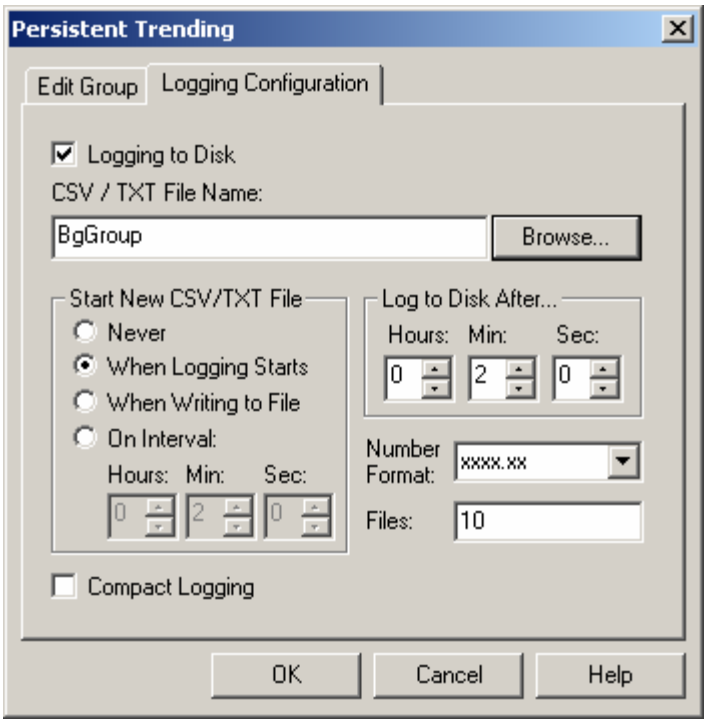
Group Configuration Tab

Logging Configuration Tab

The **Logging Configuration** tab of the **Persistent Trending** dialog box, shown in the figure below, allows you to configure the Persistent Trending server to log the buffered data to a .csv or .txt file. At this point, you can:

1. Enable data logging.
2. Choose a .csv or .txt file to log using the **Browse** command.
3. Choose a .csv or .txt file system maintenance scheme. You may choose to append all data to the same file (if **Never** is selected), create a new file every time logging starts (if **When Logging Starts** is selected), create a new file every time Persistent Trending writes to disk (if **When Writing to File** is selected), or create a new file after a certain interval of time has passed (if **On Interval** is selected and an interval is set).
4. Write more samples to each row using the **Compact Logging** feature.
5. Configure the frequency by which data will be written to disk.
6. Select the desired number format for the .csv or .txt file data.
7. Select the desired date format.
8. Select the maximum number of .csv or .txt files to maintain.

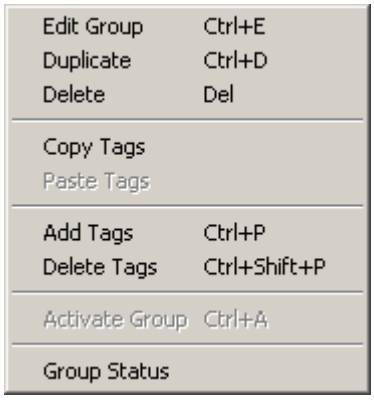
If you want to log to multiple files, the Persistent Trending server will create the files by appending to the file name the corresponding extension for the current file number. Once it reaches the maximum number of files, it will start overwriting from the first created file.



Logging Configuration Tab

Context Menu

Right-clicking on a group in the Persistent Trend interface will open a **Context** menu, which contains some of the more-common menu commands, including **Edit Group, Duplicate, Delete,** and **Add Tags.**

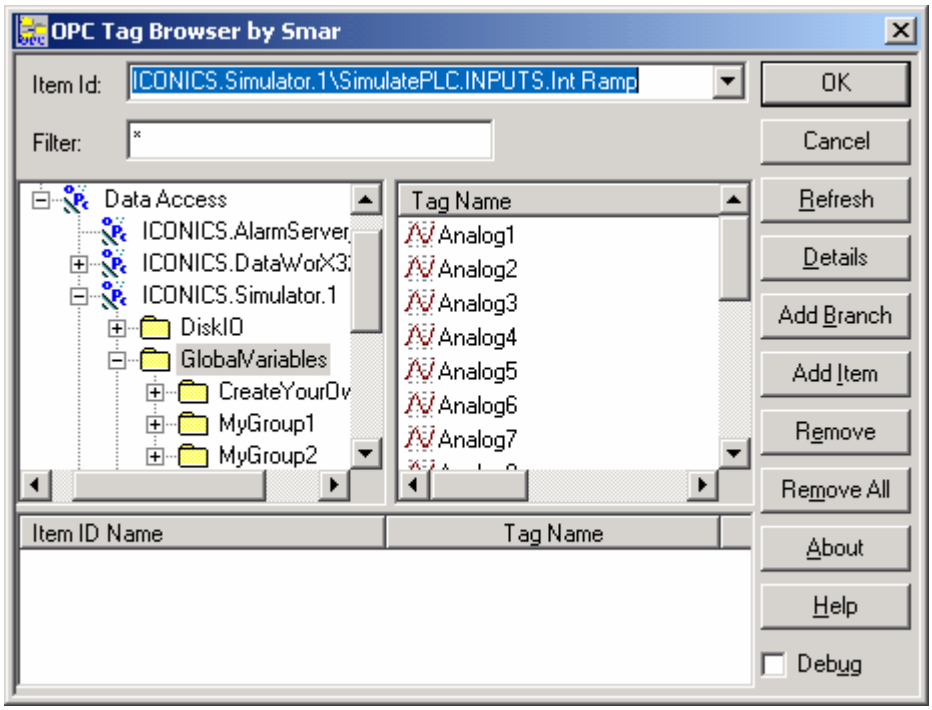


Context Menu

For further explanation of each of these commands, please see the **Menus** section.

Support for Multiple-Tag Connection

The **OPC Universal Tag Browser,** shown below, helps add the Multiple-Tag Connection feature to Persistent Trending. To open the **OPC Universal Tag Browser,** select **OPC Tag** from the **Add Persistent Tags** dialog box. Use the CTRL or SHIFT keys to select items from the **Selected Tags** list. Click **Add Item** to add all of the selected tags to a certain group.



OPC Universal Tag Browser

Using the Persistent Trending OLE Automation Server

The purpose of the Persistent Trending OLE Automation server is to function primarily as a memory-based data-logging engine, which buffers data for user-configured signals at desired data-collection rates in memory. In addition, the buffered data can be configured to be data-logged in a .csv or .txt file.

The Persistent Trending automation server is a stand-alone (EXE) server, which registers as the active running object with the tables maintained by OLE. This means that there is only one instance of Persistent Trending running per computer, and all interested clients should get an interface pointer to that running instance (rather than create a new Persistent Trending object, which will fail if Persistent Trending is already running).

The Persistent Trending server should be started and running at the time of committing a process control/HMI application to runtime mode, so it will have enough time to buffer data before any client requests are processed. There are several ways this can be done.

You can start the Persistent Trending server manually, from the Program Group, or place it in the StartUp Folder. In either case, the Persistent Trending server will load the most-recent configured file. Then it can be committed into runtime mode by choosing **Start Logging** from the **Actions** menu, or clicking the **Traffic Light** button on the toolbar.

You can evoke the Persistent Trending server programmatically. The following is a small Visual Basic code sample used to initiate the Persistent Trending server, to load a desired configuration file, and to enter runtime mode:

```
Dim myTrend As Object

 ‘ Create Persistent Trending Server Object

Set myTrend = CreateObject("TWXBgTrend. Document")

‘ load configuration file

myTrend.Open "D:\MyDirFE32\sim10.b32"

‘ Show Persistent Trending Window

myTrend.Visible = True
‘ Refresh Persistent Trending Window

myTrend.Refresh

‘ Enter Runtime

myTrend.EnterRuntime
```

Once this code is executed, Persistent Trending will initiate, load the desired configuration file, show its window, and enter runtime mode. At this point, any automation client of the Persistent Trending server should be able to get an instance to the running TWXBgTrend object, and it will be able to interact with the server completely.

Here is another Visual Basic code sample used to actually retrieve data from Persistent Trending’s buffers:

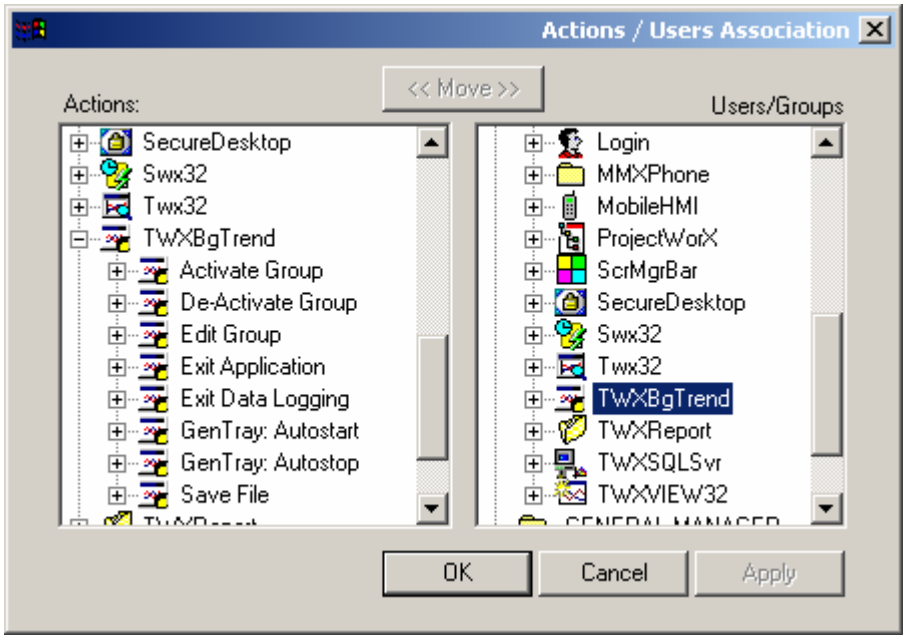
```
Dim myTrendObject As Object

‘ Get Running Object

Set myTrendObject = GetObject(, "TWXBgTrend.Document")

‘ string sPoint is the desired Point Name for which data will be       ‘ retrieved
' Set up variables to receive data from Background Trending Server
 ‘ A variant array for sample values

Dim Values              As Variant

‘ A variant array for Time and Date stamps

Dim TDates   As Variant

‘ A variant array for Msecs timestamps

Dim MSecs   As Variant

‘ A variant array for OPC quality flags
Dim Qual  As Variant

‘ Index used for iteration

Dim I  As Long

 ‘ RateVal  is a long representing the desired data resolution rate

‘  SamplesVal  is a long representing the desired number of
‘ samples to retrieve

Dim sPointVal As String
Dim vEntry As Variant
Dim bRet As Boolean
Dim strValue As String
```

```
' Call Background Trending automation method

bRet = myTrendObject.GetPointData(sPoint, RateVal, SamplesVal, FALSE, Values, TDates,
MSecs, Qual)

' Fill In Values in a listbox control called PointValues

PointValues.Clear

'Fill In !!!

For I = LBound(Values) To UBound(Values)
    vEntry = Values(I)
    strValue = TypeName(vEntry)
    sPointVal = Str(vEntry)
    PointValues.AddItem sPointVal
Next I
```

Note that error-checking code is omitted for clarity. The caller should always check for empty arrays, in case there were no data to return.

Security

The Persistent Trending Server is interfaced to the SMAR Security Server, which you can access by choosing **Security** from the **Tools** menu. It currently supports the security actions shown in the dialog box below.



Actions/Users Association Dialog Box

Persistent Trending is a very flexible OLE Automation server to configure and use. Its main advantage is that it allows you to define and configure custom client-side groups, with individual data-collection rates and number of samples to configure. Persistent Trending is interfaced to SMAR OLExpress thin-layer OPC wrapper .dll, which transfers requests for data to the underlying OPC server.

You can take some steps to optimize Persistent Trending performance and system resource usage. Defining tags (signals) from the same OPC server in Persistent Trending groups can improve system resource usage by Persistent Trending. Also, avoid requesting the same tags in different Persistent Trending groups to speed up performance. Although Persistent Trending does not require you to adhere to these optimizations, using them has many benefits, including enhanced

performance and load balancing.

Persistent Trending also has support for calculating expressions. The time resolution of the expressions is not as granular as that of ordinary OPC server tags. *Under a heavy data-logging load, expressions may not get enough time to evaluate*. In any case, Persistent Trending cannot evaluate expressions *faster than 250 milliseconds,* assuming no data-logging load and a reasonable number of points overall (about 50 OPC tags).

Persistent Trending OLE Automation Examples

The SMAR PROCESSVIEW installation directory on your hard drive contains a folder called "Examples," which contains a folder called "TrendWorx Examples." This folder contains a folder called "TrendWorx VBA Examples." This folder contains a sample TrendWorx file called "PersistentTrendVBADemo.t32," which demonstrates how to use Persistent Trending's OLE Automation properties. There is also a "readme.txt" file that explains how to use this sample Visual Basic application.

Chapter 06

Reporting

New Features in TrendWorx Reporting

In version 7.0, TrendWorx Reporting includes the following new features and enhancements:

- Microsoft Excel reporting password support
- Microsoft Excel reporting performance tuning
- Enhanced data retrieval support
- Microsoft ADO 2.7 support
- Updated Microsoft Excel date handling
- Microsoft Excel FDA password support. TrendWorx Reporting has new support for creating Microsoft Excel reports where a random password will be created to lock the worksheet if desired. The password is not stored anywhere, therefore providing added security for FDA reports. This support is on a per-report basis.
- Report tag reordering
- Report time span enabled for periodic reports
- TraceWorX debug tracing support
- Enhanced expression support
- Daylight savings time support

Note
TrendWorx up to and including Version 6.1x is using the Windows-based APIs for converting a time from local time to UTC or from UTC to local time. The Windows APIs do not correctly adjust the conversion for the daylight savings time if the timestamp to be converted was obtained from a different time period (i.e. it was obtained in "summer" time but now we have "winter" time). TrendWorx Version 7.0 has new time conversion utilities that account for this discrepancy. There are, however, some things to consider:

- These functions are used by default (no user enabling is required).
- This is what they do in order to convert each time stamp:
  - They check Windows for the PC Time Zone Settings and to see if automatic daylight savings is enabled.
  - They also obtain from Windows the times/dates for switching over. (These dates do not change; they are in the form of, e.g., the first Sunday of April.)
  - Depending on the previous information, the new functions properly adjust the conversion times to compensate for daylight savings time.

TrendWorx also includes the following features:

- Data-retrieval filters
- Scheduling and load-balancing support
- Microsoft Excel integration and template support
- HTML and e-mail support for Microsoft Excel-based reporting
- Unicode version support
- Report integration to historical database, operator comments, and batch information
- Multiple database support
- Easy-to-use report configuration wizard
- Microsoft SQL 2000 support
- Tag column description support

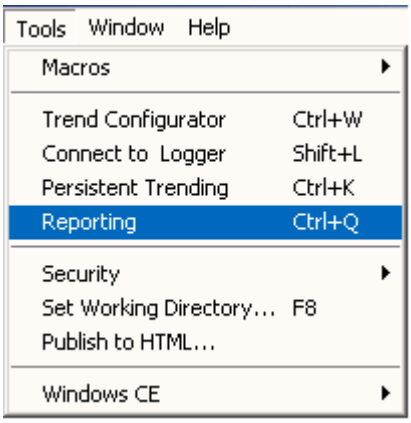
Introduction

TrendWorx has the capability to log data to a relational database. In addition to the standard tools available for accessing these data, TrendWorx has built in capability for historical data utilities and reporting. The tools available to perform historical data utilities and reporting are:

- **TrendWorx SQL Tool ActiveX Control**
- **TrendWorx SQL Reporting**

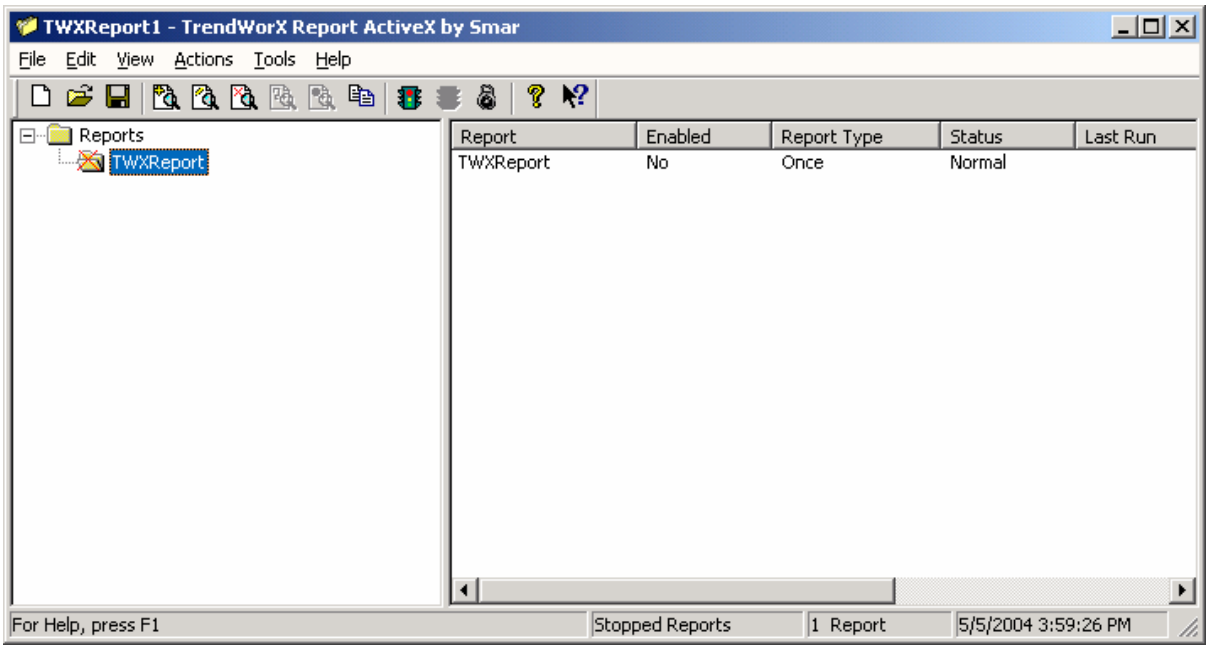
Starting TrendWorx Reporting

To start the application within the TrendWorx Container, select **Reporting** from the **Tools** menu, as shown below. To start from Windows Explorer, double-click the program icon for "TWXReport.exe."



TrendWorx Container Tools Menu

TrendWorx Reporting will be launched with the last configured file (.rtw), as shown below. If this is the first time using TrendWorx Reporting, a blank configuration is displayed.



TrendWorx Reporting Configured File

TrendWorx Reporting displays a two-pane screen. The left-hand pane contains a "tree" of all the configured reports and the tags for each report. The right-hand pane is a list view providing report configuration and status information. TrendWorx Reporting can execute reports containing multiple database groups and/or logging groups. The tree in the left pane sorts all signals by database type.

Note
Clicking a column heading in the right pane of the display, such as "Report," "Enabled," or "Report Type," sorts the list of reports by that category.

Reporting Modes

TrendWorx Reporting supports two modes of operation:

1. A **configuration** mode in which you can configure reports without any report processing.

2. A **runtime** mode in which all reports are processed and full configuration is available.

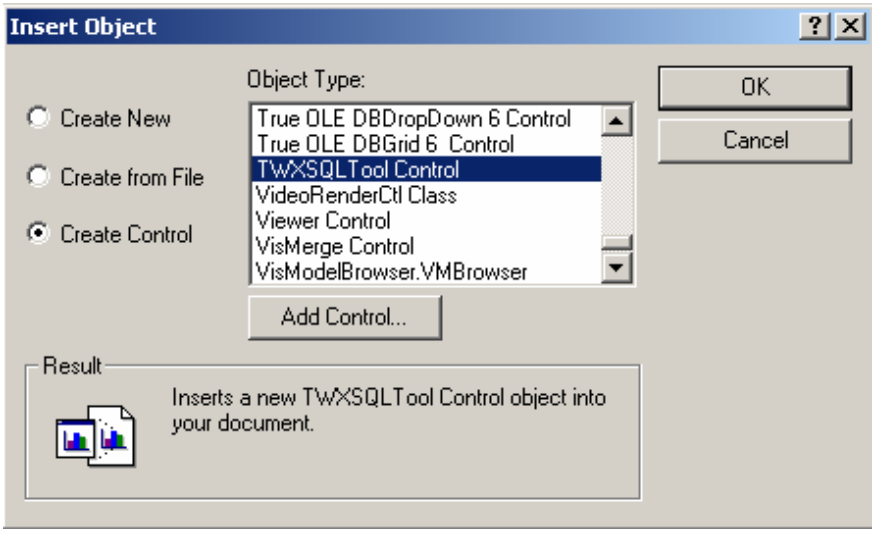
TrendWorx SQL Tool ActiveX Control

New for version 7.0 is an enhanced data-retrieval system, which utilizes a new approach to creating historical reports. The following is a summary of the changes for version 7.0:

- Data filter selection other than Raw will result in data time stamped at the beginning of each subinterval.
- When retrieving data using data filters other than Raw, subintervals for which there are no data because of no data-logging activity will be marked as “empty” slots at the corresponding time with an empty (VT_EMPTY) value. You can check the returned qualities for further processing.
- The historical qualities supported are as follows:

- o OPCHDA_EXTRADATA 0x0001
  - ❑ More data may exist
- o OPCHDA_INTERPOLATED 0x0002
  - ❑ Interpolated data value
- o OPCHDA_RAW 0x0004
  - ❑ Raw data value
- o OPCHDA_CALCULATED 0x0008
  - ❑ Calculated data value
- o OPCHDA_NOBOUND 0x0010
  - ❑ No data found to provide upper or lower bound
- o OPCHDA_NODATA 0x0020
  - ❑ No data collected. Archiving not active
- o OPCHDA_DATALOST 0x0040
  - ❑ Calculation started/stopped/lost
- o OPCHDA_CONVERSION 0x0080
  - ❑ Scaling / conversion error
- o OPCHDA_PARTIAL 0x0100
  - ❑ Aggregate value is for an incomplete interval

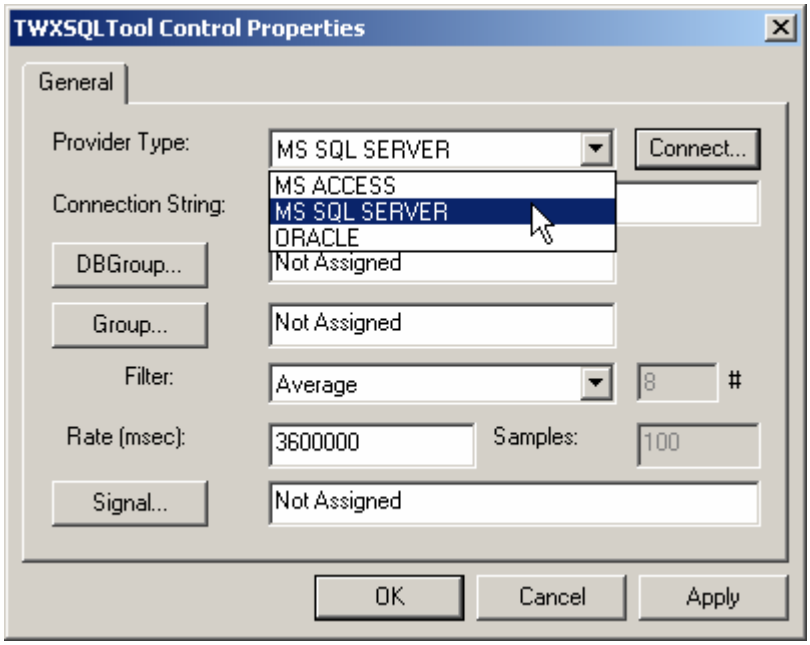
The TrendWorx SQL Tool, which is invisible during runtime mode, is an ActiveX control that you can use to browse the TrendWorx data-logging database and to retrieve time-based historical data using various data filter types. You can access this tool through the **Insert Object** dialog box, as shown below, or directly from the **ActiveX** toolbar of the TrendWorx Container.



Insert Object Dialog Box

During configuration, you can place this component inside TrendWorx displays, VBA forms, or any other container.

Use the **Smar TWXSQL Tool Control Properties** dialog box, shown below, to configure the component. This dialog box has only one tab, the **General** tab shown below, which prompts you to complete the configuration.



TWXSQL Tool Control Properties Dialog Box

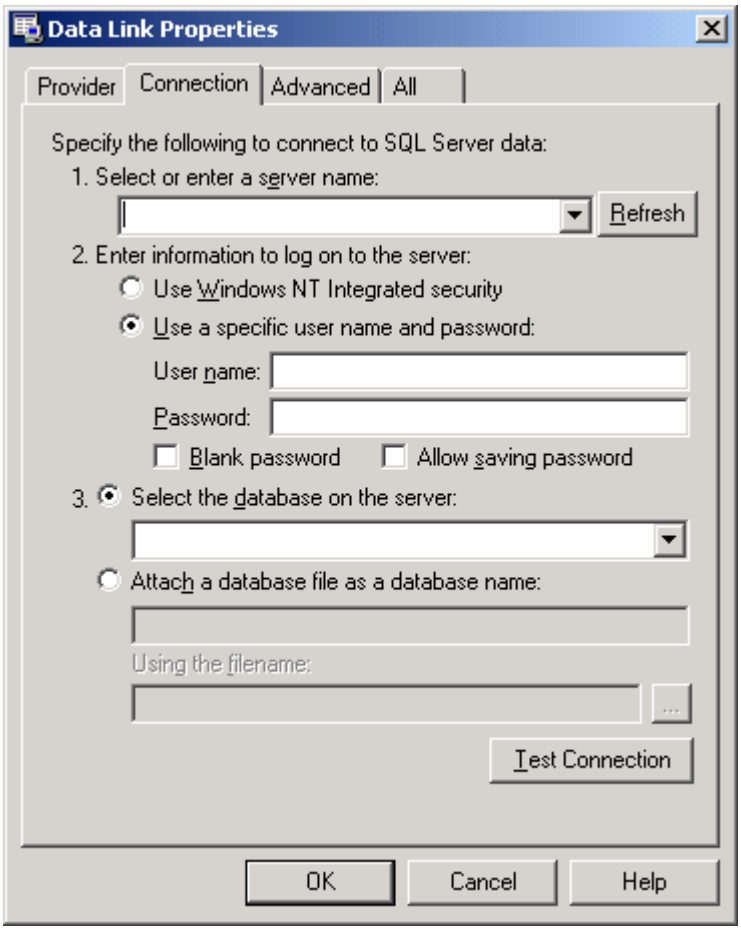
To configure the SQL Tool control, do the following:

1. From the **Provider Type** list box in the **SMAR TWXSQL Tool Control Properties** dialog box, select the OLE Database (DB) Provider type relating to the TrendWorx historical database. Currently, the following OLE DB Providers are supported:

- Microsoft Access
- Microsoft SQL Server
- Oracle

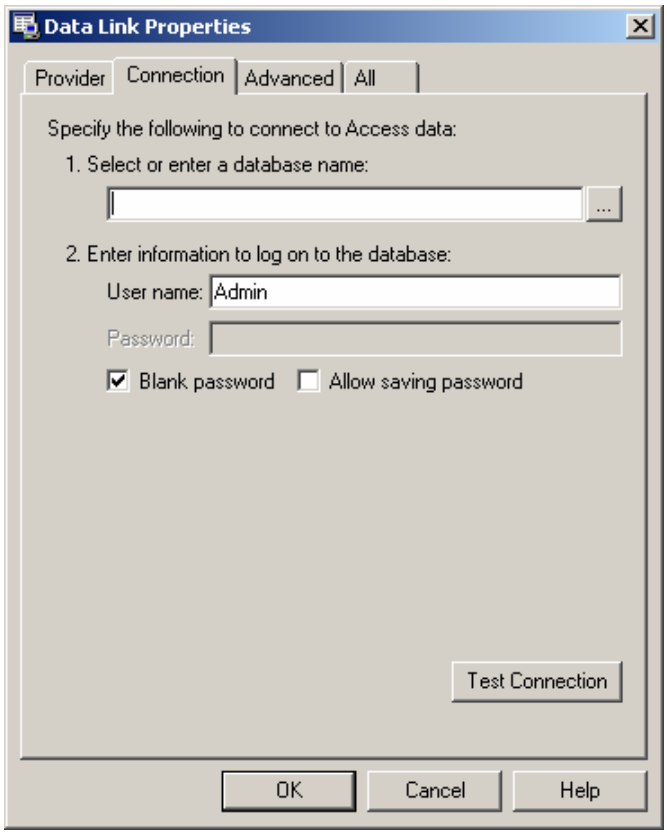
When you select a database type and then click **Connect,** the corresponding OLE DB Provider configuration dialog box opens, as shown below.

For Microsoft SQL Server, select a server name, an authentication type (Windows NT Integrated Security or user name and password), and the desired historical database, as shown in the figure below.



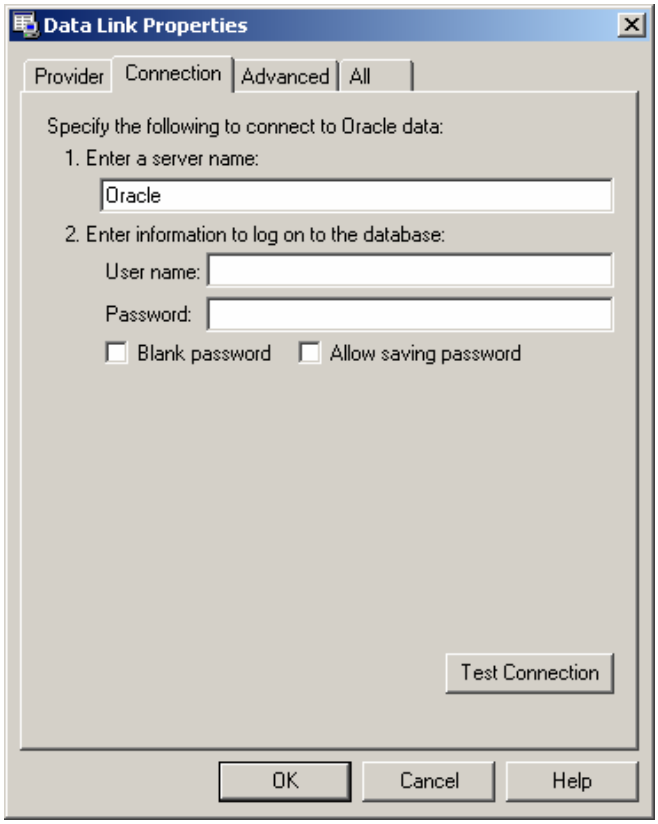
OLE DB Provider Configuration for SQL Server Databases

For Microsoft Access connections, simply navigate to the desired .mdb file by clicking on the browser button, as shown in the figure below.



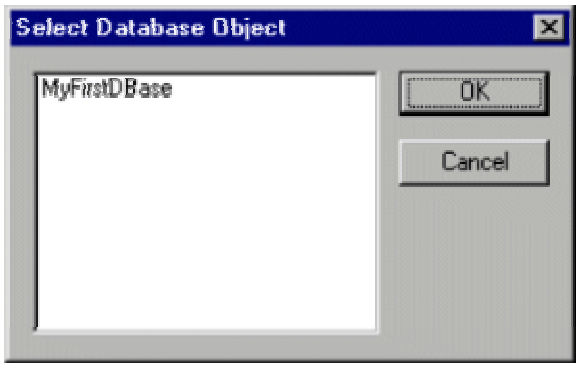
OLE DB Provider Configuration for Microsoft Access Databases

To connect to an Oracle database, fill in the appropriate information, as shown in the figure below.



OLE DB Provider Configuration for Oracle Databases

2. Select the database group object name by clicking **DBGroup** in the **SMAR TWXSQL Tool Control Properties** dialog box. This opens the **Select Database Object** list box, as shown in the figure below, which lists all of the database group objects configured for data logging in the selected database connection. To select a specific object, double-click the group object name.

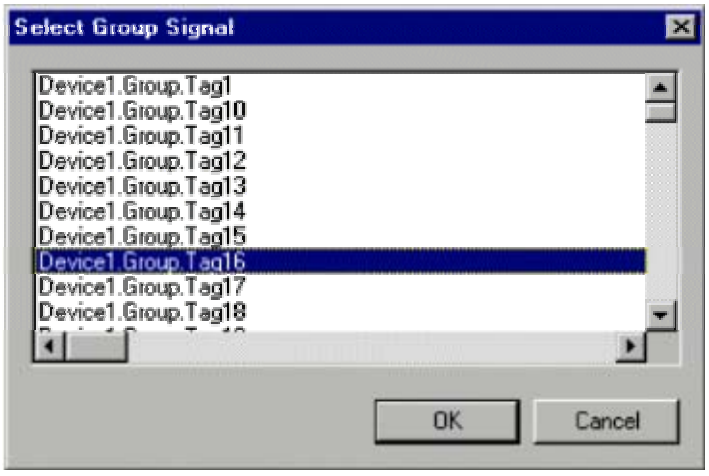


Select Database Object List Box

3. Select the logging group name by clicking **Group** in the **Smar TWXSQL Tool Control Properties** dialog box. This opens the **Select Group Object** list box, shown below, which displays all configured groups for data logging under this database. Again, you can select a desired group by double-clicking the group name in the list.

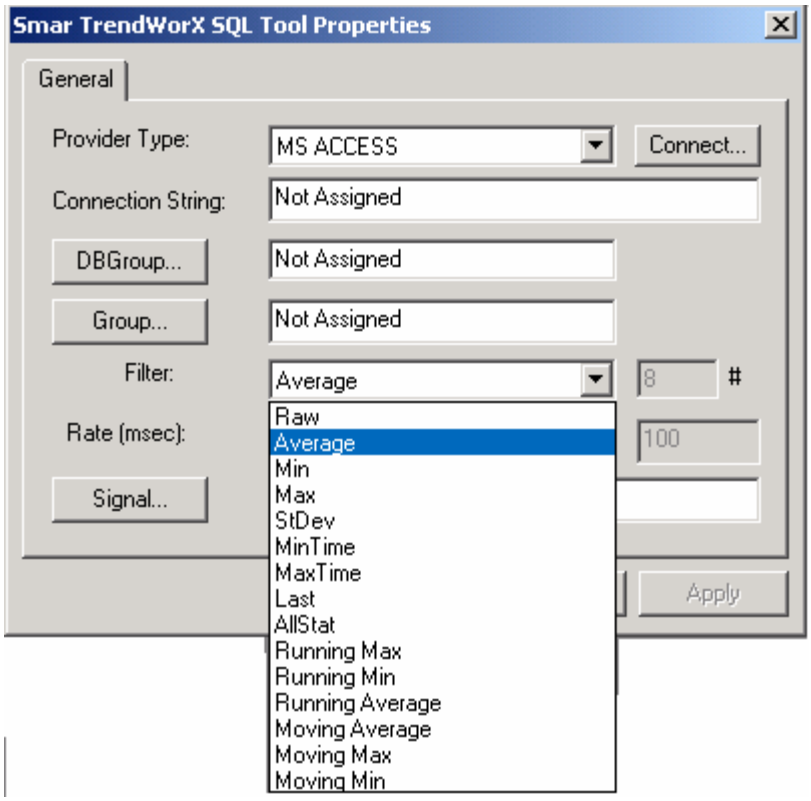
Select Group Object List Box

4. Select the signal name by clicking **Signal** in the **Smar TWXSQL Tool Control Properties** dialog box. This opens the **Select Group Signal** list box. Select a signal name from the list of all the signals configured in the group, and then click **OK.**



Select Group Signal List Box

5. Choose the data filter type to be used in historical data retrieval from the corresponding list in the **Filter** field of the **Smar TWXSQL Tool Control Properties** dialog box, as shown below.



TWXSQL Tool Control Filters

The following filters are currently supported:

- Raw (actual samples stored in the database)
- Average
- Min
- Max
- StDev (standard deviation)
- MinTime (returns actual time for Min value)
- MaxTime (returns actual time for Max value)
- Last (last sample in averaging interval)
- AllStat (all statistical values averaged through the entire period)
- Running Max
- Running Min
- Running Average (exponentially weighted moving average)
- Moving Average
- Moving Max
- Moving Min

If the data filter selected is **Moving Average, Moving Max,** or **Moving Min,** the data will be retrieved using a sliding statistics window, taking the last number of samples into consideration.

6. Select the maximum number of samples to retrieve from the **Samples** field of the **Smar TWXSQL Tool Control Properties** dialog box. This is used mostly in the case of a **Raw** data filter to avoid returning an excessive number of samples.

7. Select the data time resolution (in msec) to be used for data filtering (averaging) from the **Rate (msec)** field of the **SMAR TWXSQL Tool Control Properties** dialog box. This interval is used in the case of selecting a data filter other than Raw. It divides the search interval into subintervals of the entered resolution (in msec) and averages all samples within that subinterval. If the value is set to 0, the TrendWorx SQL Tool will retrieve the desired average across the entire time-search interval.

During runtime mode, you can use the OLE Automation methods of the TrendWorx SQL Tool to perform the following tasks:

- Set a start time and date for historical data retrieval.
- Set an end time and date for historical data retrieval.
- Set the desired data filter (or use the configured one).
- Set the desired time resolution for the historical data (or use the configured one).
- Retrieve historical data for the signal selected during configuration or any other signal.

The TrendWorx SQL Tool has OLE Automation methods to set a new database connection by specifying the corresponding OLE DB Provider connection string. In addition, TrendWorx SQL Tool supports OLE Automation methods to return all database objects configured for a given database connection, all database object groups, and all tags for a given group. The OLE Automation methods are as follows:

Definition Type	Definitions	Functions
Constant definitions	enum { Raw = 0 Average = 1 Minimum = 2 Maximum = 3 StDev = 4 MinTime = 5 MaxTime = 6 Last = 7 AllStat = 8 Running Max = 9 Running Min = 10 Running Avg = 11 Moving Avg = 12 Moving Max = 13 Moving Min = 14 } TWXSQLTOOLFILTER	Used in specifying a data filter
Database type definitions	enum { None = 0 MSAccess = 1 MSSQLServer = 2 Oracle = 4 } TWXSQLTOOLDBASE	Used in specifying database types
TrendWorx SQL	enum {	Identifies the various error

Definition Type	Definitions	Functions
Tool error codes	ErrNone = 0 ErrInvalidFilter = 1 ErrDBaseType = 2 ErrConnFailed = 3 ErrQueryFailed = 4 ErrNoResults = 5 ErrNotEnabled = 6 ErrInvalidParam = 7 ErrInvalidRate = 8 ErrInvalidMaxSamples = 9 ErrProcessing = 10 ErrInvalidTDate = 11 ErrInvalidTableName = 12 ErrInvalidSignal = 13 ErrNoData = 14 ErrInvalidFilterOrder = 15 ErrUnableToLoadLangServer = 16 ErrTranslationFailed = 17 ErrOccuredInTranslation = 18 } TWXSQLTOOLERROR	codes

TrendWorx SQL Tool ActiveX Control: Properties

BSTR GroupName	Data logging-group name.
BSTR GroupSignal	Signal name within data-logging group.
TWXSQLTOOLFILTER DataFilter	Data-retrieval filter.
BSTR DatabaseObject	Database group name.
long Rate	Data-retrieval rate (in msec).
long MaxSamples	Maximum number of samples to retrieve.
BSTR OLEDBString	OLE DB connection string to historical database.
short DatabaseType	Database type (e.g. Microsoft Access, Microsoft SQL, and Oracle).
short FilterOrder	Filter order to use for "Moving Average," "Moving Max," and "Moving Min."

Notes
The "Rate" value is specified in milliseconds, and it can have a maximum value of 1814400000 (about 21 days). Note that this is the maximum sample-to-sample resolution in the returned historical data. If the rate is set to "0," all the historical data within the search interval will be averaged.

The "MaxSamples" value specifies the maximum number of samples to be retrieved when the data filter is set to "Raw." It can range from 3 to 3600.

TrendWorx SQL Tool ActiveX Control: Methods

boolean GetDBases(VARIANT* DBNames)	Returns all TrendWorX SQL Server database objects for a given database connection.
boolean GetGroups(VARIANT* GroupNames)	Returns all group objects for a given TrendWorX SQL Server S database object.
BSTR GetGroupTable()	Returns the name of the table that the current group is data-logging.
void SetStartTimeDate(DATE StartDate)	Sets the start time and date for historical data retrieval.
void SetEndTimeDate(DATE EndDate)	Sets the end time and date for historical data retrieval.
boolean GetGroupSignals(VARIANT* SignalNames)	Returns the signal names for the currently selected group.
boolean GetSignalValues(VARIANT* Values, VARIANT* TDates, VARIANT* MSecs, VARIANT* OPCQualities, VARIANT* HDAQualities)	Retrieves the historical data based on the selected ODBC data source name, TrendWorX SQL Server database object, group object, selected signal, desired time resolution, desired data filter, start time and date, and end time and date.
TWXSQLTOOLERROR GetLastError()	Returns the most current error code, if any operation failed.
void SetLangID(long langID)	Sets the LCID for the language resources and support.
long GetLangID()	Returns the currently selected LCID.

Notes
The "VARIANT*" notation in the method parameters refers to a safe array of data. If the return code is "TRUE," TrendWorx SQL Tool will allocate a "SafeArray" of data of the appropriate data type and returned it with the values. The caller MUST free this array of data.

A typical VB type code segment for retrieving data from the returned arrays, and converting them to a string might look like the following:

```
Dim strEntry As String
For i = LBound(values) To UBound(values)
        strEntry = "Sample#" + Str(i) + "   "
        strEntry = strEntry + "Val: " + Str(values(i)) + "  "
        strEntry = strEntry + "Time: " + Str(TDates(i)) + "  "
        strEntry = strEntry + "Msec: " + Str(MSecs(i))
```

The "MSecs" array holds the milliseconds time stamp of the sample.

If the data filter is set to "AllStat," the returned array will have the following ordered results:

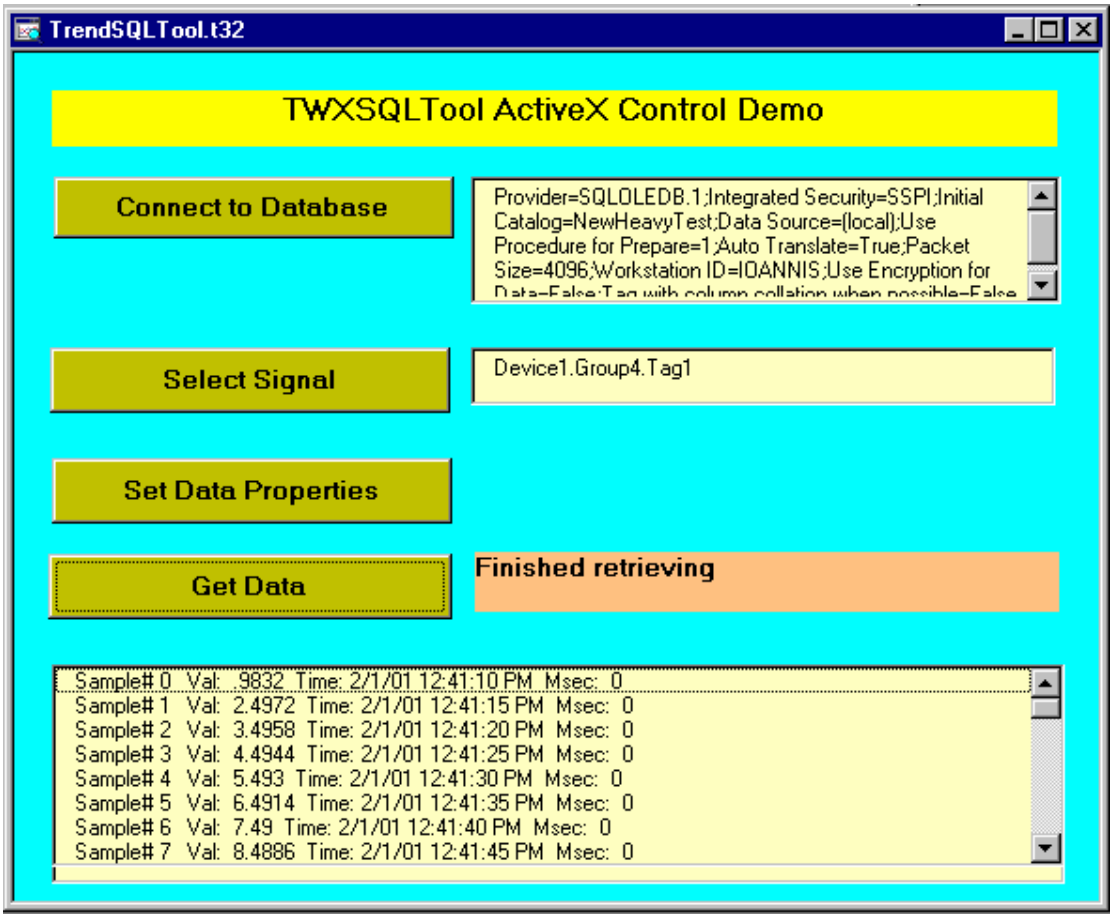
- Maximum Value
- Maximum Actual Time
- Minimum Value
- Minimum Actual Time
- Average Value
- Standard Deviation
- Last Value

A total of seven values will be computed during the entire interval spanning start time and date up to end time and date.

TrendWorx SQL Tool ActiveX Control: Events

StartedTask	Fired to indicate that historical data retrieval has started.
FinishedTask	Fired to indicate that historical data retrieval has finished.
AbortedTask	Fired to indicate that historical data retrieval has been aborted due to error.

TrendWorx includes VBA-based examples to demonstrate the usage of the Reporting tools. Under the \Smar\ProcessView\Examples\TrendWorx Examples\TrendWorX Data Logging and Reporting folder, there is a new TrendWorx display called "TrendSQLTool.t32," shown in the figure below, which utilizes VBA forms to demonstrate the usage of TrendWorx SQL Tool ActiveX control. In the same folder, there is also a "Readme.txt" file, which contains instructions on how to use the example.



TrendWorx SQL Tool ActiveX Control Example

TrendWorx SQL Reporting

This application is a stand-alone OLE Automation server capable of generating reports from the TrendWorx SQL Data Logging Server databases. It is integrated within the TrendWorx container, and it can be used as a stand-alone application.

Toolbar

All actions associated with TrendWorx Reporting can be accessed through the menu commands and the toolbar, shown in the figure below.

TrendWorx Reporting Toolbar

The TrendWorx Reporting toolbar contains the following command buttons. For more information about these commands, refer to the **Menus** section.

- New
- Open
- Save
- Add report
- Edit report
- Delete report
- Report status
- Cancel report
- Duplicate report
- Start reports
- Stop reports
- Security configuration
- About
- Help

Menus

The TrendWorx Reporting menu bar contains the following menus:

- **File menu**
- **Edit menu**
- **View menu**
- **Actions menu**
- **Tools menu**
- **Help menu**

Some of the commands available on these menus are standard Windows options. However, some options are specific to TrendWorx Reporting.

File Menu

The **File** menu contains the following commands:

Command	Shortcut Keys	Function
New	CTRL+N	Creates a new report.
Open	CTRL+O	Opens an existing report.
Save	CTRL+S	Saves the open report to file.
Save As		Saves the report under a different name.
Exit		Closes the application.

For further explanations of these commands, please refer to your Microsoft Windows documentation.

Edit Menu

The **Edit** menu contains the following commands:

Command	Shortcut Keys	Function
Add report	CTRL+A	Adds a report to the configuration.
Edit report	CTRL+E	Edits an already-configured report.
Enable report	CTRL+SHIFT+E	Makes a report available for execution.
Duplicate	CTRL+D	Duplicates the selected report.
Delete report	DEL	Deletes the selected report.

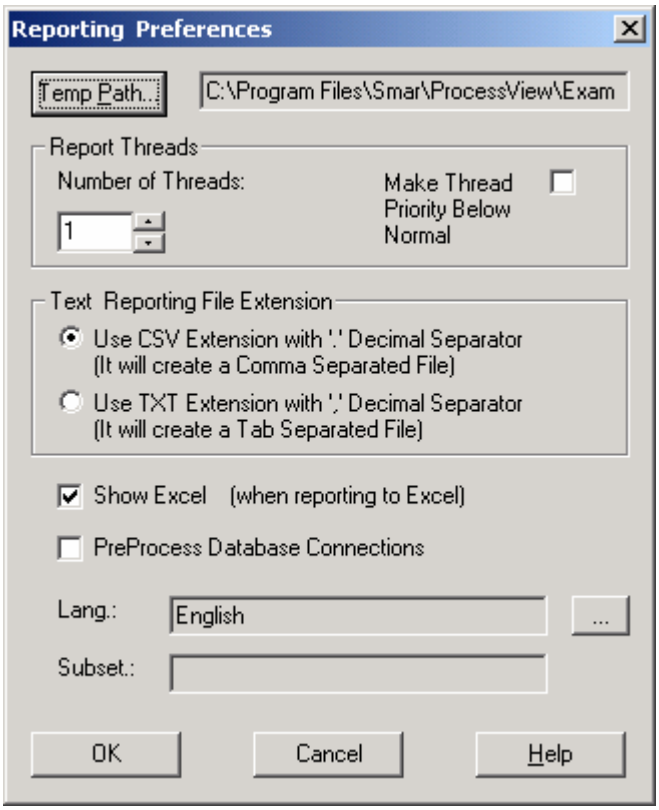
View Menu

The **View** menu contains the following commands:

Command	Shortcut Keys	Function
Toolbar	CTRL+T	Toggles the **toolbar.**
Status bar	CTRL+B	Toggles the status bar.
Select language	CTRL+ALT+U	Prompts you to select a language. If a language resource .dll is present in the TrendWorx "Bin" directory, TrendWorx will automatically load it, convert its menus and dialog boxes to the chosen language, start up in that language.
Reporting preferences	SHIFT+R	Opens the **Reporting Preferences** dialog box.

Reporting Preferences

The **Report Threads** field in the **Reporting Preferences** dialog box, shown below, specifies the number of threads on which to run reports. Because TrendWorx Reporting is a multithreaded application, you can choose to run up to 20 reports simultaneously.



Reporting Preferences Dialog Box

You can select to log to a .csv file or a .txt file. When you are using a .csv file, decimal places will be indicated by the '.' When you are using the .txt file, decimal places will be indicated by the',. This is useful if you are using the TrendWorx Reporting on systems set up for European standards, which use ',' as a decimal separator).

You can also indicate whether you want to show Microsoft Excel after a report has run. This option is selected by default but may be deselected if you do not wish to view your report after each instance.

A temporary path is used for intermediate table creation. When you click **Temp Path** in the **Reporting Preferences** dialog box, TrendWorx Reporting will use a temporary database table to create the report and then populate Microsoft Excel, .csv files, or the target database. Prior to Version 6.00, this temporary table was created in the source historical database. Thus, it added an additional load to the database while the database was actively data logging and retrieving historical data for clients. Now this temporary table is created inside a temporary Microsoft Access (.mdb) file in the chosen temporary path, and it is deleted as soon as the report is completed.

If **Make Thread Priority Below Normal** is checked in the **Reporting Preferences** dialog box, TrendWorx Reporting will start its background report processing threads at a lower priority than normal, so that the system will be able to spend more time executing other more important tasks.

Note
By default, TrendWorx Reporting uses only a single thread. This allows for lower usage of CPU on single-processor systems. In general, it is suggested that you increase the number of threads to more than one only if the TrendWorx Reporting tool is running on a dedicated node.

In the Unicode version, the **Language** and **Subset** fields in the **Reporting Preferences** dialog box allow you to select a desired language set from the Language Server. To select a language, click the **...** button to the right of the **Language** field.

Actions Menu

The **Actions** menu contains the following commands:

Command	Shortcut Keys	Function
Report status	SHIFT+S	Opens the **Report Status** dialog box, which provides you with pertinent information about the report.
Cancel report	SHIFT+A	Cancels the report that is currently selected and running.
Start reports	CTRL+R	Starts previously configured reports.
Stop reports	CTRL+SHIFT+R	Stops the reports that are currently running.

Tools Menu

The **Tools** menu contains the following commands:

Command	Shortcut Keys	Function
Security login	F6	Opens the **SMAR Security Login** dialog box. Enter your user name and password to access the Security Server.
Security configuration	F7	Opens the SMAR Security Server. If a proper login has not occurred, you will be prompted for one at this time.
Working directory	F8	Opens the **Set Working Directory** dialog box, which allows you to set the directory in which all files associated with this report will be located.

Help Menu

The **Help** menu contains the following commands:

Command	Shortcut Keys	Function
Help Topics	F1	Launches the online Help for TrendWorx Reporting.
About Application		Launches the **SMAR About Box,** which contains information about the product version number, copyright, and available disk space. It also contains information about how to contact SMAR.

Report Configuration

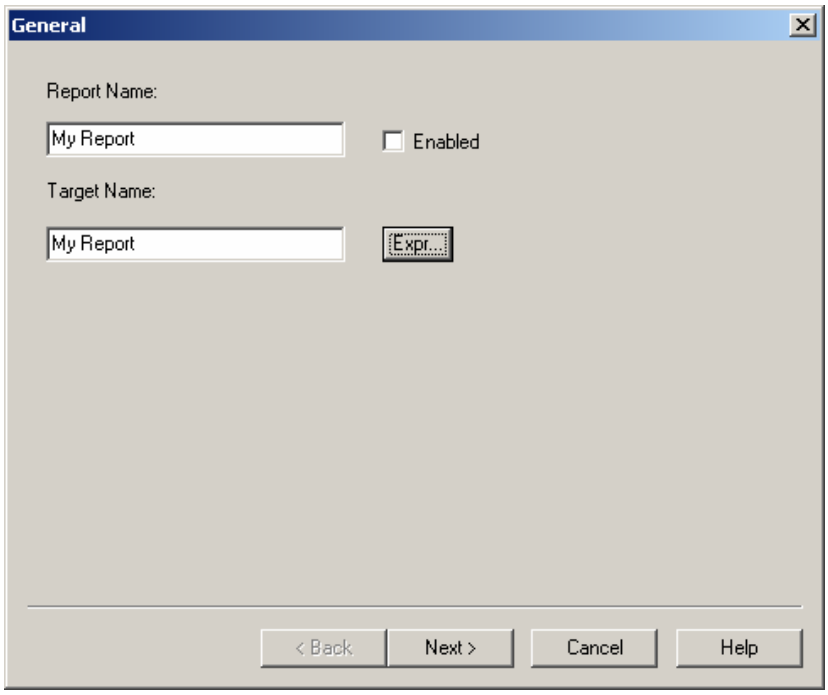
In configuration mode, you can add, edit, or delete reports without report processing taking place. To add a report, select **Add Report** from the **Edit** menu or the toolbar. This opens the Report Configuration Wizard, which is a series of dialog boxes that guide you through the report configuration.

- **General**
- **Tags**
- **Report**
- **Target**
- **Schedule**
- **Range**

Note
For TrendWorx Reporting to run properly on your machine, the TrendWorx SQL Data Logger must be running.

General

The first step in configuring a report is to pick the database from which the report data will be retrieved. There are two ways that the report will be referenced: in the report window and in the actual report. In the **General** dialog box, shown below, the **Report Name** is what will appear in the window, and the **Target Name** is what will appear in the report. While both of these names are somewhat arbitrary, you must enter a name in both fields. If either field is left blank, you will not be able to continue with the configuration of the report.



General Dialog Box

The **Enabled** check box controls whether the report will be scanned for processing within runtime mode. Any report that is enabled is removed from the active scan list of reports to be processed. All reports that are not enabled will show up with an “X” mark on the left-hand pane tree structure. If you do not select a report to be enabled upon creation, you can select it by using the right-click menu or by selecting **Edit Report** from the **Edit** menu.

Note
If an error is encountered during the adding or editing of an existing report, the report will automatically reset the "Enabled" flag if it is properly configured. In addition, if a report copy is inserted its "Enabled" flag will be reset by default.

Note
If you choose to include qualities, the maximum number of tags to be included in the report is reduced to a total of 55. If qualities are not selected, the maximum number of tags to be included in the report is 110 tags.

To enter an expression for the **Target Name,** click the **Expr** button. This opens the **Expression Editor.** When you are finished, click **Next** to continue the Report Configuration Wizard. This opens the **Tags** dialog box.

Note
For information about the Expression Editor, please see the TrendWorx Viewer ActiveX documentation.

Tags

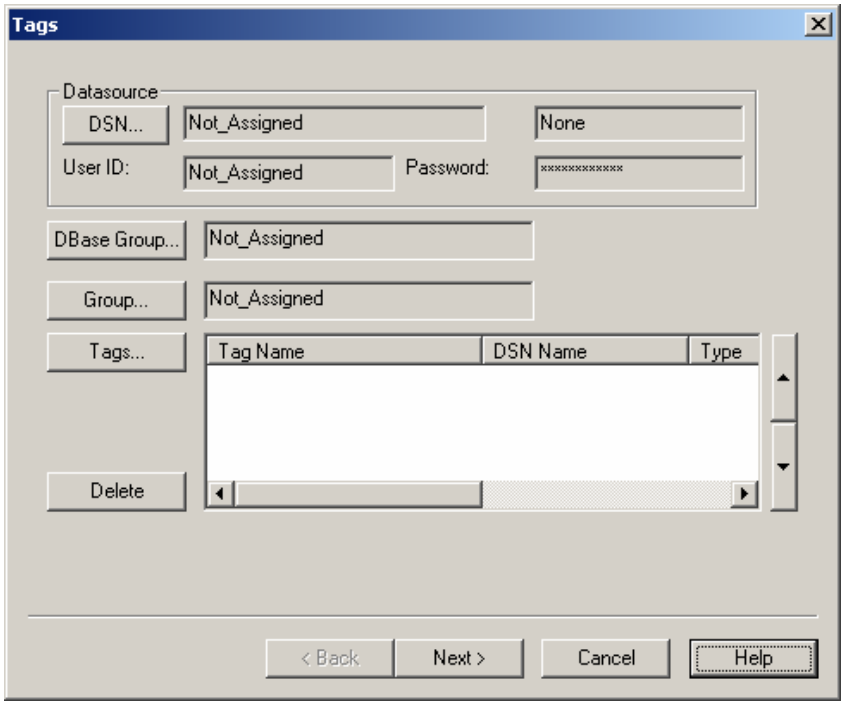
The next step in the Report Configuration Wizard is the **Tags** dialog box, shown below, which prompts you to select the database group, group, and tags used for the report.

TrendWorx Reporting supports the use of a Description text on a per-report-tag basis. This option, if used, will label the resulting data columns of the target report using the defined Description entries in the TrendWorx Configurator. By default, when a signal is inserted in the TrendWorx Configurator, the Description entry of the signal will be its logging name. You can override the **Description** field, which will be used to label the resulting data column in the final report. If the **Description** field in the TrendWorx Configurator is left empty, the logging name will be used to label the resulting data column of the report. The TrendWorx Reporting application will still display in the tree view or edit dialogs the report tags using their logging names.

In addition, for the Unicode version of TrendWorx Reporting, the **Description** field can be language-aliased to be used with various languages.

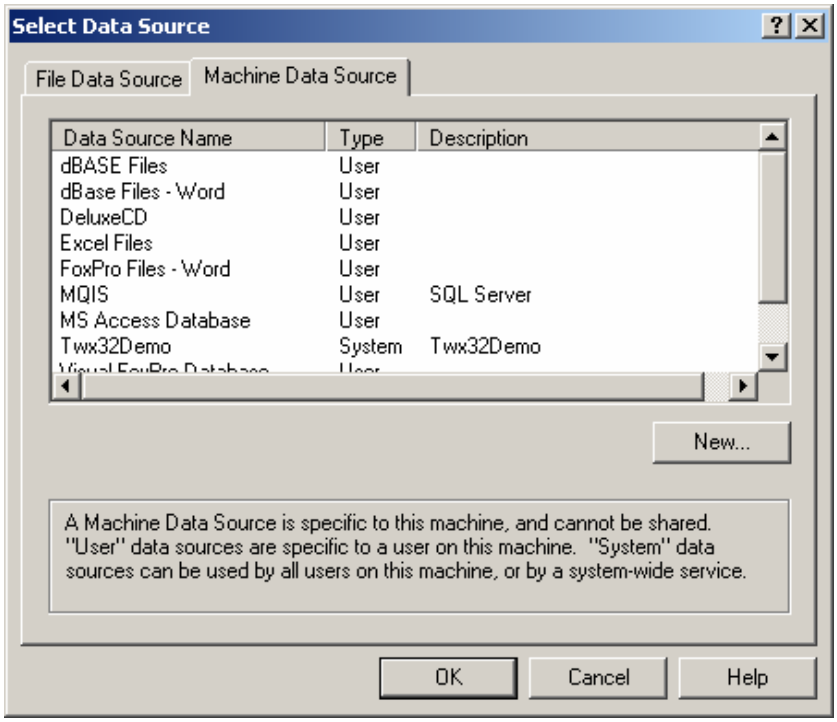
Note
TrendWorx Reporting also supports report generation across multiple database groups. The **Tags** dialog box lists and sorts all report signals based on database group, type, etc. You can use following procedure for each database group:

1. Click the **DSN** button to establish a connection to the source historical database.
2. Click the **DBase Group** button to select a database group.
3. Click the **Group** button to select a logging group.
4. Click the **Tags** button to select report signals (tags) from the data-logging group for each individual database group and/or logging group. If you have selected multiple tags, you can change the order of the tags for reporting. Simply the desired tags to move up or down by clicking on the Up and Down arrow buttons to the right of the tags list, as shown below.



Tags Dialog Box

Selecting a Data Source
In the **Data Source** field of the **Tags** dialog box, you can select the source from which the data for the report will come. Click the **DSN** (Data Source Name) button to open the **Select Data Source** dialog box, shown below.

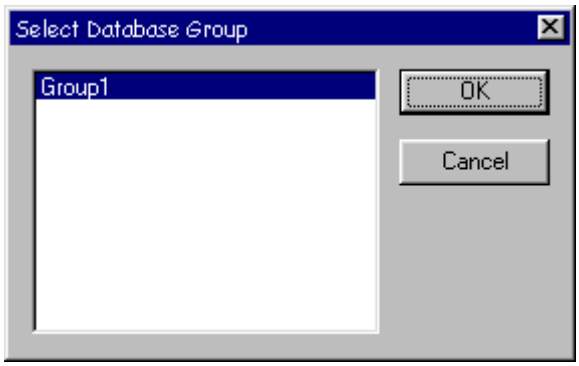


Select Data Source Dialog Box

Select the desired database. This should be a database where the TrendWorx SQL Data Logger is configured to log data. As soon as the selection is made, the TrendWorx Reporting will fill in the type of the source database, the user ID, and name. When you have selected the data source, click **OK.** To continue the Report Configuration Wizard, click **Next** in the **Tags** dialog box.

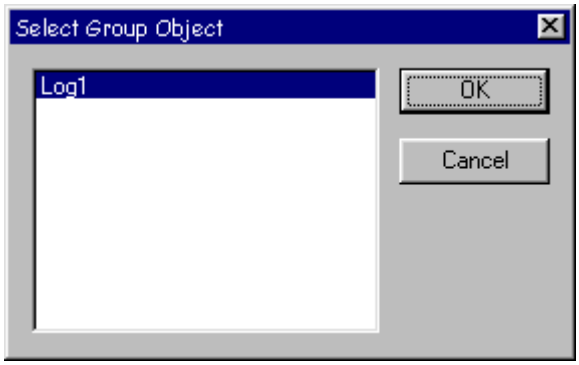
Note
If TrendWorx Reporting is running on a PC other than the one on which the TrendWorx SQL Data Logger is running, you will have to configure an ODBC data source by connecting to the databases on which TrendWorx SQL Data Logger is logging data.

Selecting a Database Group
You must choose a database group from those configured for the database you selected in the **Select Data Source** dialog box. Click **DBase Group** in the **Tags** dialog box. Then select the desired database from the **Select Database Group** list box, as shown below.



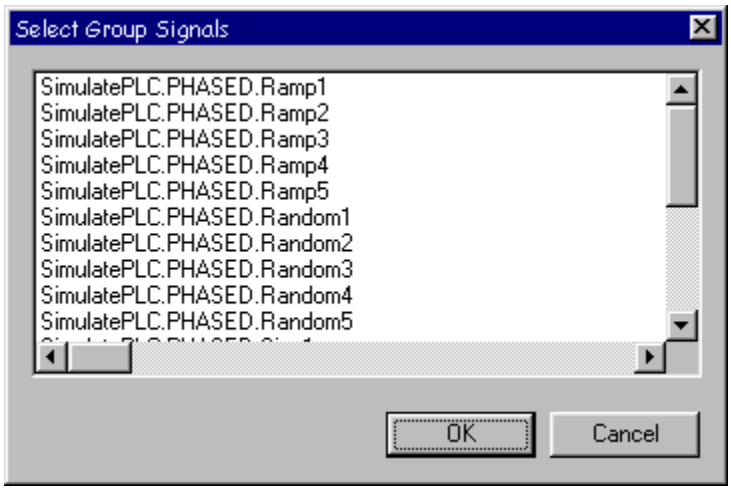
Select Database Group List Box

Selecting a Group Object
You must select a configured group within the selected database group. Click **Group** in the **Tags** dialog box. This opens the **Select Group Object** list box, shown below, which contains a list of all groups configured for the specific database group. Then select a desired group from the list.



List of available Groups

Selecting a Group Signals
You must also select the tags that will be used for the basis of the report. Click **Tags** in the **Tags** dialog box. This opens the **Select Group Signals** list box, shown below. Then select the appropriate tags from the list.



List of Available Tags

Once you have made all your selections, click **Next** to continue the Report Configuration Wizard. This opens the **Report** dialog box.

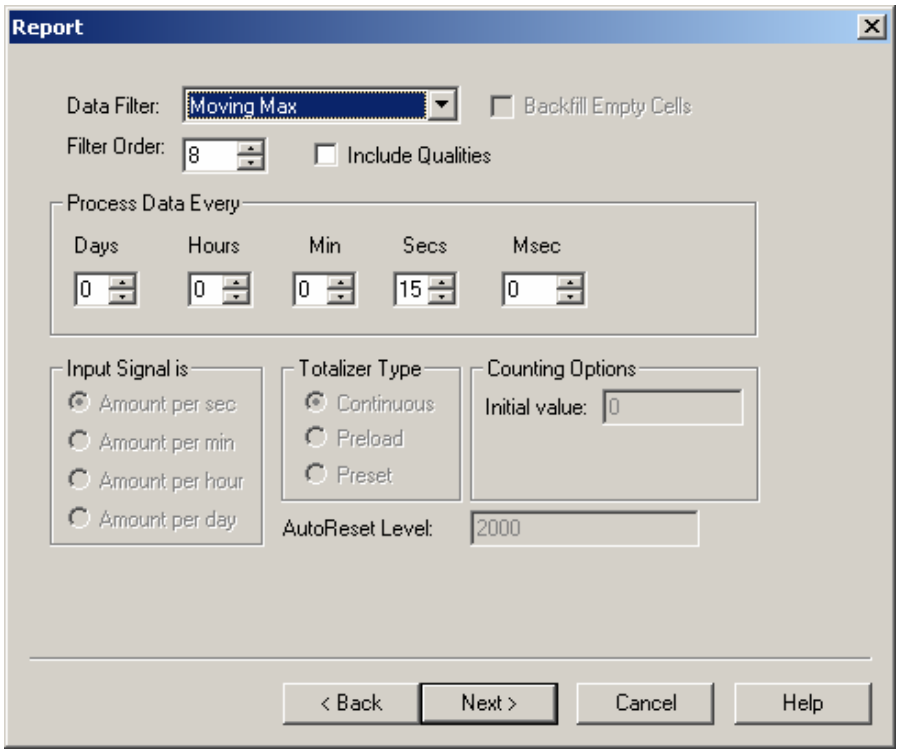
Report

The next step in the Report Configuration Wizard is the **Report** dialog box, shown below. This allows you to select which data filter to use when creating the report, as well as how often to process data.

New for version 7.0 is an enhanced data-retrieval system, which utilizes a new approach to creating historical reports. The following is a summary of the changes for version 7.0:

- Data filter selection other than Raw will result in data time stamped at the beginning of each subinterval.
- When creating reports using data filters other than Raw, subintervals for which there are no data because of no data-logging activity will be marked as “empty” slots at the corresponding time stamp within the database, .csv or Microsoft Excel target report.
- The historical qualities supported are as follows:

- OPCHDA_EXTRADATA 0x0001
  - More data may exist
- OPCHDA_INTERPOLATED 0x0002
  - Interpolated data value
- OPCHDA_RAW 0x0004
  - Raw data value
- OPCHDA_CALCULATED 0x0008
  - Calculated data value
- OPCHDA_NOBOUND 0x0010
  - No data found to provide upper or lower bound
- OPCHDA_NODATA 0x0020
  - No data collected. Archiving not active
- OPCHDA_DATALOST 0x0040
  - Calculation started/stopped/lost
- OPCHDA_CONVERSION 0x0080
  - Scaling / conversion error
- OPCHDA_PARTIAL 0x0100
  - Aggregate value is for an incomplete interval



Report Dialog Box

Note
When running an "AllStats" report for every month or year, the report should return the Min, Max, Avg (and StDev) for the last month or year for the specified tags. Also, only one value for each of the stats should be reported per tag. To do this properly set all values in the **Process Data Every** field of the **Report** dialog box to "0."

The following table describes the different Data Filter types listed in the Data Filter field of the **Report** dialog box.

Filter Type	Description
Raw	All of the actual (raw) samples stored in the database will be retrieved and time-aligned to produce the report. If no samples were stored for a specific time interval, a "NULL" value will be stored. You can override this by enabling the **Backfill Empty Cells** option. As a result, TrendWorx Reporting will copy over the previous sample value (if it is available). This is a time-intensive and CPU-consuming report type that may increase hardware requirements or prolong report execution times.
Average	Divides the overall time range of the report into subintervals, and provides the computed average sample.
Min	Divides the overall time range of the report into subintervals, and provides the computed minimum sample.
Max	Divides the overall time range of the report into subintervals, and provides the computed maximum sample.
StDev	Divides the overall time range of the report into subintervals, and provides the computed standard deviation sample.
Last	Divides the overall time range of the report into subintervals, and provides the computed the computed last value sample.
AllStat	The columns of the report will be the statistical quantities "Average," "Min," "Max," "StDev," etc. computed for every subinterval.
RunningMax	Running maximum value.
RunningMin	Running minimum value.
RunningAvg	Exponentially weighted moving average.
Moving Average	Average computed over a sliding time window.
Moving Max	Maximum computed over a sliding time window.
Moving Min	Minimum computed over a sliding time window.
Totalizer	Performs totalizer function.

If **Include Qualities** is checked in the **Report** dialog box, values, OPC Data Access and historical data qualities will be retrieved.

The **Filter Order** field becomes available when the Moving Average, Moving Max, or Moving Min filter is selected under **Data Filter.** If **Filter Order** = X, then X samples in the past from the current time will be used to calculate the Moving Average, Moving Max, or Moving Min.

Other Options
The following table lists the functions of the **Input Signal** and **Totalizer Type** fields in the **Report** dialog box.

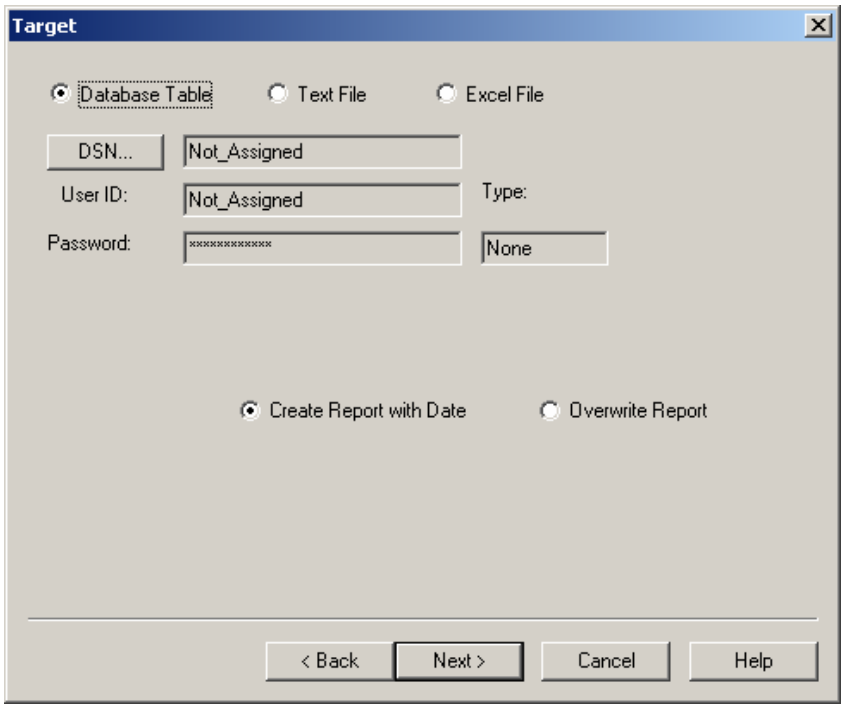
Function	Description
Amount per second	The signal represents data in seconds.
Amount per minute	The signal represents data in minutes.
Amount per hour	The signal represents data in hours.
Amount per day	The signal represents data in days.
Continuous	When **Continuous** is checked, the Totalizer will keep counting, starting from 0 until it comes to the end of the trend period, or until the integrated value exceeds the **Auto Reset Level** (a maximum limit).

Function	Description
Preload	When **Preload** is checked, the Totalizer commences counting from any value. This is especially useful when totalizing must be “held” (suspended) while a necessary operation is being performed. For example, the pipes are being cleaned and then started from a known value.
Preset	When **Preset** is checked, you simply specify a preset value. • If you are counting upwards, the value will obviously be positive. • If you are counting downwards, the preset value will be negative. A negative value would be relevant in a situation where a reservoir is being drained, for example. Then the Totalizer function, if enabled for a circular chart, would help monitor the flow rate. • When counting upwards, when the total exceeds the preset value, it is reset. • When counting downwards, the preset value is reset at a point when it becomes negative.
Auto reset level	Sets the level at which the system will automatically reset, returning to its initial value and disabling everything else.

Once you have made all your selections, click **Next** to continue the Report Configuration Wizard. This opens the **Target** dialog box.

Target

The next step in the Report Configuration Wizard is the **Target** dialog box, shown below. The target name that you entered will be used as the basis of the generated target report database table, .csv file, .txt file, or Excel worksheet.



Target Dialog Box

The **Target** dialog box has several options for logging a report, including:

- **Logging to a database**
- **Logging to a .txt or .csv file**
- **Logging to an Excel file**

In addition, you can select to:

- Overwrite the report.
- Create a new report with a date.

If you overwrite the report, the target report table or file will be named using the selected target name, and any previous data will be overwritten. If you create a new report, a new table or file will be generated every time the report is run, and its name will consist of the report name and a string representation of the time and date when the report was created.

TrendWorx Reporting can also generate a report table within the same database in which the historical data reside. The selection process is identical to the one described earlier.

Note
TrendWorx Reporting currently supports only Microsoft Access, Microsoft SQL Server, and Oracle databases as targets configured as machine data sources, *not* file data sources. Refer to the **Tags** section as needed.

Note
When you are creating reports to Excel or to a .txt or .csv file, remember that Excel 2000 can handle a maximum of about 65,000 rows. Make sure that your report will not exceed this amount so that the report will be completed without errors.

Note
When you are creating reports to Excel, the target report file name will always be appended by the time and date extension at the time the report was executed.

TrendWorx Reporting will create a table in the target database. The table name will be produced from the target name. If **Create Report with Date** is selected, the time and date of the report creation will be appended to the name. If **Overwrite Report** is selected, the table name will be the same as the report name, and all the existing data will be overwritten.

Now that you have selected the Target Type and location, click **Next** to continue the Report Configuration Wizard. This opens the **Schedule** dialog box.

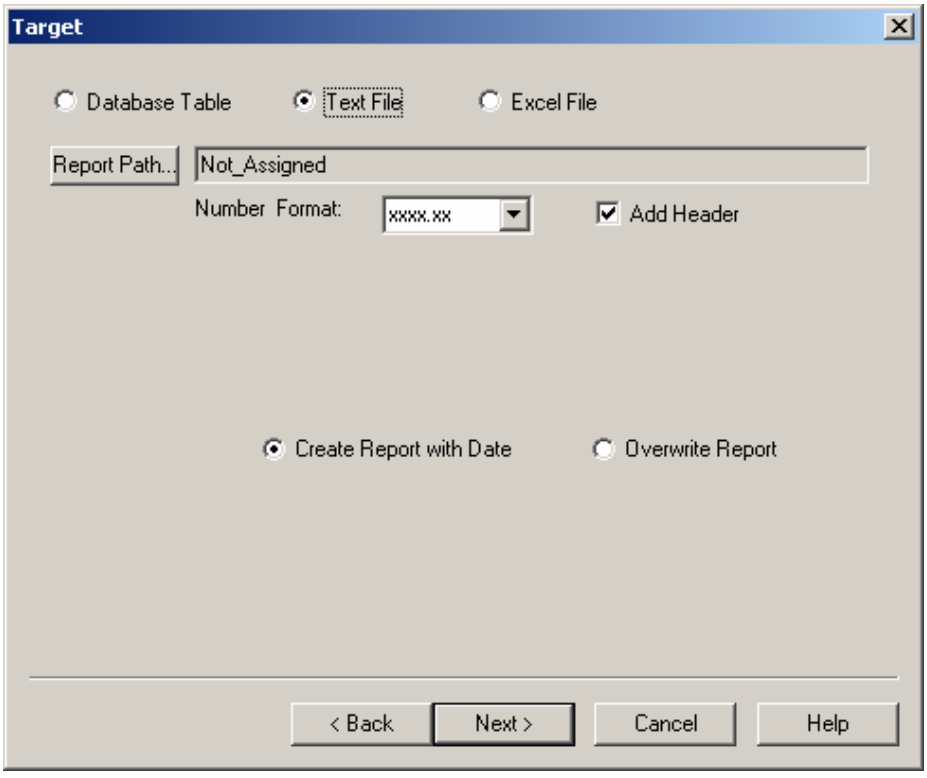
Logging to a Database

If you choose to create a report that will write to a database, you must configure a database that will contain all the resulting data from the report. Click the **DSN** button in the **Target** dialog box to open the **Select Data Source** dialog box. You can select an existing database, or you create a new database by selecting **New** and following the Report Configuration Wizard. When you make your selection, TrendWorx Reporting will fill in the type of the source database, user ID, and name.

Note
If TrendWorx Reporting is running on a PC other than the one on which the TrendWorx SQL Data Logger is running, you will have to configure an ODBC data source by connecting to the databases on which the TrendWorx SQL Data Logger is logging data.

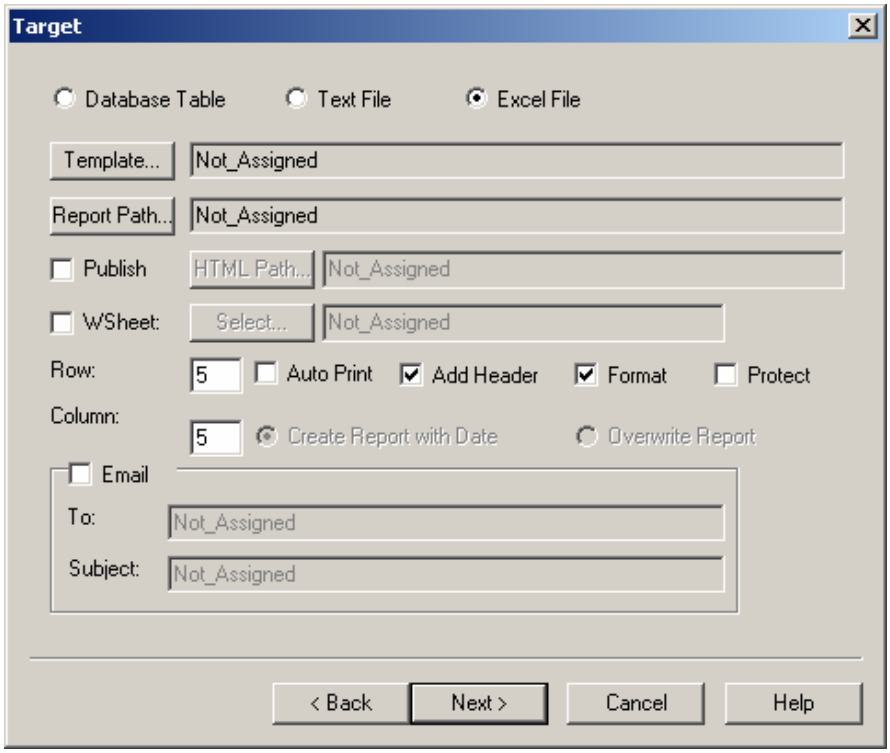
Logging to a Text File

To configure the report to log to a .txt or .csv file, select **Text File** on the **Target** dialog box, as shown in the figure below. Then click **Report Path** to select the directory in which the file will be created. After you have selected the location for the file, select the **Number Format** for the data from the report. If **Add Header** is checked, TrendWorx Reporting will add a report header to the file.



Logging to a Text File in the Target Dialog Box

Logging to an Excel File
To configure the report to log to an Excel file, select **Excel File** from the **Target** dialog box, as shown in the figure below.



Logging to an Excel File in the Target Dialog Box

TrendWorx Reporting Version 7.0 has the following integration with Microsoft Excel:

- Microsoft Excel template support.
- HTML output support.
- Report header support.
- E-mail support.
- Enhanced directory management.
- Enhanced performance integration with Microsoft Excel, which greatly reduces the time required to populate an Excel spreadsheet with the report data. This functionality may require the utilization of more memory resources.
- New date format support, which includes the month name for international support.
- TrendWorx Reporting now supports an internally created password for creating Microsoft Excel reports. Based on this internal password, the resulting Microsoft Excel worksheet will be locked and no data changes will be allowed.

When creating reports in Microsoft Excel, you need to create and customize (if desired) a source Excel workbook, which should be saved as a template. TrendWorx treats each Excel workbook selected from the **Template** button as an Excel template, and it creates an Excel-based report using the user-configured format and layout in the source workbook. To configure an Excel report, you need to do the following:

1. Create an Excel workbook to be the source of the report formatting and layout.
2. Click **Template** in the **Target** dialog box to select the workbook.
3. Click **Report Path** in the **Target** dialog box to assign a path where the generated reports will be created.
4. Select **Publish** if HTML output of the Microsoft Excel-based report is desired.

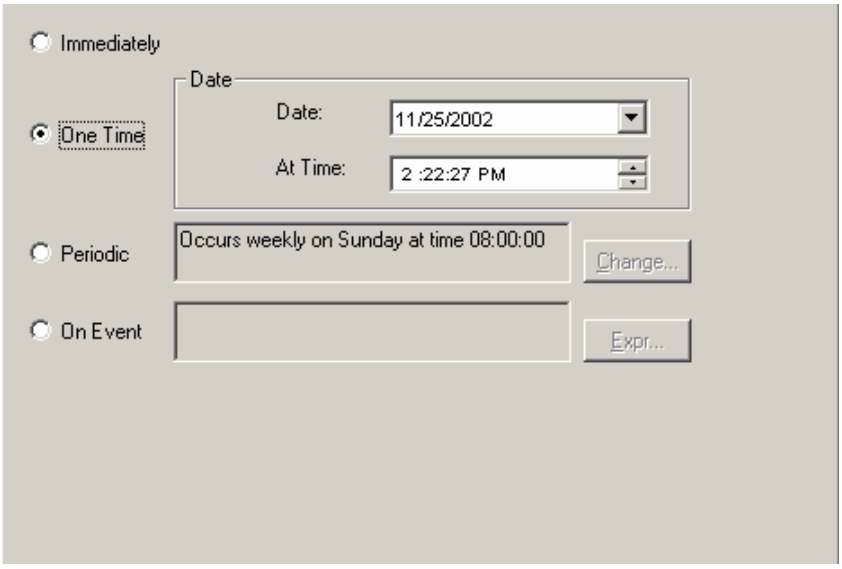
5. If the **Publish** option is checked, click **HTML Path** to select a target directory for the HTML output of the report.
6. If you want to select a specific worksheet from the source workbook, you should enable the **WSheet** option and then click **Select** to display a list of all workbooks available. Then select the desired workbook.
7. You can specify the starting cell of the Excel workbook in which the report will be stored by supplying the desired values for the **Row** and **Column** fields.

In addition to the above, you have the following options:

- **Auto Print.** If enabled, the generated report will be sent automatically to the current Windows default printer.
- **Add Header.** If enabled, TrendWorx Reporting will add an informative header to the generated report.
- **Format.** If enabled, TrendWorx Reporting will automatically format the generated report and adjust the column width so that the values within the column cells will be readable. If you want to provide a custom format and layout, this option should not be checked. As an example, to hide a certain column in the generated report, calculate its location and make its width zero within Microsoft Excel.
- **Protect.** Enables password protection based on an internally created password for Microsoft Excel reports. The resulting Microsoft Excel worksheet will be locked and no data changes will be allowed.
- **Create Report with Date.** This is the only option for Microsoft EXCEL reporting. If enabled, the target worksheet will use the report name, and the time and date extension will be appended to the name.
- **Overwrite Report.** Not available for Excel reporting.
- **E-Mail.** If enabled, you can fill a subject and a recipient e-mail address list, such as "myname@mycompany.com; yourname@yourcomapny.com" (with the list items separated by a semicolon). TrendWorx Reporting, upon completing the report, will attach it to an e-mail message and send the message to all listed recipients.

Schedule

The next step in the Report Configuration Wizard is the **Schedule** dialog box, shown below.



Schedule Dialog Box

Reports can be configured to execute:

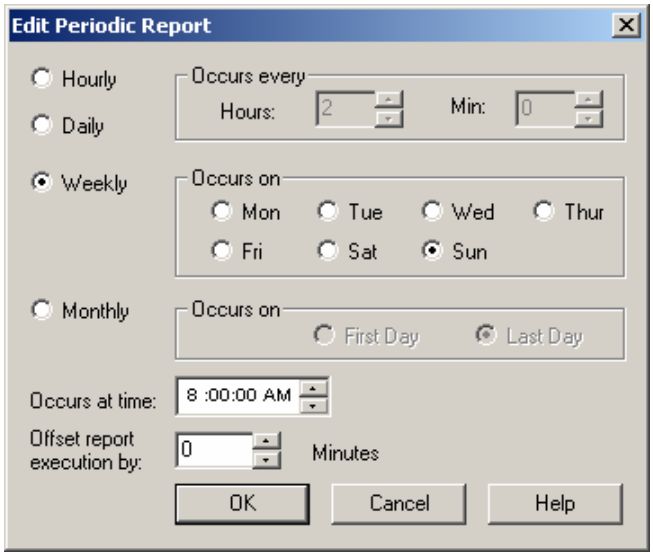
- Immediately
- One time
- Periodically
- On event

If the report is configured to run **Immediately,** it will execute as soon as possible within runtime, and after completion its enabled flag will be reset. All immediate reports have their priority of execution boosted internally by TrendWorx Reporting over periodic reports.

If the report is configured to run **One Time,** you must pick the desired time and date for the report to run by clicking on **Set** in the **Schedule** dialog box to enable time and date selection. To select the date, click the down arrow in the **Date** field, and then choose a date from the calendar. After completion, the report's enabled flag and time field will be reset.

Clicking **Set** opens the standard Microsoft Calendar control. Select a desired date by double-clicking on the date.

If the report is configured to be **Periodic,** you must select the reports periodic schedule by clicking **Change.** This opens the **Edit Periodic Report** dialog box shown below.



Edit Periodic Report Dialog Box

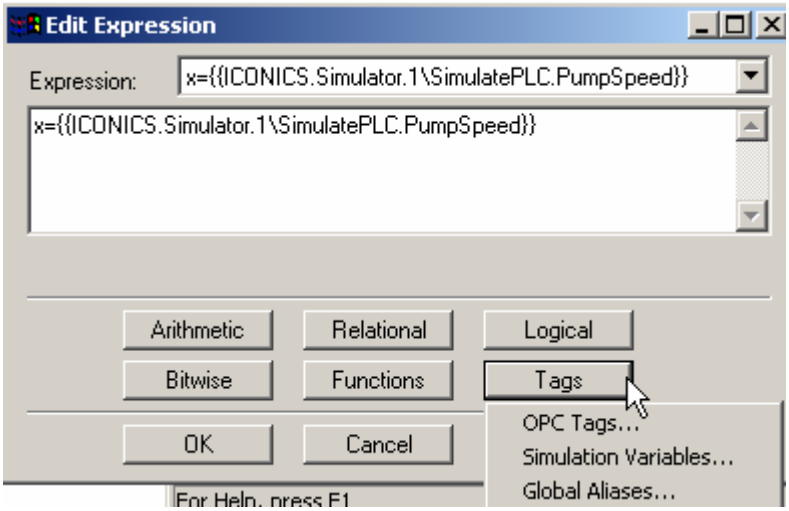
Periodic reports can run:

- Hourly
- Daily
- Weekly (on a desired day of the week)
- Monthly (on the first and/or last day of month)

You can select the desired time of the report for execution. In addition, you can select a report execution offset interval, which will add a delay between consecutive report executions. You can also run reports faster than one hour.

Note
Daily, weekly, and monthly reports will automatically create a report based on the last day's, week's, or month's data from the report execution time. Hourly reports will span data based on how many hours they are configured to run, while event-based reports can be configured to retrieve data spanning a selected report time span.

If the report is configured to run on an event, you must configure an event expression by clicking the **Expr,** which opens the **Edit Expression** dialog box, shown below.



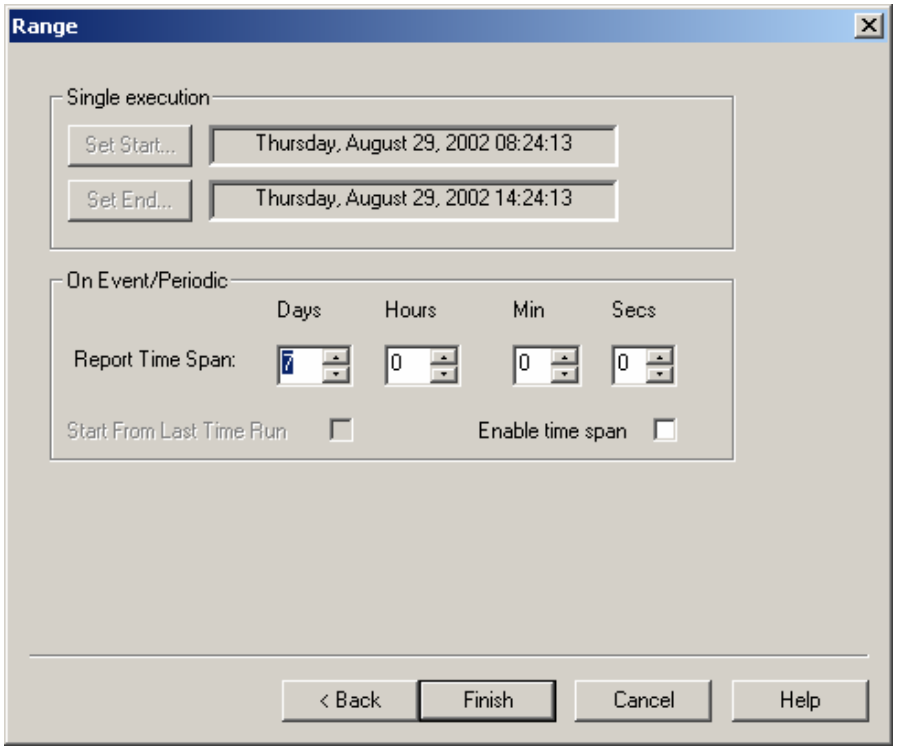
Expression Editor

Event-based reports provide finer control over timing of report execution. The event scan time is currently 1 second.

Once you have configured the report schedule, click **Next** to continue the Report Configuration Wizard. This opens the **Range** dialog box, which enables you to pick the time range of the report. This is basically the time interval over which historical data will be retrieved and processed. It is available for immediate and one time report types.

Range

The next step in the Report Configuration Wizard is the **Range** dialog box, shown below.



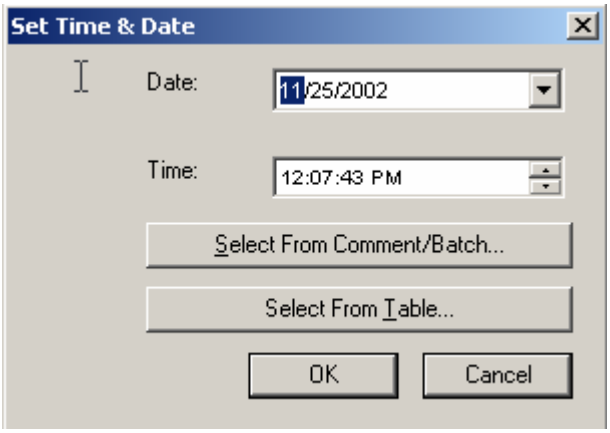
Range Dialog Box

If the report is configured to execute **Immediately** or **One Time,** you can configure the single execution start and end times by clicking **Set Start** and **Set End.**

If the report is configured to run **On Event,** you can configure the **Report Time Span** for which historical data should be processed. In addition, if **Start From Last Time Run** is checked, the starting time for data retrieval of the report will be the last time the report was executed.

You can also enable the **Report Time Span** for **Periodic** reports. This way you will be able to select a time span different from the one determined by the periodic frequency of the report alone.

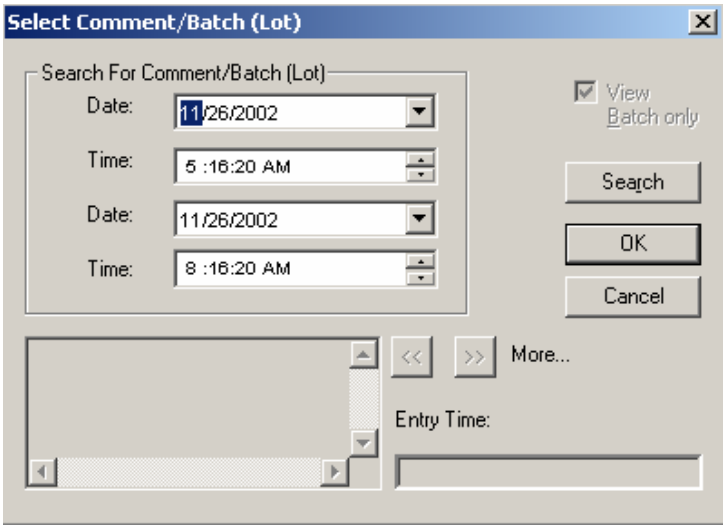
Clicking on **Set Start** or **Set End** in the **Range** dialog box opens the **Set Time and Date** dialog box, shown below. Within this dialog, the you can click click the down arrow in the **Date** field to open the Calendar control for selecting a desired date, adjust the desired time in the time picker control or select the time based on a given historical table or operator comment and batch entry.



Set Time and Date Dialog Box

Clicking **Select From Comment/Batch** in the **Set Time and Date** dialog box opens the **Select Comment/Batch (Lot)** dialog box, shown below. This enables you to:

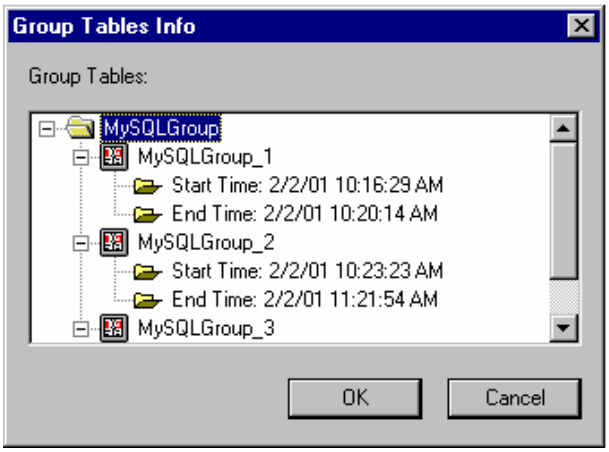
- Select a start time and date. To select the date, click the down arrow in the **Date** field, and then choose a date from the calendar.
- Select an end time and date.
- Click **Search** to initiate the search.
- Scroll through multiple operator comments and batch entries once the search is completed; use the **<<** and **>>** buttons. Once you locate the desired one, click **OK.**



Set Comment/Batch (Lot) Dialog Box

Note
Selecting **View Batch Only** filters out the historical operator comments to display only the related batch (lot) entries.

Clicking **Select From Table** in the **Set Time and Date** dialog box opens the **Group Tables Info** dialog box, shown below. This displays the table entries for the last-accessed database connection so that you can select a starting and ending time and date based on the available historical tables.



Group Tables Info`

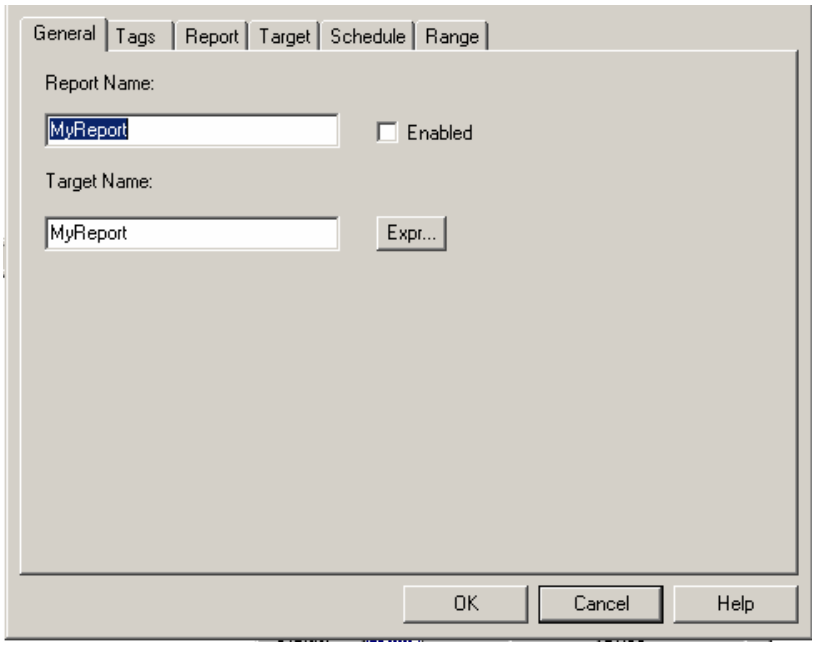
Note
The Unicode version has enhanced language-aliasing support, including automatic value scaling. You need to configure the Smar Language Server as well as configure language aliases in the TrendWorx Configurator. Once all language aliases are configured, TrendWorx Reporting will automatically scale all historical values to those corresponding to the startup language. While TrendWorx Reporting is in runtime mode, all subsequent events generated by you selecting a different language will result only in updating the user interface to match the currently selected language, but not the scaling equations used in the report generation.

Finally, clicking **Finish** will complete the new report configuration and addition. If any errors are found, the new report's enabled flag will be reset and will be marked with an "X".

Editing a Report

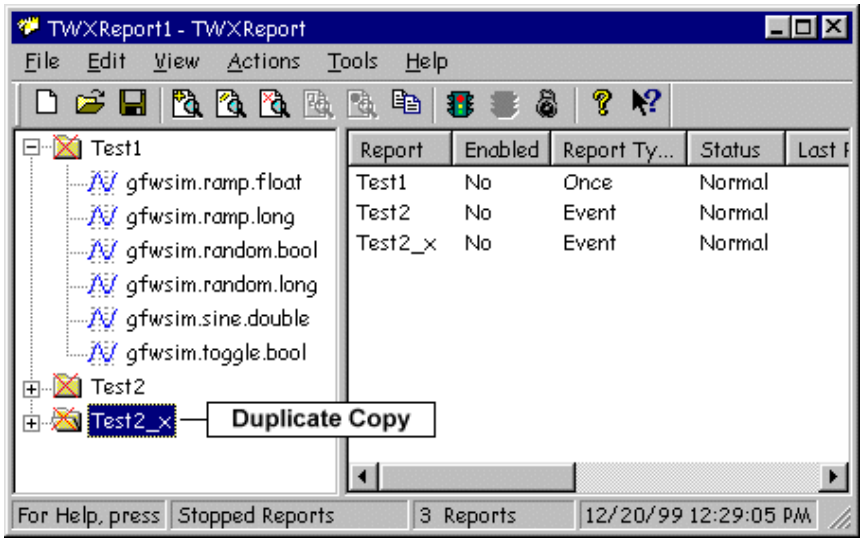
In configuration mode, you can also edit, delete, and copy a report using the **Edit** menu commands or the toolbar. Alternatively, you can select a report and right-click to display the configuration mode report inspector menu, as shown below.

The editing tabs in the **TWXReport** dialog box, shown below, are identical to the series of dialog boxes in the **Report Configuration Wizard.**



Editing a Report

To copy a report, select an existing report and click **Duplicate** on the **Edit** menu or the main toolbar. This will copy all the configuration data of the original report, modify the original report name, and reset the enabled flag, as shown below.



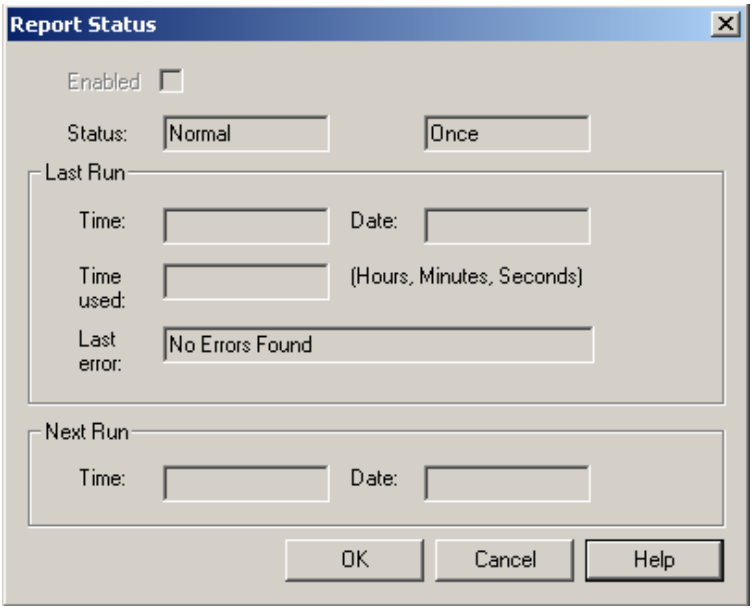
Copying a Report

Runtime Mode

To enter runtime mode, select **Start Reports** from the **Actions** menu. TrendWorx Reporting will enable scanning of all reports and process them accordingly. In addition, both the right-hand and left-hand panes will be updated to reflect the latest status of reports. In runtime mode, you can:

- Add new reports.
- Edit existing reports.
- Duplicate reports.
- Delete reports.
- Cancel reports.
- Get report status information.

You can fully edit or delete reports in runtime mode, as long as they are not running. If the reports are currently running, or are in "stand by" mode, they need to be cancelled first and then edited (or deleted). In addition, you can get runtime status information by clicking **Report Status** on the **Actions** menu. This opens the **Report Status** dialog box, shown below.



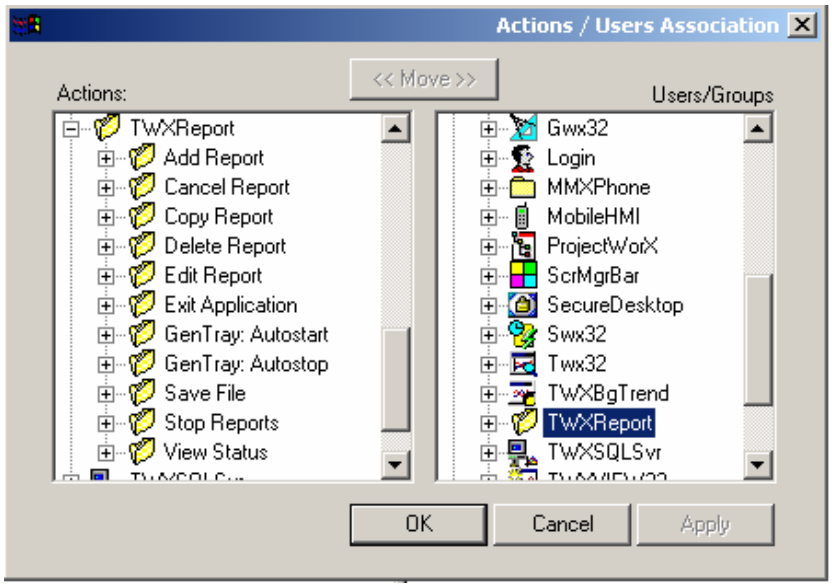
Report Status Dialog Box

TrendWorx Reporting is a multithreaded OLE Automation server, which allows for concurrent report processing. Within runtime, it allocates a pool of threads for simultaneous report scanning and processing. The number of threads can be adjusted via a registry setting. The default thread pool number is one worker thread. Note that if the target of all reports is an Excel worksheet, the reports will be serialized such that only one report accesses Excel at a time. In this case, you should *not* Increase the thread number used by TrendWorx Reporting in the registry. In addition, TrendWorx Reporting implements its own scheduling mechanism, which boosts the priority of reports when they are configured to run immediately.

Since TrendWorx Reporting may use the source database for creating temporary tables and actual report generated tables, it is very important that you allow for the source database to have enough disk space for TrendWorx Reporting to perform its table creation.

TrendWorx Reporting Security

TrendWorx Reporting is interfaced to the Smar Security Server and currently supports the following security actions within runtime mode, as shown in the figure below.



SMAR Security Server

GenEvent Registrar Integration

TrendWorx Reporting is interfaced to the GenEvent Registrar Server. If it is enabled within the GenEvent Registrar configuration tools, it will post events to the GenEvent Registrar and subsequently to the NT Event Logger. The following events will be posted:

- Started Reports (Severity 500 - Normal Event)
- Stopped Reports (Severity 500 - Normal Event)
- Error in Starting Reports (Severity 800 - Abnormal Event)
- Report Deleted (Severity 650 - Warning Event)
- Report Cancelled (Severity 650 - Warning Event)
- Report Executed (Severity 500 - Normal Event) if no errors occurred
- Report Executed (Severity 650 - Warning Event) if errors occurred

OLE Automation

The TrendWorx Reporting Application registers with the OLE ROT (Running Object Table) as a single-instance OLE Automation server. If it has started, all clients can connect to it by using a "GetObject" call (i.e. connecting to the running instance of reporting). The TrendWorx Reporting OLE Automation server currently supports the following OLE Automation properties and methods.

OLE Automation Properties

boolean Visible	Shows/hides application window.
boolean Maximized	Maximizes/minimizes application window.

OLE Automation Methods

void Refresh()	Redraws the view.
void Open(BSTR FileName)	Opens a configuration file.
void StartReports()	Starts runtime mode.
void StopReports()	Exits runtime mode.
booleanAreReports Running()	Returns true if in runtime mode.
voidClose(boolean SaveChanges, BSTR file)	Exits the report.

A set of new OLE automation methods has been added to allow for flexible report manipulation. For these OLE automation methods to be used effectively, you should call first the **GetReportNames** method to get a listing of all the currently available reports and then use automation to set the desired time span, etc. Depending on the status of each report or the periodic schedule, a VBA-enabled application can filter which reports will be available to the operator for manipulation. Note that the best way to make use of operator-based triggering of report execution within a VBA-enabled application, such as GraphWorx, is to configure immediate report types, and do not enable the desired reports. Then, the operator through the newly added OLE Automation support will be able to start or stop existing reports.

These methods are:

VARIANT GetReportNames()	Returns a Safearray with all the report names.
short GetReportStatus(BSTR ReportName)	Returns an enumerated type TWXREPORTSTATUS with the report status for each report by name, which can be of the following enumerated values: RptStatusOk = 0 RptStatusEditing = 1 RptStatusDeleting = 2 RptStatusExecuting = 3 RptStatusExiting = 4 RptStatusPaused = 5 RptStatusCancelled = 6 RptStatusStandby = 7 RptStatusNotFound = 8 RptStatusConfigErrors = 9 RptStatusConfigure = 10
short GetReportScheduleType(BSTR ReportName)	Returns an enumerated type TWXREPORTSCHEDULE with the desired report schedule type: RptNotFound = 0 RptImmediate = 1 RptOnce= 2

	RptPeriodic = 3 RptEvents = 4
boolean SetReportTimeSpan(BSTR ReportName, DATE StartDateTime, DATE EndDateTime)	Sets the report time range for immediate type of reports which currently are not executing.
boolean SetReportTarget(BSTR ReportName, BSTR ReportTarget)	Sets the report target name for the desired report. The report has to be disabled first using the DisableReport method if necessary.
short RunReport(BSTR ReportName)	Executes the desired report returning a TWXREPORTSTATUS status enumeration with the status of the report. Works only in runtime mode.
short StopReport(BSTR ReportName)	Stops execution of the desired report. Works only in runtime mode. It returns a TWXREPORTSTATUS status enumeration with the status of the report.
short AddNewReport(BSTR ReportName, BSTR ReportTargetName, long ReportDataFilter, long ReportFilterOrder, boolean Qualities, boolean CopyOver, long ProcessDataSecs, long ProcessDataMSecs)	Adds a new report with basic configuration settings. The report is initially disabled. It returns a TWXREPORTEDIT edit status code. The ReportDataFilter is of type GFWREPORT_DATA_FILTERS. The ReportFilterOrder parameter is used only in Moving filters, and the ProcessDataSecs, ProcessDataMSecs define the report processing interval for non-Raw reports
short SetReportCSVTarget(BSTR ReportName, BSTR ReportCSVPath, BSTR ReportCSVNumberFormat, boolean AddHeader, boolean CreateNewWithDate)	Sets the target of an existing report to be a .csv file. The report needs to be disabled first, and the ReportCSVPath refers only to the file path. It returns a TWXREPORTEDIT edit status code.
short SetReportEXCELTarget(BSTR ReportName, BSTR ReportXLSTemplate, BSTR ReportXLSPath, boolean PublishHTML, BSTR ReportHTMLPath, boolean UseXLSWKSheet, BSTR ReportWKSheetName, long ReportXLSRow, long ReportXLSColumn, boolean ReportAutoprint, boolean AddHeader, boolean ReportAutoFormat, boolean ReportXLSProtect, boolean ReportXLSEmail, BSTR ReportXLSEmailAddress, BSTR ReportXLSEmailSubject)	Sets the target of an existing report to be an Microsoft Excel workbook. The report needs to be disabled first, and the ReportXLSPath refers only to the file path. It returns a TWXREPORTEDIT edit status code.
short	Sets the target of an existing report to be a database

SetReportDBTarget(BSTR ReportName, BSTR DBConnString, long DBType, boolean CreateNewWithDate)	table. The report needs to be disabled first, and the DBConnString refers to an ADO ODBC connection string. It returns a TWXREPORTEDIT edit status code. The DBTYpe is of TWXREPORTSDBTYPE enumeration.
short SetReportImmediate(BSTR ReportName, DATE StartTime, DATE EndTime)	Sets the schedule of an existing report to be of Immediate type. The report needs to be disabled. It returns a TWXREPORTEDIT edit status code.
short SetReportOnce(BSTR ReportName, DATE DateToRun, DATE StartTime, DATE EndTime)	Sets the schedule of an existing report to be of Single execution type (Once). The report needs to be disabled. It returns a TWXREPORTEDIT edit status code.
short SetReportEvent(BSTR ReportName, BSTR EventCondition, long ReportRangeSecs, boolean StartFromLastTime)	Sets the schedule of an existing report to be of Event execution type. The report needs to be disabled. It returns a TWXREPORTEDIT edit status code. The EventCondition represents an OPC tag-based expression.
short SetReportHourly(BSTR ReportName, DATE TimeToRun, long Hours, long Minutes, long OffSetMinutes, boolean UseReportTimeSpan, long ReportTimeSpanSecs)	Sets the schedule of an existing report to be of periodic (Hourly) execution type. The report needs to be disabled. It returns a TWXREPORTEDIT edit status code. The UseReportTimeSpan enables the time range of the report not to be defined by the periodic interval but to be set by the user. The TimeToRun is the desired time of the first report execution.
short SetReportDaily(BSTR ReportName, DATE TimeToRun, long OffSetMinutes, boolean UseReportTimeSpan, long ReportTimeSpanSecs)	Sets the schedule of an existing report to be of periodic (Daily) execution type. The report needs to be disabled. It returns a TWXREPORTEDIT edit status code. The UseReportTimeSpan enables the time range of the report not to be defined by the periodic interval but to be set by the user. The TimeToRun is the desired time of the first report execution.
short SetReportWeekly(BSTR ReportName, DATE TimeToRun, long DayOfTheWeek, long OffSetMinutes, boolean UseReportTimeSpan, long ReportTimeSpanSecs)	Sets the schedule of an existing report to be of periodic (Weekly) execution type. The report needs to be disabled. It returns a TWXREPORTEDIT edit status code. The UseReportTimeSpan enables the time range of the report not to be defined by the periodic interval but to be set by the user. The TimeToRun is the desired time of the first report execution. The DayOfTheWeek refers to the day of the week for the report to execute (with Sunday = 1 and Saturday = 7).
short SetReportMonthly(BSTR ReportName, DATE TimeToRun, boolean FirstDayOfWeek, long OffSetMinutes, boolean UseReportTimeSpan, long ReportTimeSpanSecs)	Sets the schedule of an existing report to be of periodic (Weekly) execution type. The report needs to be disabled. It returns a TWXREPORTEDIT edit status code. The UseReportTimeSpan enables the time range of the report not to be defined by the periodic interval but to be set by the user. The TimeToRun is the desired time of the first report execution. The DayOfTheWeek refers to the day of the week for the report to execute (with Sunday = 1 and Saturday = 7).
short EnableReport(BSTR ReportName)	Enables a given report for execution.

short DisableReport(BSTR ReportName)	Disables a given report for execution.
short AddReportTag(BSTR ReportName, BSTR TagLoggingName, BSTR TagDescrText, BSTR TagEngUnits, BSTR TagDBConnString, long DBType , BSTR TagDBaseGroupName, BSTR TagLogGroupName, long TagDBHandle)	Adds a a new report tag to an existing report. The report needs to be disabled. It returns a TWXREPORTEDIT edit status code. The TagLoggingName is the one defined in the TrendWorx Configurator, while the TagDBConnString parameter refers to the ADO ODBC connection string for the historical database. The TagDBHandle parameter is the index of the specific tag in the _Tags table of the historical database.
short DeleteReport(BSTR ReportName)	This method deletes a report. The report needs to be disabled. It returns a TWXREPORTEDIT edit status code.
short SetReportTotalizerParams(BSTR ReportName, long TotalizerUnits, long TotalizerType, long TotalizerDirection, double TotalizerValue, double TotalizerAutoResetLevel)	This method sets the Totalizer filter related parameters. The TotalizerUnits can be any of: Seconds = 0 Minutes = 1 Hours = 2 Days = 3 The TotalizerType can be of type: Continuous = 0 PreLoad = 1 Preset = 2 The TotalizerDirection can be 0, for counting upwards, or 1 for counting downwards The Totalizer value is simply the Preload or Preset value depending on the Totalizer type.

For these OLE automation methods to be used effectively, you should call first the **GetReportNames** method to get a listing of all the currently available reports and then use automation to set the desired time span, etc. Depending on the status of each report or the periodic schedule, a VBA-enabled application can filter which reports will be available to the operator for manipulation. Note that the best way to make use of operator-based triggering of report execution within a VBA-enabled application, such as GraphWorx, is to configure immediate report types, and do not enable the desired reports. Then, the operator through the newly added OLE Automation support will be able to start or stop existing reports.

Example
The sample code below adds a simple MS EXCEL Report:

```
Private Sub cmdReports_Click()
Dim reports As TWXReport.Document
Set reports = GetObject(, "TWXReport.Document")

'Add a report
reports.AddNewReport TextBox1.Text, TextBox1.Text, TWXReport.Raw, 8, False, False, 60, 0
reports.SetReportImmediate TextBox1.Text, Now, Now - 1
reports.SetReportEXCELTarget TextBox1.Text, "D:\Logging Tests\TWX EXCEL Templates\Production -- Daily Yield.xlt", "D:\Logging Tests\Test Reports", False, "", False, "", 3, 3, False, True, True, False, False, "", ""
```

```
'Add a tag
reports.AddReportTag TextBox1.Text, "SimulatePLC.Random", "SimulatePLC.Random", "", "Provider=MSDASQL.1;Extended Properties=""DSN=TWXREPORT_MSJET;DBQ=D:\Logging Tests\Logging Data\TWXREPORT_MSJET.mdb;DriverId=25;FIL=MS Access;MaxBufferSize=2048;PageTimeout=5;UID=admin;""", 1, "MSJET", "JetGroup", 3

'Execute Report
reports.StartReports
reports.EnableReport TextBox1.Text
reports.RunReport TextBox1.Text
```

ProjectWorx Support

Several new OLE Automation methods have been added to facilitate ProjectWorx deployment and WebHMI enhanced support:

1. **ReplaceStringInString(**
   StringToReplace as String,
   OldSubstring as String,
   NewSubstring as String
) as String

2. **ReplaceHost(**
   OldHostName as String,
   NewHostName as String
) as Long

3. **ReplaceFilePath(**
   OldSubstring as String,
   NewSubstring as String
) as Long

4. **ReplaceTag(**
   OldSubstring as String,
   NewSubstring as String
) as Long

5. **ReplaceHostEx(**
   OldHostNameSubstring as String,
   NewHostNameSubstring as String
   MatchCase as Boolean,
   MatchWholeWord as Boolean
) as Long

The ReplaceHostEx with parameters MatchCase=False & MatchWholeWord=True works exactly the same as the ReplaceHost() function.

The following is a simple example of using the new OLE automation methods of TrendWorx Reporting added for Version 7.0. It assumes that the TrendWorx Reporting application is already running. If not, a Shell command can be used to start it.

```
Private Sub cmdReports_Click()
Dim reports As TWXReport.Document
Set reports = GetObject(, "TWXReport.Document")
```

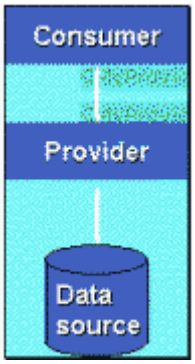
```
'Add a report
reports.AddNewReport “MyReport”, “MyReport”, TWXReport.Raw, 8, False, False, 60, 0
reports.SetReportImmediate “MyReport”, Now, Now - 1
'reports.SetReportEXCELTarget “MyReport”, "D:\Logging Tests\TWX EXCEL Templates\Production -- Daily Yield.xlt", "D:\Logging Tests\Test Reports", False, "", False, "", 3, 3, False, True, True, False, False, "", ""
reports.SetReportCSVTarget “MyReport”, "D:\Logging Tests", "x.xxxxx", False, False

'Add tags
reports.AddReportTag “MyReport”, "SimulatePLC.Random", "SimulatePLC.Random", "", "Provider=MSDASQL.1;Extended Properties=""DSN=TWXREPORT_MSJET;DBQ=D:\Logging Tests\Logging Data\TWXREPORT_MSJET.mdb;DriverId=25;FIL=MS Access;MaxBufferSize=2048;PageTimeout=5;UID=admin;""", 1, "MSJET", "JetGroup", 3

' Get Report Names
Dim ReportNames As Variant
ListBox1.Clear
ReportNames = reports.GetReportNames
For i = LBound(ReportNames) To UBound(ReportNames)
   ListBox1.AddItem ReportNames(i)
Next i

'Execute Report
reports.StartReports
reports.EnableReport “MyReport”
reports.RunReport “MyReport”

'Delete Report
'reports.DeleteReport MyReport

End Sub
```

TrendWorx OLE DB Provider

OLE DB is the dominant data access methodology from Microsoft that allows high-performance data access from any data source. Any tabular data is viewable through OLE DB regardless of whether it came from a database. This flexibility gives developers a tremendous amount of power.

In version 7.0, the TrendWorx OLE DB Provider includes the following new features:

- New database connection dialog
- Enhanced data retrieval support



OLE DB Architecture

The design of OLE DB includes the concept of consumer and provider. The figure above shows a graphical representation of the OLE DB system. The consumer represents the traditional client. The provider places data into a tabular format and returns it to the client. A provider is a set of COM components that contains a series of interfaces. Because these are standard interfaces, any OLE DB consumer can access data from any provider. Since providers are COM objects, consumers can access them in any language (C++, Basic, Java, and so on).

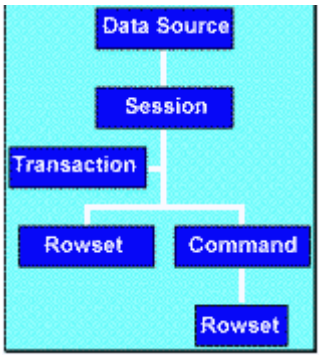
ADO is a lightweight object set for accessing data from any OLE DB provider, using a consistent API within any programming language and or environment.

The TrendWorx SQL Server application, which is SMAR' next-generation enterprise data-logging and historical data server, uses relational databases as storage media to log process historical data. The historical data can be accessed through a variety of methods, such as:

- Using the OPC Historical Data Access interface which is supported in TrendWorx SQL Server
- Using the TrendWorx SQL Tool ActiveX Control to retrieve process data in a VBA-scripting environment
- Using the TrendWorx Reporting, which creates a variety of historical data reports in databases, .csv and .txt files, and Excel
- Using ADO within any programming environment to parse TrendWorx SQL Server historical tables

The SMAR TrendWorx OLE DB Provider, which encapsulates all the work needed to retrieve historical data spanning multiple historical data tables, interpolate and or extrapolate for missing values, and perform custom averaging of data over desired time periods.

OLE DB providers are a set of COM objects that transfer data from a durable source to a consumer. The OLE DB provider places those data in a tabular format in response to calls from a consumer. Providers can be simple or complex. A provider may return a table, allows the client to determine the format of that table, or perform operations on those data. Each provider implements a standard set of COM objects to handle requests from the client. A provider may implement optional COM objects to provide additional functionality. The figure below shows the different COM objects a provider may implement.



COM Components in an OLE DB Provider

mponent	Interfaces	Comments
Data Source	[mandatory] **IDBCreateSession** [mandatory] **IDBInitialize** [mandatory] **IDBProperties** [mandatory] **IPersist** [optional] **IDBDataSourceAdmin** [optional] **IDBInfo** [optional] **IPersistFile** [optional] **ISupportErrorInfo**	Connection from the consumer to the provider. The object is used to specify properties on the connection, such as user ID, password, and data source name. The object can also be used to administer a data source (create, update, delete, tables, and so on).
Session	[mandatory] **IGetDataSource** [mandatory] **IOpenRowset** [mandatory] **ISessionProperties** [optional] **IDBCreateCommand** [optional] **IDBSchemaRowset** [optional] **IIndexDefinition** [optional] **ISupportErrorInfo** [optional] **ITableDefinition** [optional] **ITransaction** [optional] **ITransactionJoin** [optional] **ITransactionLocal** [optional] **ITransactionObject**	The session object represents a single conversation between a consumer and provider. It is somewhat similar to the ODBC HSTMT in that many sessions can be active simultaneously. The session object is the primary link to get to OLE DB functionality. In order to get to a command, transaction, or rowset object, you go through the session object.
Command	[mandatory] **IAccessor** [mandatory] **IColumnsInfo** [mandatory] **ICommand** [mandatory] **ICommandProperties** [mandatory] **ICommandText** [mandatory] **IConvertType** [optional] **IColumnsRowset** [optional] **ICommandPrepare** [optional] **ICommandWithParameters** [optional] **ISupportErrorInfo**	The command object handles operations on data such as queries. It can handle statements with or without parameters. The command object is also responsible for handling bindings for parameters and output columns. A binding is a structure that contains information about how a column, in a rowset, should be retrieved. It contains information such as ordinal, data type, length, status, and so on.
Rowset	[mandatory] **IAccessor** [mandatory] **IColumnsInfo** [mandatory] **IConvertType** [mandatory] **IRowset** [mandatory] **IRowsetInfo** [mandatory] **IRowsetIdentity** [optional] **IColumnsRowset** [optional] **IConnectionPointContainer** [optional] **IRowsetChange** [optional] **IRowsetLocate** [optional] **IRowsetResynch** [optional] **IRowsetScroll** [optional] **IRowsetUpdate** [optional] **ISupportErrorInfo**	The rowset object represents the data from the data source. The object is responsible for the bindings of that data and any basic operations (update, fetch, movement, and so on) on the data. You will always have a rowset object to contain and manipulate data.
Transaction	[mandatory] **IConnectionPointContainer**; [mandatory] **ITransaction** [optional] **ISupportErrorInfo**	The transaction object defines an atomic unit of work on a data source and determines how those units of work relate to each other. This object is not directly supported by the OLE DB provider templates. That is, you create your own object.

COM Components and Their Uses
Each COM component represents a series of COM interfaces. Some COM interfaces are mandatory, while others are optional. By implementing the mandatory interfaces, a provider guarantees a minimum level of functionality that any client should be able to use. By implementing the optional interfaces, a provider can have more functionality and a richer feel to the client. The client should always call "QueryInterface" to determine whether a provider supports a given interface.

The Smar TrendWorx OLE DB Provider is a simple read-only provider, which implements all of the mandatory interfaces listed in the table above, with the exception of the transaction-based component. Smar TrendWorx OLE DB Provider supports, among others, the following:

- Similar historical replay functionality to the OPC Historical Data Access specification
- Raw or time-processed data-retrieval over a user-defined time interval
- Multiple historical tag data retrieval
- Dedicated "trend SQL" query parsing and execution capability
- Historical database browsing/prompting capability
- Schema information support for the "Recordset" structure it returns
- Support for a "MaxRecords" property to limit the total number of returned samples
- Multiple historical data filter support

The Smar TrendWorx OLE DB Provider internally uses a high-speed data-retrieval mechanism based on the native OLE DB providers for the historical databases configured in the TrendWorx SQL data-logging server.

Using Smar TrendWorx OLE DB ProviderIDH_Using_the_Iconics_TWX_OLE_DB_Provider

Using TrendWorx OLE DB Provider

In this section, we will discuss how SMAR TrendWorx OLE DB Provider can be used to retrieve data from the TrendWorx SQL Server historical database capability.

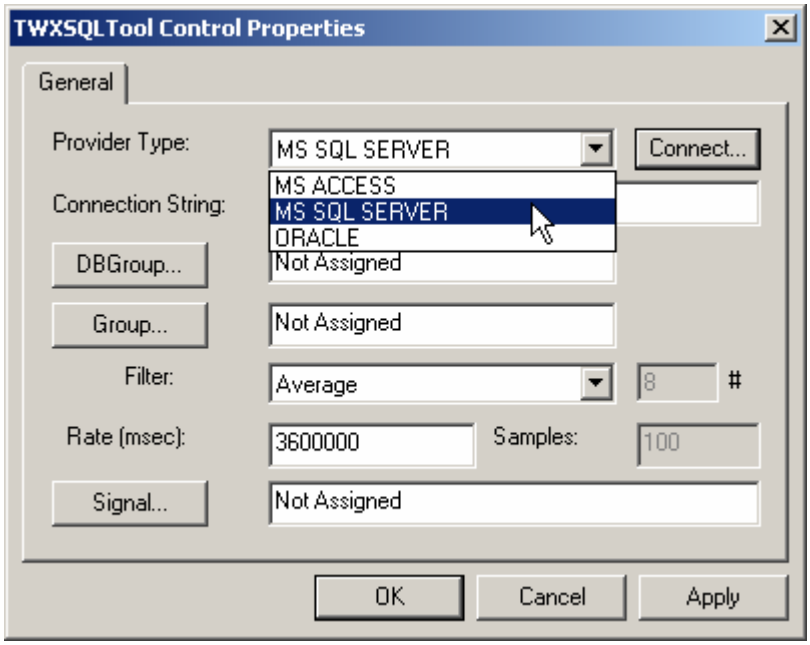
Connecting to TrendWorx OLE DB Provider

To connect to SMAR TrendWorx OLE DB Provider, you must set the corresponding properties or ask the provider to prompt and provide database navigation and browsing tools.

In order to have the provider prompt, a typical VBA type of code would be:

```
Dim twx As New ADODB.Connection
' Set Provider
twx.Provider = " SMAR.TWXOLEDB "
' Set up for Prompting
twx.Properties("Prompt") = 1
'Open Connection
twx.Open
```

Use the **TWXSQL Tool Control Properties** dialog box, shown below, to connect to a database. This dialog box has only one tab, the **General** tab shown below, which prompts you to complete the configuration.



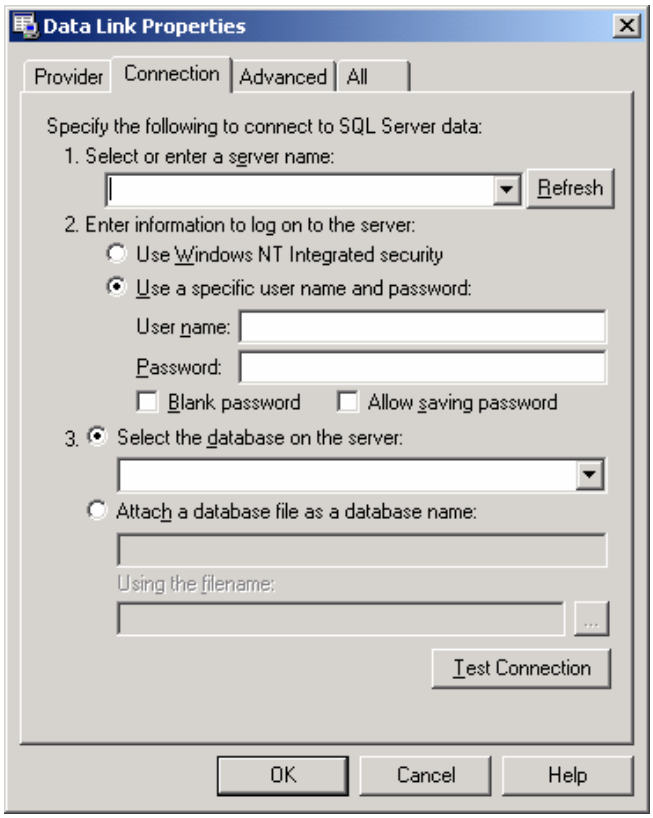
TWXSQL Tool Control Properties Dialog Box

To configure the SQL Tool control, from the **Provider Type** list box in the **TWXSQL Tool Control Properties** dialog box, select the OLE Database (DB) Provider type relating to the TrendWorx historical database. Currently, the following OLE DB Providers are supported:

- Microsoft Access
- Microsoft SQL Server
- Oracle

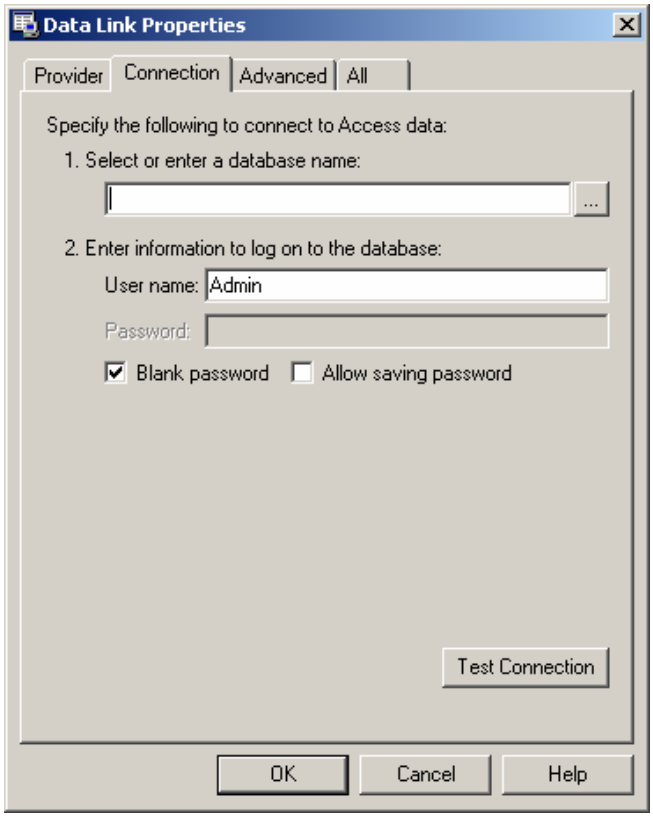
When you select a database type and then click **Connect,** the corresponding OLE DB Provider configuration dialog box opens, as shown below.

For Microsoft SQL Server, select a server name, an authentication type (Windows NT Integrated Security or user name and password), and the desired historical database, as shown in the figure below.



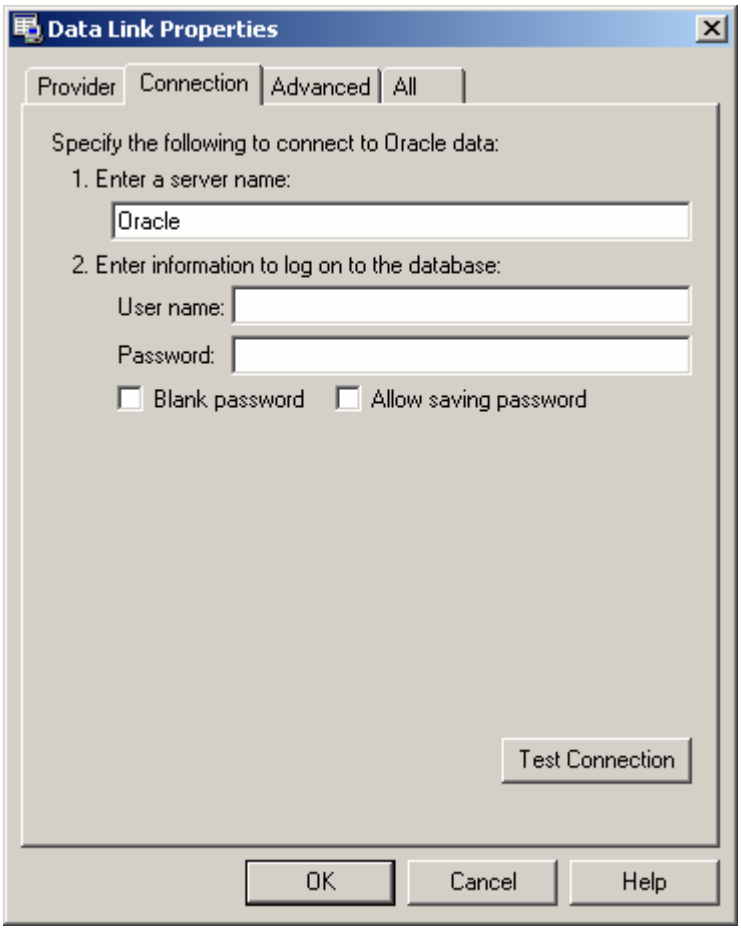
OLE DB Provider Configuration for SQL Server Databases

For Mirosoft Access connections, simply navigate to the desired .mdb file by clicking on the browser button, as shown in the figure below.



OLE DB Provider Configuration for Microsoft Access Databases

To connect to an Oracle database, fill in the appropriate information, as shown in the figure below.



OLE DB Provider Configuration for Oracle Databases

To increase speed and efficiency, the Smar TrendWorx OLE DB Provider establishes a connection on a per-data-logging group basis and retrieves data for the historical tags in that group. You can always close an existing connection, set different properties and reopen the connection to retrieve data for a different group of historical tags.

Alternatively, you can set the required properties for opening a connection of the SMAR TrendWorx OLE DB Provider individually. These properties are:

Data source. For a Microsoft Access historical database, the data source is the complete path (including the file name) of the Microsoft Access .mdb file. For a Microsoft SQL Server historical database, the data source is the server name used for local SQL server installation. If the Microsoft SQL Server is installed locally, the server name will be "(local)."

Password. The required password. If the underlying historical database is a Microsoft SQL Server database, and no password is defined, the SMAR TrendWorx OLE DB Provider will attempt to use NT integrated security.

User ID. The user ID name (if required).

Location. If the underlying historical database is a Microsoft SQL Server database, this property will be used for storing the initial catalog (i.e. the default SQL server database) for the connection to the historical database.

Extended properties. This is a dedicated SMAR TrendWorx OLE DB Provider string that is formulated as follows:

TWXPROVIDER=provider;TWXDBASE=database group;TWXGROUP=group;

"Provider" is the internal OLE DB Provider name (i.e. SQL OLE DB for Microsoft SQL Server, or Microsoft.Jet.OLEDB.4.0 for Microsoft Access historical database)

"Database group" is the historical database group.

"Group" is the desired group of historical tags under the database group for which the provider will retrieve data.

Using the properties listed above, you can also connect to the SMAR TrendWorx OLE DB Provider through ADO in the following ways:

Dim twx As New ADODB.Connection

' Set Provider

twx.Provider = " SMAR.TWXOLEDB "

' Set up Properties

twx.Properties("Prompt") = 0

twx.Properties("Data Source") = “(local)”

twx.Properties("Password")=””

twx.Properties("User ID")=””

twx.Properties("Extended Properties")=
”TWXPROVIDER=sqloledb;TWXDBASE=MyFirstDBase;TWXGROUP=LoopX;”

twx.Properties("Location")=”TWXSQL_TEST_1”

'Open Connection

twx.Open

This code assumes the following:

- The historical database is a Microsoft SQL Server database.
- A trusted connection is used.
- The SQL Server database where the historical data are logged is called "TWXSQL_TEST_1."
- The Microsoft SQL Server is located on the local workstation.

In addition to the above properties, the SMAR TrendWorx OLE DB Provider supports language aliasing by making its resources available in a resource .dll. When translating the resources, do *not* translate the strings related to the default properties of the provider.

Retrieving Historical Data

TrendWorx Reporting Version 7.0 has been updated to be compliant with the latest OPC HDA specification 1.2. Although TrendWorx Reporting is not a direct OPC HDA client or server, it cretaes reports with data outputs as specified by the OPC HDA specification.

New for version 7.0 is an enhanced data-retrieval system, which utilizes a new approach to creating historical reports. The following is a summary of the changes for version 7.0:

- Data filter selection other than Raw will result in data time stamped at the beginning of each subinterval.
- When retrieving data using data filters other than Raw, subintervals for which there are no data because of no data-logging activity will be marked as “empty” slots at the corresponding time with a zero value. You can check the returned qualities for further processing.

- The historical qualities supported are as follows:
  - o OPCHDA_EXTRADATA 0x0001
    - ❑ More data may exist
  - o OPCHDA_INTERPOLATED 0x0002
    - ❑ Interpolated data value
  - o OPCHDA_RAW 0x0004
    - ❑ Raw data value
  - o OPCHDA_CALCULATED 0x0008
    - ❑ Calculated data value
  - o OPCHDA_NOBOUND 0x0010
    - ❑ No data found to provide upper or lower bound
  - o OPCHDA_NODATA 0x0020
    - ❑ No data collected. Archiving not active
  - o OPCHDA_DATALOST 0x0040
    - ❑ Calculation started/stopped/lost
  - o OPCHDA_CONVERSION 0x0080
    - ❑ Scaling / conversion error
  - o OPCHDA_PARTIAL 0x0100
    - ❑ Aggregate value is for an incomplete interval

Critical Note
Because of the new compliance changes in historical replay and reporting, a version 7.0 historical replay or reporting may not produce identical results to existing 6.1x version reports and or historical replay screen captures for the same signals and time periods.

The SMAR TrendWorx OLE DB Provider supports a minimal set of “trend SQL” keywords that can be used to formulate “trend” queries in order to retrieve historical data. A typical “trend” SQL statement may look like the following:

Select=Device1.Group.Tag1,Device1.Group.Tag10;Filter=MaxTime;
SubInterval=10000; Start=1999/6/16, 18:00:00; End=1999/6/16, 18:10:00;

Select=tag1,tag2,…,tagn

This specifies the desired historical tags to participate in the query. If the `*' is used instead (e.g. Select=*,), without other keywords, the SMAR TrendWorx OLE DB Provider will return information relating to the properties of the historical tags, such as device point name, logging name, and units. Note that in this query the logging names of the historical points should be used.

Filter=filter type;
This specifies the desired historical data-processing filter to be used when retrieving data historical data. The supported filter types are:

- Raw (all values are retrieved)
- Average
- Min
- Max
- StDev
- MinTime (minimum values with actual time stamp)
- MaxTime (minimum values with actual time stamp)
- Last (decimated value)
- AllStat (maximum, minimum, standard deviation, and average over entire time span)
- Total (summary of values)

- Running Min
- Running Max
- Running Average (exponentially weighted moving average)
- Moving Average
- Moving Min
- Moving Max

If no "Filter" value is specified, the SMAR TrendWorx OLE DB Provider will retrieve all raw data-logged values.

SubInterval=interval;
This specifies the interval (in msec) between processed samples. The SMAR TrendWorx OLE DB Provider will process all samples, which have time stamps within a time interval to compute the corresponding sample with the desired filter. It is ignored if the data-retrieval filter is set to "Raw" or "AllStat." If it is set to 0, all historical samples within the search time interval will be included in creating a “processed” sample, which will be returned to the user.

Note that when the data filter is set to "Raw," the SMAR TrendWorx OLE DB Provider will return all historical samples, which fall within the search time interval using the original time stamp that was data-logged. On the other hand, if it is not set to "Raw," the SMAR TrendWorx OLE DB Provider will divide the search time interval into subintervals of "SubInterval" duration and “process” all samples that fall within each subinterval to calculate a “processed” sample to return.

Start=yyyy/mm/dd, hh:mm:ss;
This specifies the starting time for retrieving historical data, and it has to match the indicated format. If it is not specified, the time search will include all historical values starting at the beginning of the historical data

End=yyyy/mm/dd, hh:mm:ss;
This specifies the ending time for retrieving historical data, and it has to match the indicated format. If it is not specified, the time search will include all historical values up to the most recent ones

Important Notes
If any or both of the start and end dates are not specified, the SMAR TrendWorx OLE DB Provider will perform an exhaustive database search to retrieve all samples in the database, or those samples starting from the start date or ending prior to the end date. Because this can be an extremely time-consuming operation, it is suggested that you use the "MaxRows" property of the provider to establish a limit to the total number of retrieved samples.

Note
The Unicode version has enhanced language aliasing support, including automatic value scaling. You need to configure the SMAR Language Server, as well as configure language aliases in the TrendWorx Configurator. Once all language aliases are configured, you can use the LCID property of the SMAR TrendWorx OLE DB Provider connection to set the desired language settings.

Returned Recordset Structure

The SMAR TrendWorx OLE DB Provider returns the following recordset structure (column names):

TagLoggingName	A variable length text column displaying the logging name of the tag.
TagPointName	A variable length text column displaying the actual point name of the tag.
TimeDate	A "date" type showing the time stamp.
Msecs	A "long" type indicating the msec accuracy of the time stamp.
Value	A "double" type indicating the value of the sample.
OPCDataQuality	A "long" type indicating the OPC data access quality of the sample.
OPCHDAQuality	A "long" type indicating the OPC data access quality of the sample.
QualityText	A variable-length "text" type indicating the quality string related to the combined data and historical quality values.
DataFilter	A variable-length "text" type indicating the data filter type, such as "Raw," used in retrieving the data.
EngUnits	A variable-length "text" type indicating the "EngUnits" of the tag.

Important Note
In the case that only the tags under the desired logging group are returned (that is, when Select=*) the "DataFilter" column will contain the data-logging filter for the tag. See the TrendWorx SQL Server documentation for more information.

A code sample for opening a recordset to return all tags data-logged in a particular group and to display their logging name might be as follows:

```
Dim rstwx As New ADODB.Recordset
Dim strLoggingName As String

' Set Recordset properties
rstwx.CursorType = adOpenForwardOnly
rstwx.LockType = adLockReadOnly
' Set cache size
        rstwx.CacheSize = 100
' Open Recordset
        rstwx.Open "Select=*;", twx, , , adCmdText

‘ Process Records
Do While Not rstwx.EOF
    strLoggingName = rstwx!TagLoggingName
rstwx.MoveNext
Loop

' Close Recordset
If rstwx.State = adStateOpen Then
  rstwx.Close
End If

End Sub
```

In this case, "twx" is the SMAR TrendWorx OLE DB Provider ADO connection object we just opened.

Example Application Using TrendWorx OLE DB Provider

In order to provide a sample application using the SMAR TrendWorx OLE DB Provider, SMAR has created a sample VBA application to demonstrate its use. It is located under the PROCESSVIEW "Examples" directory in the "TrendWorx Examples" folder, and it is called "TrendOleDB.t32." This file consists of a main form, which is shown below. Click **Connect** to connect to a TrendWorx SQL Server historical database. Click **Signal Info** to retrieve the data-logged signal for a particular group. You can also build a trend query and execute it to retrieve historical data.

To prepare for the example, you must:

- Set the PROCESSVIEW working directory to be "TrendWorx Examples\TrendWorX Data Logging and Reporting," where the examples are installed. (For example you can use the **Set Working Directory** command in the **Tools** menu of the TrendWorx Container.
- Make sure that none of the files in this folder has a read-only attribute.

Once you have completed these steps, do the following:

1. Start the TrendWorx Container.

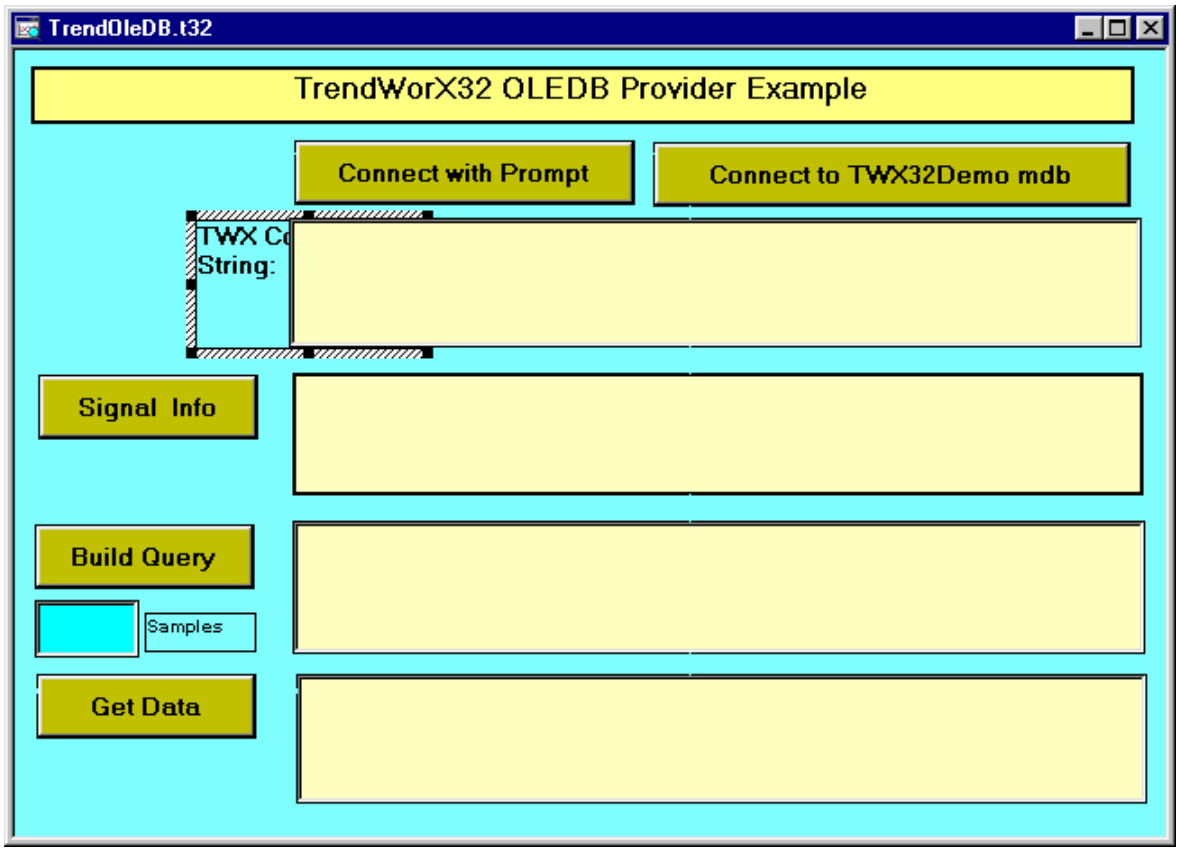
2. Load the TrendOleDB.t32 display into TrendWorx.

3. Enter animation mode.

4. Click the various buttons to retrieve TrendWorx historical data using the SMAR TrendWorx OLE DB Provider.

5. When prompted, you can select Microsoft Access as the historical database type and enter "Twx32Demo.mdb."

6. You can now start data logging, stop data logging, and retrieve historical data.



Sample Visual Basic Application for the TrendWorx OLE DB Provider

Chapter 07

Viewer ActiveX

Introduction

The TrendWorx Viewer ActiveX is an OPC client application that provides both real-time trending as well as historical data trending within the ProcessView product family. It can also be used with third-party OPC server applications to provide excellent trending features.

Features of the TrendWorx Viewer include:

- Real-time data displays.
- Historical data displays.
- Data utility functions.
- Sophisticated, multithreaded data buffering to guarantee data integrity with support for customer-configurable data-collection rates.

TrendWorx Viewer is interfaced to display memory-based historical data from the Smar Persistent Trending memory-based data-logging OLE Automation server, as well as historical servers supporting the OPC HDA (Historical Data Access) Interface, such as the Smar TrendWorx SQL Server.

TrendWorx Viewer ActiveX Component

TrendWorx Viewer ActiveX includes the following features:

- Highly customizable component
- Fast data replay
- Independent data collection/screen refresh mechanism
- Full exposure through OLE Automation objects, such as:
    - Title
    - X-grids
    - Y-grids
    - Ranges/*x*-axis ranges (for XY plots)
    - Details
    - Time settings
    - Statistics
    - Pens
- Extensive runtime configuration
- Built-in buffering system
- Integration with the Smar Security Server
- Support for custom imported data
- Multilingual support
- Interface to OPC Real-Time servers
- Easy Visual Basic integration
- Drag-and-drop support during runtime

- Extensive real-time signal information (including signal quality)
- Expression handling
- Real-time statistical information with .csv file support
- User-configured alarm levels for signals
- User-defined global or relative signal ranges
- Fixed location or scrolling grids
- Embedded signal simulator
- Support for multiple plot types, including:

  * Time plots
  * XY-plots
  * Bar plots
  * Logarithmic plots
  * Strip charts
  * Circular charts

- Custom data displaying
- Global aliasing with browsing support
- Language aliasing with browsing support
- Latest HDA compliance support

New Features

The TrendWorx Viewer ActiveX has many new features, including:

- Global aliasing with browsing support
- Language aliasing with browsing support
- Latest HDA compliance support
- Enhanced daylight savings time support for historical replay
- Reordering on Trend pens
- TraceWorX debug tracing support
- Enhanced expression support
- Progress indicator dialogs for potentially time consuming pen connections or historical updates

Note
TrendWorx up to and including Version 6.1x is using the Windows-based APIs for converting a time from local time to UTC or from UTC to local time. The Windows APIs do not correctly adjust the conversion for the daylight savings time if the timestamp to be converted was obtained from a different time period (i.e. it was obtained in "summer" time but now we have "winter" time). TrendWorx Version 7.0 has new time conversion utilities that account for this discrepancy. There are, however, some things to consider:

- These functions are used by default (no user enabling is required).
- This is what they do in order to convert each time stamp:

  o They check Windows for the PC Time Zone Settings and to see if automatic daylight savings is enabled.
  o They also obtain from Windows the times/dates for switching over. (These dates do not change; they are in the form of, e.g., the first Sunday of April.)

- Depending on the previous information, the new functions properly adjust the conversion times to compensate for daylight savings time.

Using the TrendWorx Viewer ActiveX

The TrendWorx Viewer ActiveX component integrates easily into Visual C++ or Visual Basic container applications. The Smar ProcessView containers, such as GraphWorx, provide Toolbar support for inserting the TrendWorx Viewer ActiveX. Once inserted into a document or a form, the TrendWorx Viewer ActiveX can be resized and configured.

Within the Smar ProcessView containers and in Visual Basic forms, the component is initially placed in design mode. In design mode, you can configure the TrendWorx Viewer ActiveX using the **TWXView32 ActiveX Properties** dialog box. Once the application is committed to runtime mode, the **Trend Viewer** toolbar is activated. In addition, it becomes a drop target for text and therefore can establish signal connections through drag-and-drop.

The TrendWorx Viewer ActiveX configuration data are saved directly in the container form or within its own streamed file format with the file extension .v32. You must provide a valid file name before the data are serialized and saved. TrendWorx Viewer uses the concept of a “working directory,” defined in the Smar ProcessView containers (such as GraphWorx). This represents the working directory where project files and configuration files will be stored. TrendWorx Viewer will use this directory as a starting point for saving and loading its configuration files.

Connections

The TrendWorx Viewer can display data from real-time signals connected to OPC servers, calculated variables (using expressions), Smar simulated data and custom (user-fed) data through OLE Automation, or historical data connected to OPC HDA servers (such as SMAR TrendWorx SQL Server).

Signal connections can be established in various ways:

- In configuration mode, through the **Pens** tab of the **TWXView32 ActiveX Properties** dialog box
- In runtime mode, through the **Edit Pens** button on the **Trend Viewer** toolbar
- Using OLE Automation methods (such as "AddRealTimePen" and "AddHistoryPen") and VB Script/VBA
- Using drag-and-drop (text format), in runtime mode only

Once a signal is connected to a TrendWorx Viewer pen, the TrendWorx Viewer adds the pen to its buffering system manipulation and starts data collection and data display. To configure a pen to display a calculated variable, click **Tags Menu** and select **Expression Editor.** This opens the **Edit Expression** dialog box. In the **Edit Expression** dialog box, click **Tags** to open the **OPC Universal Tag Browser,** which enables you to connect pens to real-time OPC server signals.

To connect a real-time pen to a signal using drag-and-drop, the TrendWorx Viewer must be activated and in runtime mode. The drag-and-drop object should be of text type.

The TrendWorx Viewer ActiveX utilizes the SMAR thin wrapper OLExpress to communicate to OPC servers, therefore providing a very fast and efficient mechanism for real-time data acquisition and display.

To display only historical data, select **History Only** in the **Pens** tab of the **TWXView32 ActiveX Properties** dialog box. Connections to the historical signals can be made by selecting **History Tag** from the **Tags Menu** to view all of the available OPC HDA servers. In addition to real-time and historical data, the TrendWorxViewer also supports the custom pen type through OLE Automation. This pen can be fed with user data using OLE Automation methods.

Runtime Mode Operations

The **Trend Viewer** toolbar, shown below, enables you to modify the trend display during runtime mode.

Trend Viewer Toolbar

During runtime mode, the TrendWorx Viewer provides support for the following functions:

- Adding, deleting, and editing a pen.
- Freezing or unfreezing the Trend display (does not halt data collection).
- Editing trend options, such as grids, ranges, cursor step, and language resources.
- Editing the trend period or data-collection rates. Note that by changing data period, TrendWorx Viewer may modify the data- collection rate in order not to exceed the configured number of samples.
- Displaying statistical information for all the pens regarding the displayed values. This statistical information can be stored in a .csv file. You first need to provide a valid file name for the function to work.
- Zooming on a specific region of a trend when the trend is in **Freeze Mode.** You can zoom by pressing the left mouse button while holding down the **SHIFT** key and selecting the area you on which you would like to zoom. Clicking the left mouse button on the trend display undoes the zoom. In addition, there is Point and Click support for zooming by clicking the Zoom Trend button on the **Trend Viewer** toolbar.
- Scanning the range of a trend by using the cursor to view specific sample values.
- Selecting the focus pen, which is the pen whose details and (if desired) range information will be displayed first in the TrendWorx Viewer.
- Retrieving and replaying from the TrendWorx Persistent Trending server.
- Paging forward and backward in time.
- Time shifting for comparison of pens.

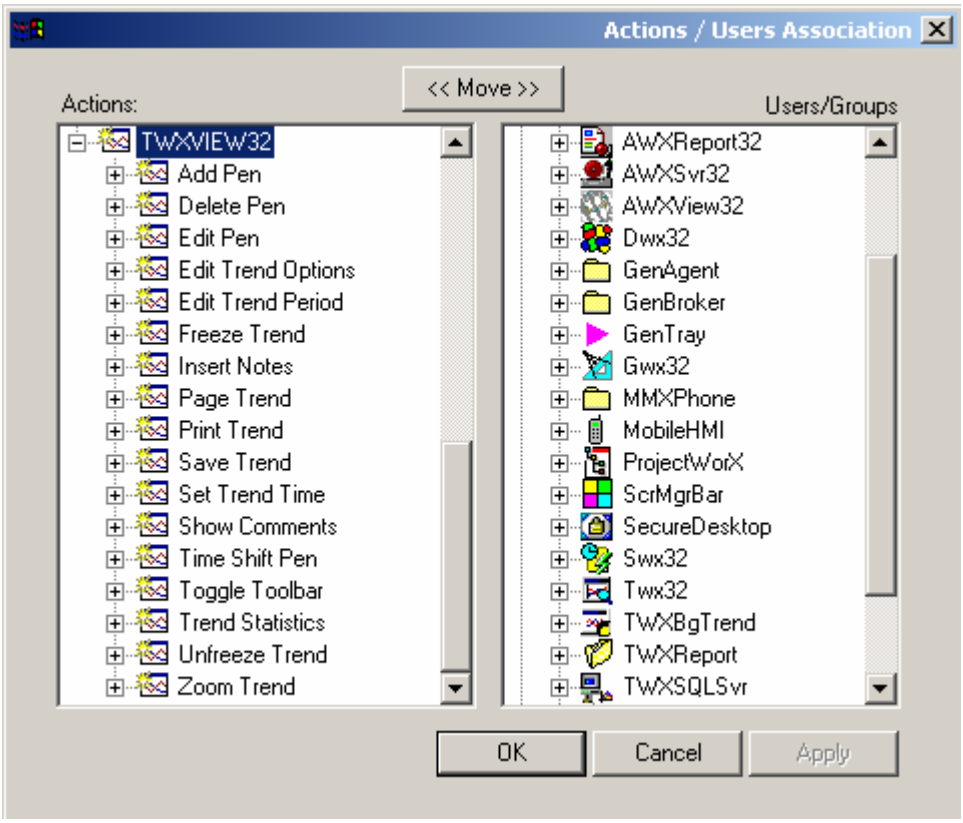
Functions Not Supported in Runtime Mode

The following functions are not supported in runtime mode:

- Replacing point names (You should use delete/add, or within the VBA environment, use the "FormLoad" event for replacing point names.)
- Changing the trend plot type
- Getting to the Time Settings object through the OLE interface
- Modifying the *x*-axis of XY plots
- Modifying file name for saving statistics
- Modifying preference for global ranges
- Modifying preference for shifting grids
- Modifying preference for startup value
- Modifying preference for restoring range values

Security

The TrendWorx Viewer ActiveX is currently interfaced to the Smar Security Server through OLExpress. The security system is enabled within runtime mode to provide a very flexible security mechanism. Currently the TrendWorx Viewer supports the security actions shown in the dialog box below.



Smar Security Server

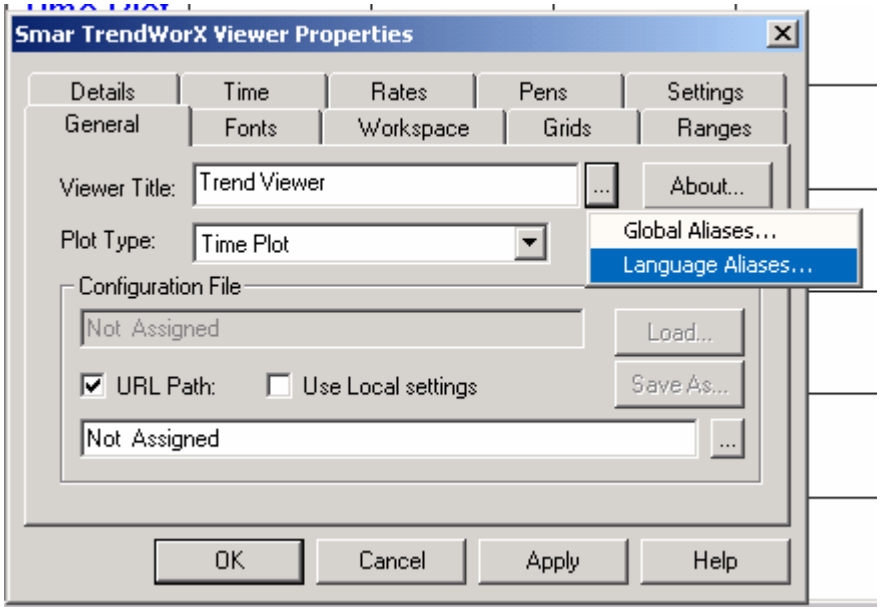
If you do not have the appropriate security actions for the functions you want to perform, an error message box will appear indicating that you do not have the security level required by the action.

Asynchronous Downloading Features

The TrendWorx Viewer supports asynchronous downloading of configuration data when used inside SMAR ActiveX document servers, such as GraphWorx, to produce documents, which can be viewed using Microsoft Internet Explorer.

To enable this feature, select **URL Path** from the **General** tab of the **TWXView32 ActiveX Properties** dialog box, shown below, and supply a URL path. In the case of viewing ActiveX documents within an Intranet setup, you can supply a server name and directory specifying the location of the TrendWorx Viewer configuration data (must be a shared directory), by using the convention file:\\Server Name\Directory\File Name.v32.

You can also enable the **Use Local Settings** option, which, if checked, stores runtime changes to a local copy of the remote configuration file. It will use this local file every time the HTML page that hosts the Viewer is loaded inside the Web browser.



TrendWorx Viewer ActiveX Properties: General Tab

Language-Aliasing Support

The TrendWorx Viewer ActiveX component has all of its strings saved in the resource file, which can be modified to provide custom versions. In addition, it provides real-time support for loading a resource-only .dll to support international languages. This .dll file is compiled as a standard Win32 .dll, and it is made up of all the resources and the .odl file of the TrendWorx Viewer module. Any time the Smar applications settings are switched to a different language, TrendWorx Viewer will load the corresponding resource .dll.

The resource-only .dll file name uses the TrendWorx Viewer component, followed by the three characters used in Windows NT as the abbreviation for a language name (e.g., the abbreviation "deu" stands for German, and the .dll should be named "TWXViewer_deu.dll"). In addition, using the OLE automation property language ID, you can control this functionality through OLE automation.

In addition, the Unicode version of the TrendWorx Viewer ActiveX also supports language aliasing with automatic range and value scaling, as well as unit conversions, formatting, and font selection. For more information about configuring Unicode version language-aliasing support refer to the ProcessView **Language Configurator** documentation. The TrendWorx Viewer ActiveX supports the following language-aliased strings:

- Pen description
- Pen engineering units (with scaling support)
- Pen details format
- Title string of viewer
- Format strings of details
- Detail window column names

Note
The TrendWorx Viewer requires the following additional language- aliasing configuration work. If any expression is to be used for range, alarm limits, and or unit scaling, you need to define both a "Read Expression" and a "Write Expression" in the Language Configurator. By doing so, the Viewer will be able to function properly between language switches.

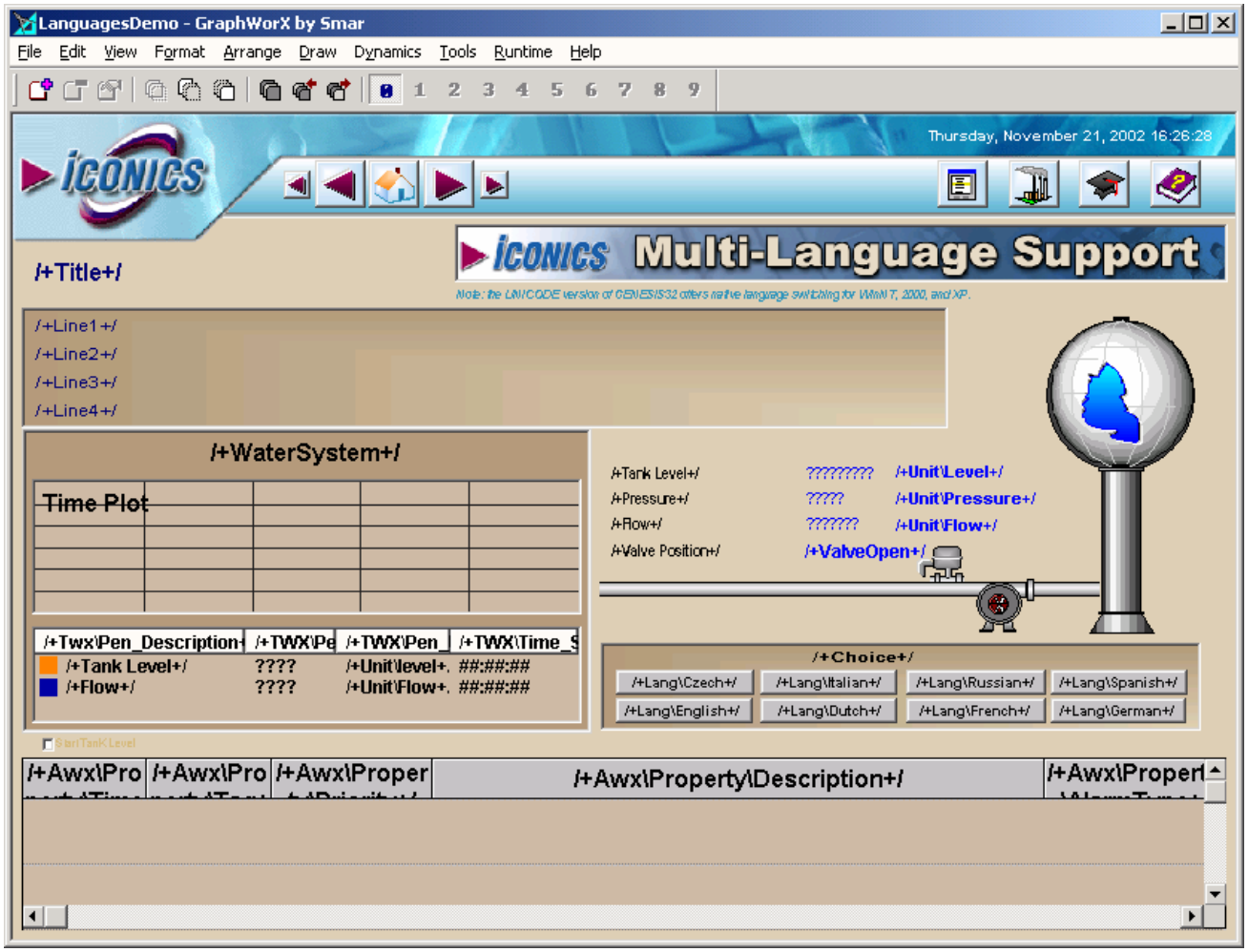
Note
To enhance language-aliasing performance, select the Microsoft Arial Unicode font, which contains all Unicode characters. The Arial Unicode MICROSOFT font must be selected separately within the Properties dialog box of each ActiveX component.

Sample Language Configuration

The Unicode Installation of ProcessView installs a sample Language Server configuration under the "Languages" folder of the ProcessView product installation "tree." In addition, a sample display "languagesDemo.gdf," which includes a sample Viewer configuration, is provided under the Examples/Languages folder. The figure below shows this sample during runtime mode. Notice that you can switch between languages in this display by simply clicking the buttons in the Change Language field.

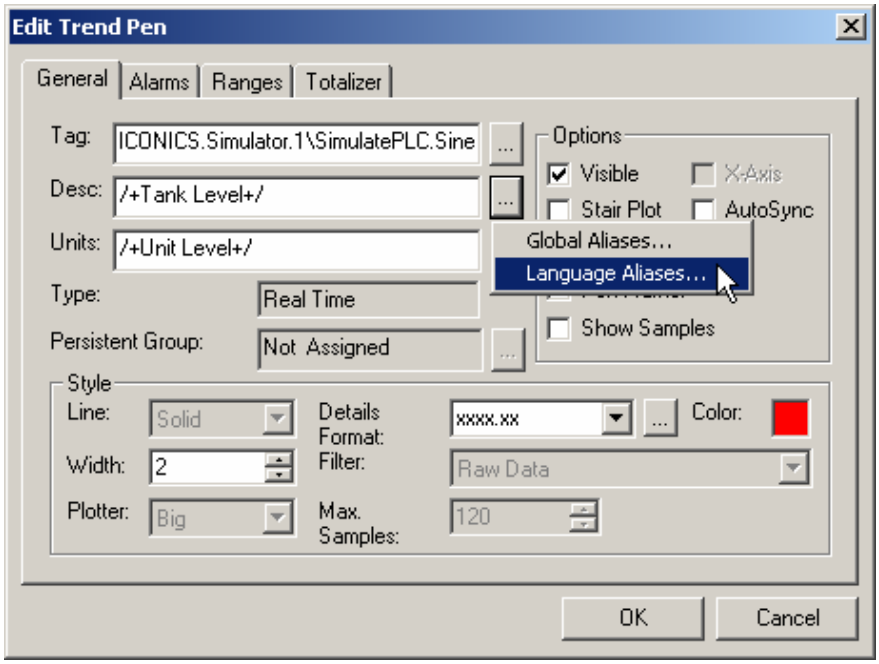
Language-Aliasing Demo in Runtime Mode

The figure below shows this same language-aliasing demo in configuration mode. This display incorporates ActiveX objects from GraphWorx, TrendWorx, and AlarmWorx.



Language-Aliasing Demo in Configuration Mode

For example, if you click on the "Water System" time plot trend in the language-aliasing configuration shown above, you can view the properties of the trend in the TrendWorx Viewer Active X. The **Edit Trend Pen** dialog box, shown below, displays the language-aliasing configuration of a pen in the Viewer.

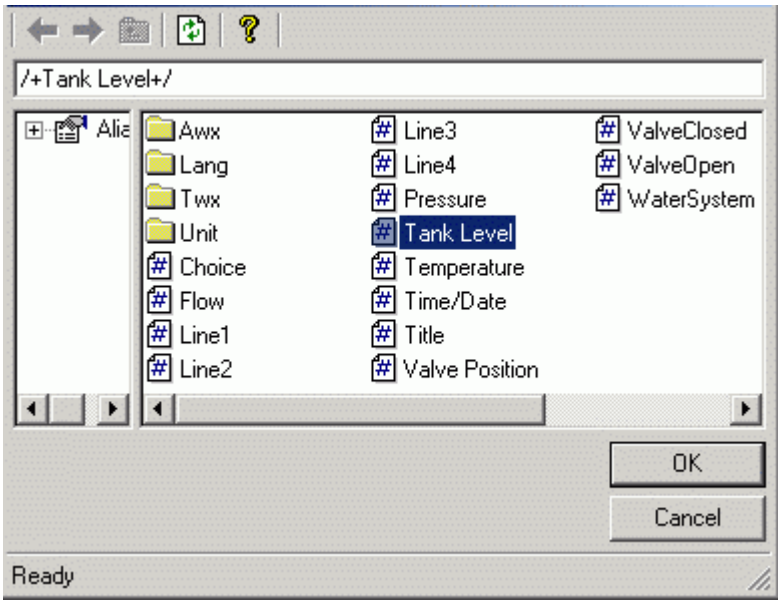


Language Aliasing Pen Configuration

For the example above, the Trend display appears as shown in the figure below. Note that the strings within a "/+" and "+/" delimiter pair define a language-aliased string.

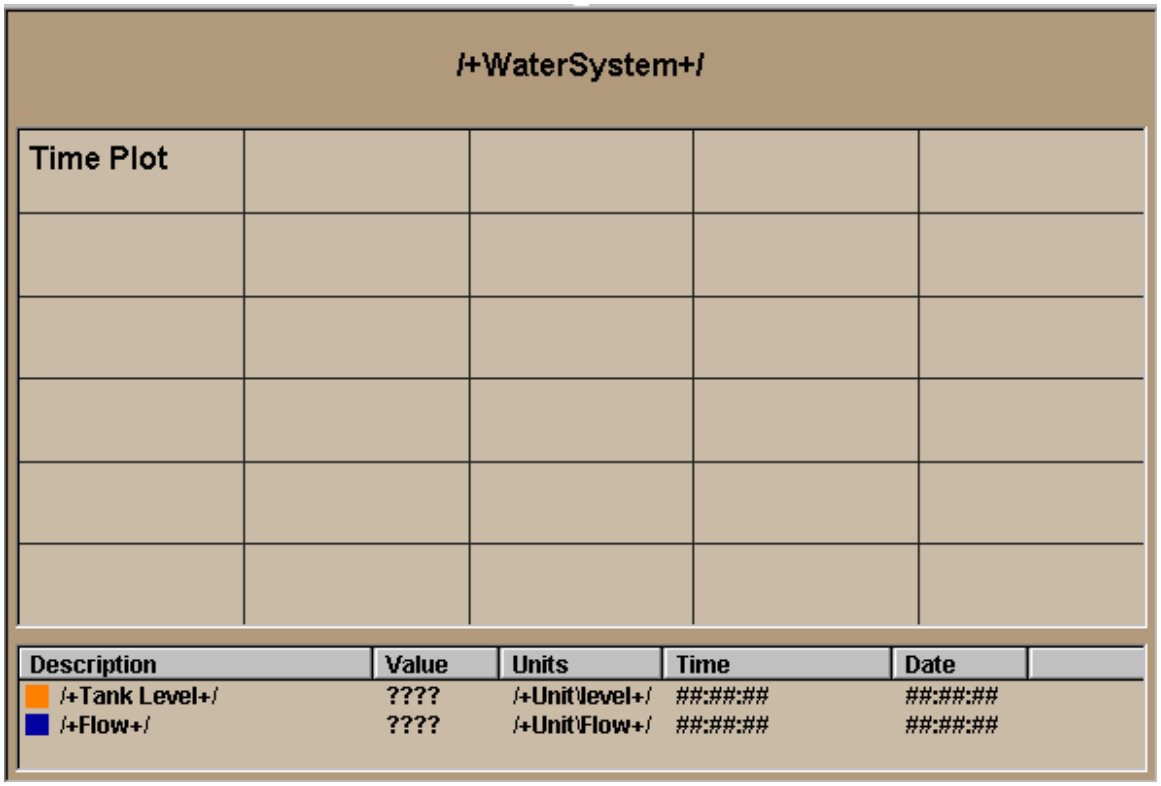
When specifying a language alias in the **Edit Trend Pen** dialog box, you can also select a language alias from the Language Alias Browser, which includes all language aliases in the language database. This eliminates the need to manually type in the alias name. Click the **...** button next to the **Lang Alias** box and select **Language Aliases,** as shown in the figure above.

The **Language Alias Browser** opens, as shown in the figure below. The browser includes all languages aliases in the language database. All language aliases that are configured in the Language Configurator are conveniently available to choose from inside the browser. The tree control of the Language Configurator is mimicked in the tree control of the Language Alias Browser. Select a language alias by double-clicking the alias name. The alias name appears at the top of the browser, which automatically adds the /+ and +/ delimiters to the alias name. Click the **OK** button.



Selecting an Alias From the Language Alias Browser

During animation (runtime) mode, the Viewer ActiveX will interface to the SMAR Language Server, and it will try to resolve the language-aliased strings. If successful, it will display the translated strings in the trend screen configuration, as shown below. In addition, if the **Units** language alias string has an equation defined in the Language Configurator, it will autoscale the pen values based on the scaling equation supplied by the Language Server.



Language-Aliased Trend Display

Note
The Unicode version language aliasing is independent of the resource .dll selection, which relates mostly to the text in the dialog boxes and other user interface elements.

Global Aliasing Support

The TrendWorx Viewer supports Global Aliasing by interfacing to the SMAR Global Aliasing Server. The following strings can be aliased:

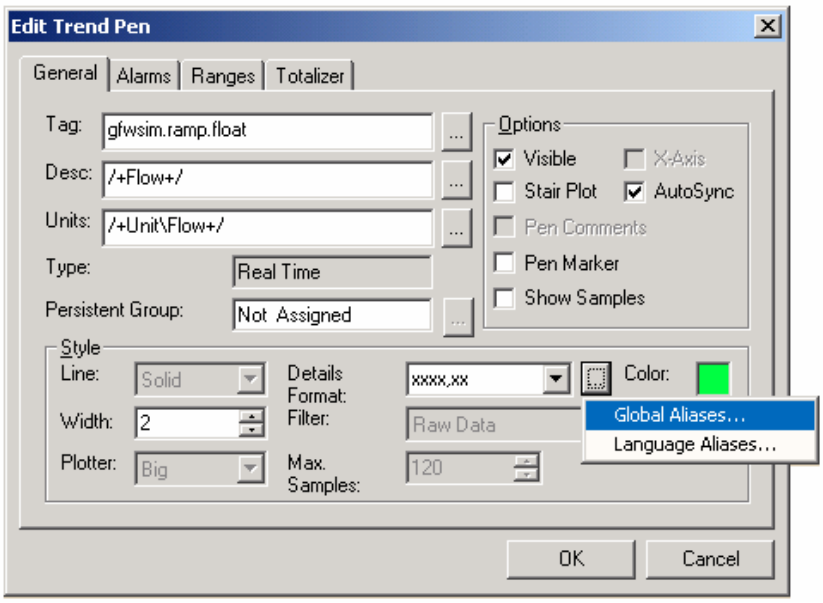
- ❑ **Title**
  - o Title
- ❑ **Ranges**
  - o Hi Tag, Lo Tag, Format, Format XY
- ❑ **Details**
  - o Format
- ❑ **Pen**
  - o Point Name, Hi Tag, Low Tag, Description, Units, Details Format, Ranges Format, Persistent Group Name
- ❑ **URL Path**
  - o Configured in the **General** tab of the **TrendWorx Viewer ActiveX Properties** dialog box.
- ❑ **Expressions**
  - o In the **Expression Editor,** click the **Tags** button and select **Global Aliases** from the pop-up menu to open the **Global Alias Browser.**

Currently the TrendWorx Viewer supports machine-level and process-level aliasing. All fields, which support aliasing, have been interfaced to the Global Alias Browser dialog, which is evoked by clicking on the **...** button.

In addition, the TrendWorx Viewer now has Language and Global Aliasing browsers integrated.

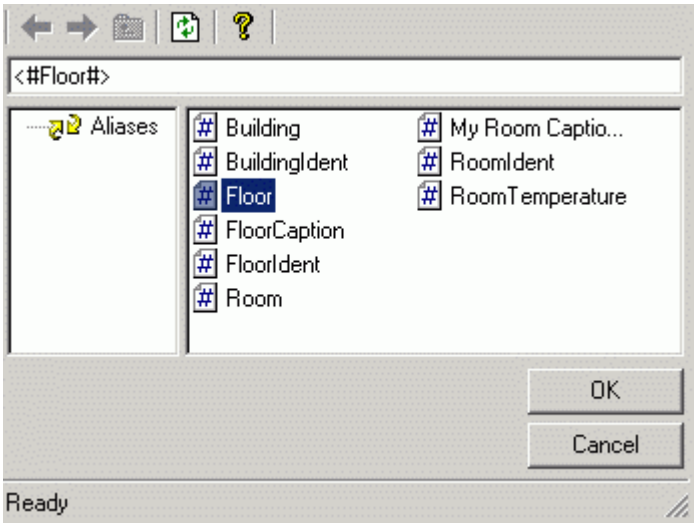
The user first connects a real time, persistent, or historical tag and then has the option to alias the entire pen string or part of it. Global aliasing is also supported also for drag-and-drop operations as well as related OLE automation methods.

- ❑ What is NOT supported:
- o Runtime editing of aliased fields
- o Aliases resulting in new global aliases (ie a resolved alias is also an alias)
- o Local settings saving if Global Aliases are used.



Global Aliasing Pen Configuration

Clicking the ... button and selecting **Global Aliases** from the pop-up menu opens the Global Alias Browser, as shown in the figure below. Select a global alias from the Global Alias Browser, which includes all global aliases in the global alias database. This eliminates the need to manually type in the alias name. All global aliases that are configured in the Global Alias Engine Configurator are conveniently available to choose from inside the browser. The tree control of the Global Alias Engine Configurator is mimicked in the tree control of the Global Alias Browser. Select a global alias by double-clicking the alias name (e.g. "Floor" in the figure below). The alias name appears at the top of the browser, which automatically adds the <# and #> delimiters to the alias name. Click the **OK** button.



Selecting an Alias From the Global Alias Browser

Internal Architecture of ActiveX

The internal architecture of the TrendWorx Viewer ActiveX is composed of three individual object managers:

- A **Point** manager (used to store point name information)
- A **Variable** manager (used to store data buffers and server updates for each point)
- A **Pen** manager (used to represent the visual aspect of the collected data points)

In addition, TrendWorx Viewer has the following threading mechanism:

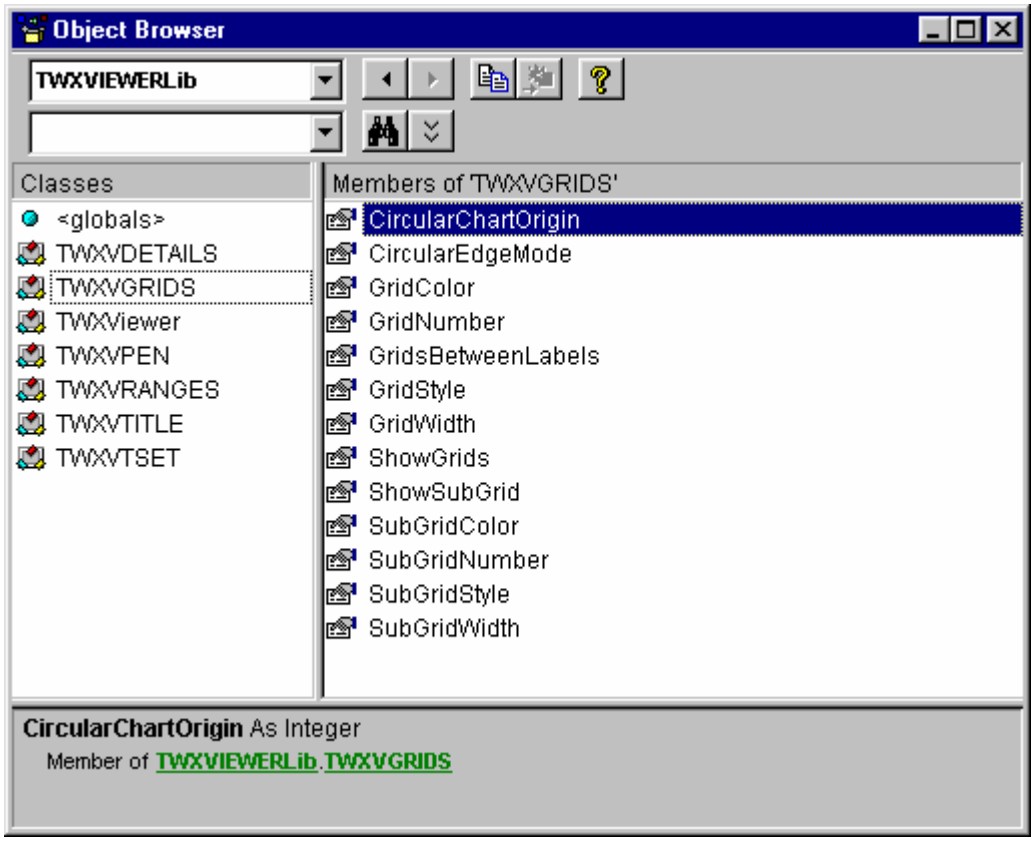
- A **Main** (primary) thread
- A **Worker** thread used for data updates and buffer management

The internal architecture of the TrendWorx Viewer allows the data to be collected at a different rate and graphically drawn at a multiple of the data-collection rate in order to minimize overall system load. Currently the minimal scan rate is set to be 10 milliseconds, and it is required that all data-collection rates that you set be an integer multiple of 10 milliseconds.

In addition, you can configure the desired number of samples to view on the screen (up to a maximum of 7200) and the desired window time period. Furthermore, all objects exposed by the TrendWorx Viewer ActiveX can be accessed directly through OLE Automation, and their associated properties can be manipulated directly through C++ clients (which support OLE containment) or Visual Basic applications. The fastest display refresh (redraw) rate is 50 milliseconds.

TrendWorx Object Capability

This section describes the objects exposed through OLE Automation used in TrendWorx Viewer ActiveX. These can be easily viewed in Visual Basic's **Object Browser,** shown below.



Object Browser

Using Visual Basic To View Title Objects

Title manages title information, such as the title name, font options, and drawing of the title. The **Title Object** serializes all title-specific information.

Using Visual Basic To View Grid Objects

Grid manages grid options and drawing of the grid. The **Grids Object** serializes all grid-specific information. There are individual objects for X-grids and Y-grids.

Using Visual Basic To View Ranges Objects

Ranges manages range information, such as border options, and drawing of the ranges according to plot type. The **Ranges Object** serializes all range-specific information.

Using Visual Basic To View Time Settings Objects

Time Settings manages time information, such as border options, font options, and drawing of the time field. The **Time Settings Object** serializes all time field-specific information.

Using Visual Basic To View Details Objects

Details manages detail information, such as border options, and drawing of the Details field. The **Details Object** serializes all detail-specific information.

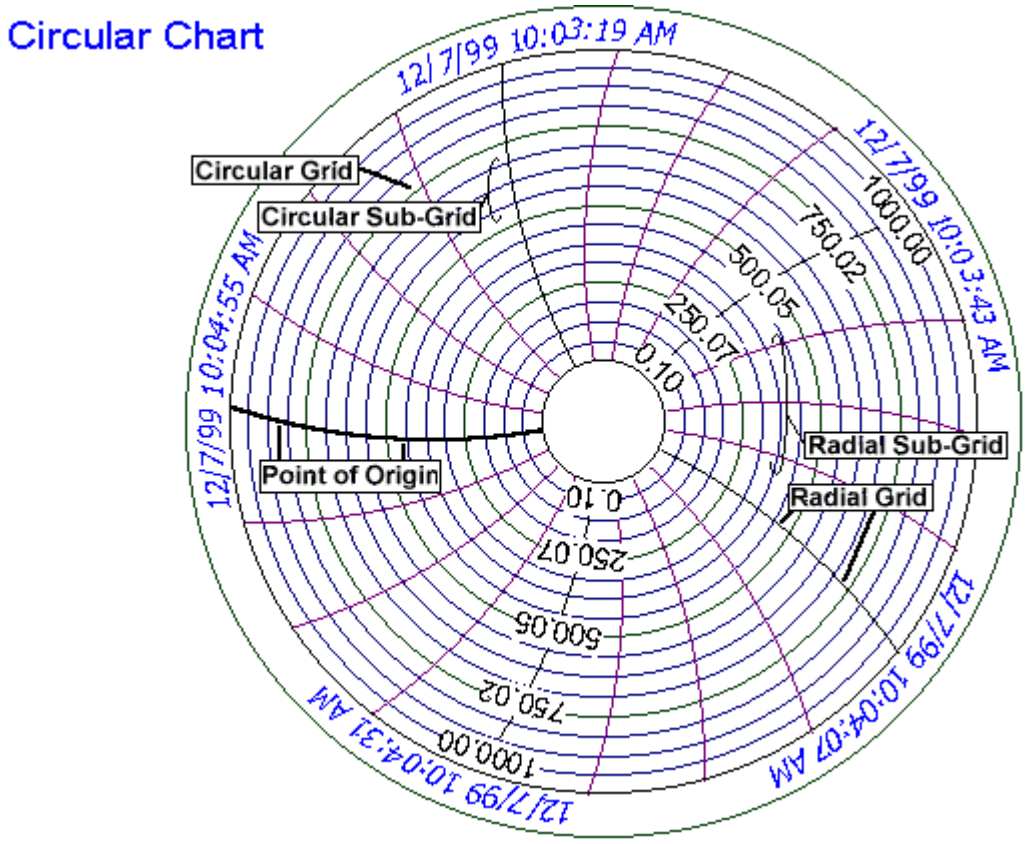
Using Visual Basic To View Pen Objects

Pen manages all visual aspects of the signal being trended, including display management, statistics, and curve style. The **Pen Object** serializes all pen-specific information.

Circular Charts

A **circular chart** is a trend type that plots signal values in a circular field. The **signal value** is represented by the distance from the center of the chart. The angular position of the points on the line represents **time.**

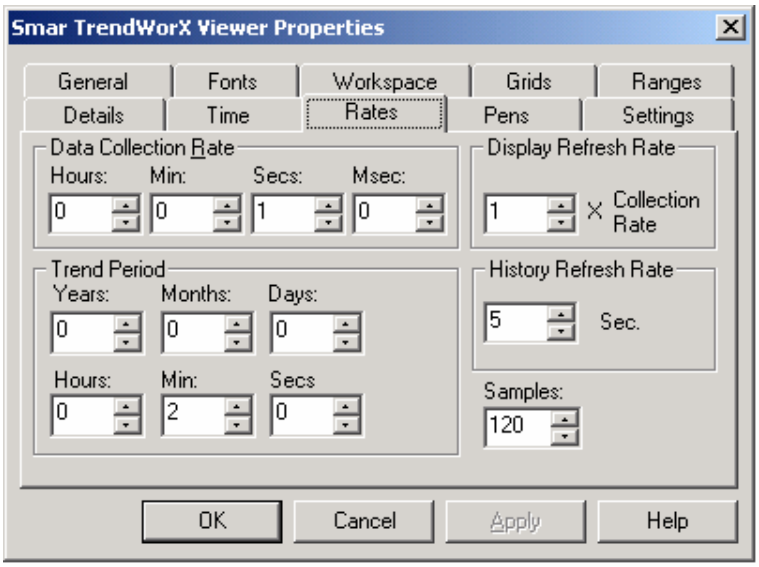
To create a circular chart ActiveX, select **Circular Chart** from the **Add Trend** submenu of the **Edit** menu, or press the shortcut keys **CTRL+6.** This will display the circular chart ActiveX in the TrendWorx Container, as shown below.



Circular Chart

Open the **TWXView32 ActiveX Properties** dialog box by double-clicking the circular chart ActiveX, or by selecting **Properties** from the **Edit** menu. This will enable you to set the properties for the circular chart.

Set the trend period and the data-collection rate using the **Rates** tab in the **TWXView32 ActiveX Properties** dialog box, shown in the figure below. The thickest line on the circular chart, prominent because of its bold appearance, represents the point of origin for the trend period. Notice that the time labels go counter-clockwise in conformity to the industry standards.



Properties Dialog Box: Rates Tab

Once all the data points are plotted within the trend period during runtime mode, one of the following will occur:

- All data points will disappear, and a new trend period will begin.
- All data points will remain and continuously scroll as old data points are replaced by new data points.

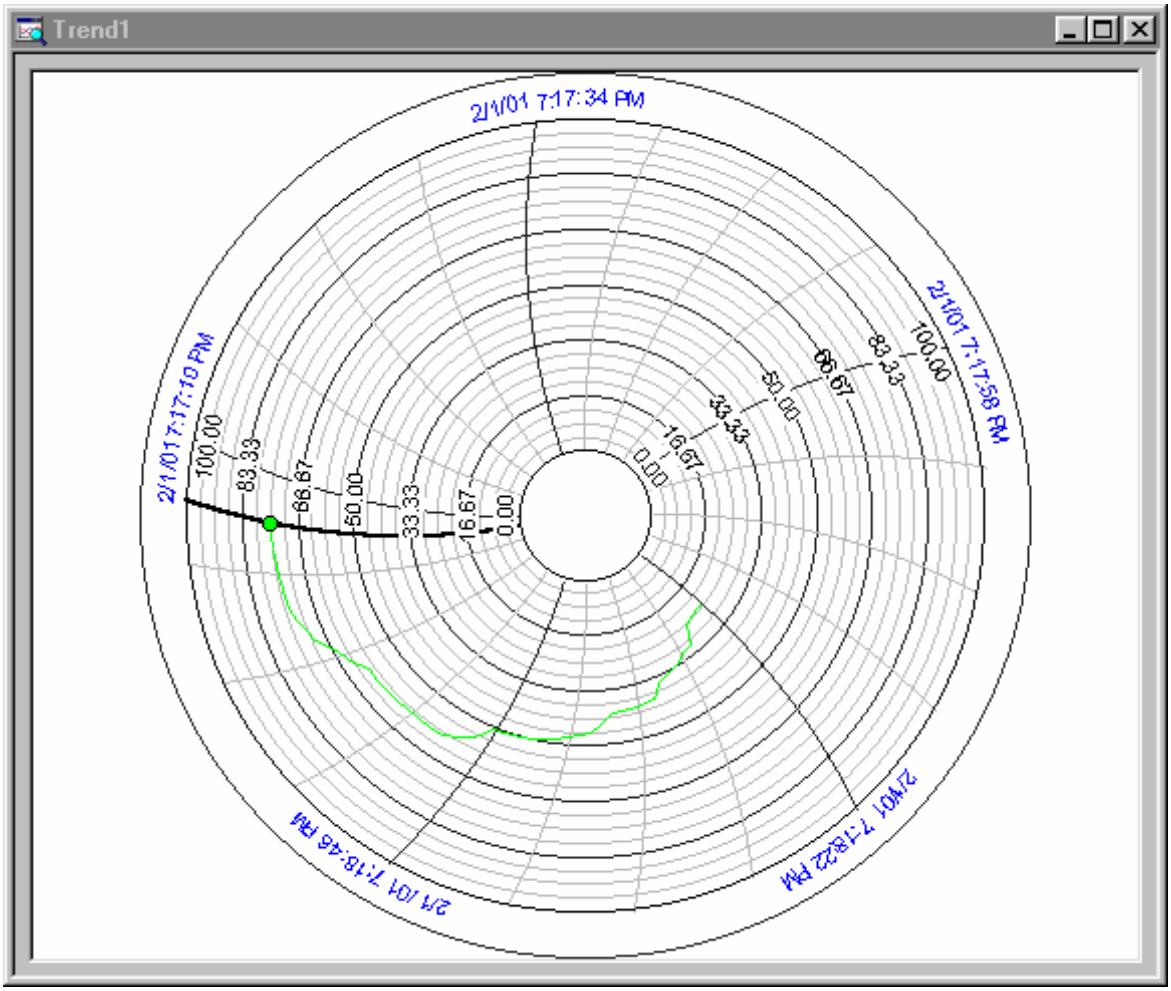
You can control these conditions using the **Settings** tab of the **TWXView32 ActiveX Properties** dialog box. When **Reset Circular Chart** is checked in the **Settings** tab, all data points will disappear at the beginning of each new trend period. In addition, you can choose to have the circular chart auto print upon resetting after a full trend period has elapsed.

Altering the Appearance of a Circular Chart

You can change the appearance of a circular chart using the tabs in the **TWXView32 ActiveX Properties** dialog box. Particularly relevant to the appearance of the circular charts are the **Grids** tab, **Fonts** tab, and to a lesser extent, the **Ranges** tab. For more information on how to use these tabs, please see the appropriate sections.

Circular Charts in Runtime

The following figure is an example of how a circular chart looks during runtime mode.



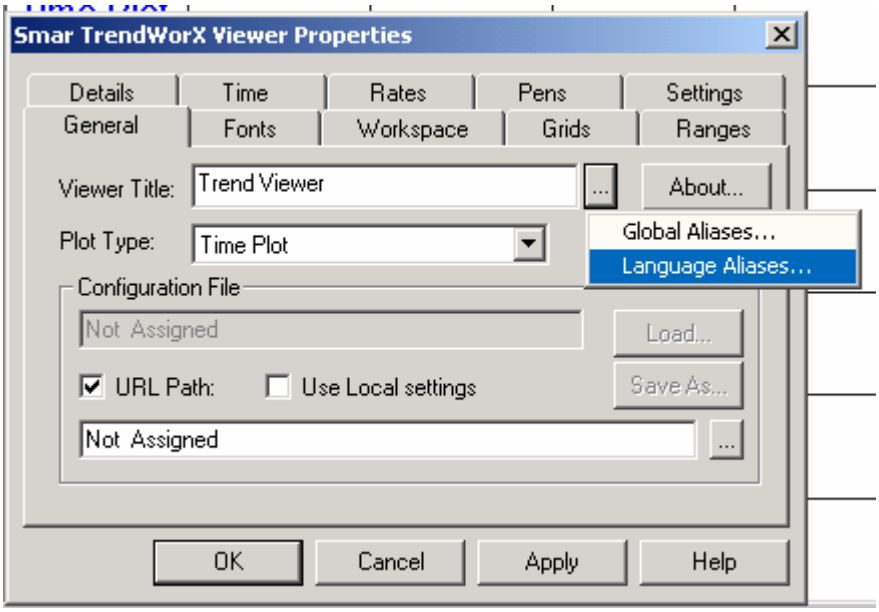
Circular Chart in Runtime Mode

User Interface

This section describes the user interface for TrendWorx Viewer ActiveX.

ActiveX Properties Dialog Box
The **TwxView32 ActiveX Properties** dialog box (also called the **Properties** dialog box), shown below, is the configuration user interface for the ActiveX. Double-clicking the ActiveX during configuration mode opens the **Properties** dialog box, which as you can see contains the following tabs:

- General tab
- Fonts tab
- Workspace tab
- Grids tab
- Ranges tab
- Details tab
- Time tab
- Rates tab
- Settings tab
- Pens tab

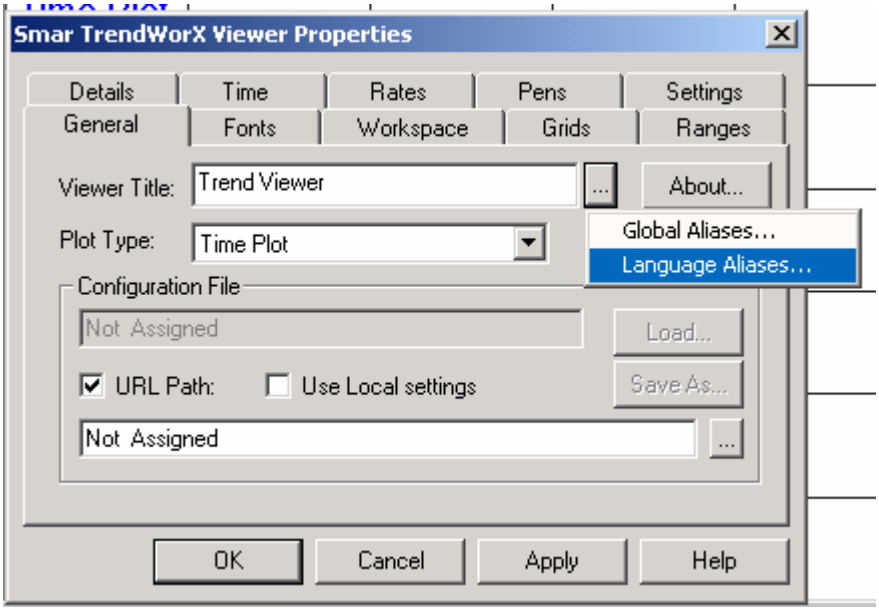


TWXView32 ActiveX Properties Dialog Box

General Tab

The **General** tab, shown below, is the default tab of the **Properties** dialog box. The **General** tab handles the following functions:

- Viewer title
- File selection
- Web configuration
- Plot type



Properties Dialog Box: General Tab

To select an alias to use for the **Viewer Title,** click the **...** button to the right of the text box and select either **Global Aliases** or **Language Aliases** from the pop-up menu, as shown in the figure above. This opens the respective alias browsers, allowing you to choose from a list of available aliases.

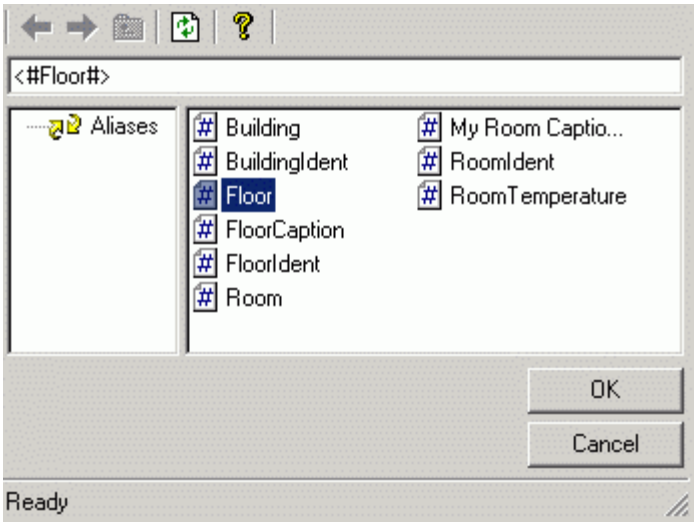
You should always choose the **Plot Type** first because this choice determines which options will also be available later on. The TrendWorx Viewer component can save its configuration data on a serialized file using the file extension .v32. By default, its configuration is saved in the container. You must configure this parameter (by clicking **Save As**) for all configuration data to be saved.

Clicking **About** launches the **Smar About Box,** which displays information about the product and SMAR.

By default, information is stored as part of the container application's document file. You can also store information as part of a separate (.v32) file. To save the .v32 file, under **Configuration File** click **Save As** to open the **Save TWXViewer Display** dialog box. Enter a name for the .v32 file in the **File Name** field, and then click **Save.**

You can also open an existing configuration file by clicking the **Load** button on the **General** tab and browsing for the file. The ActiveX will attempt to load the configuration file. If **URL Path** is checked, the ActiveX will use the specified network URL path upon loading the file.
Note: The ActiveX cannot be saved to a URL path. To create a URL file, save a report configuration to a local file and copy the file to the desired network location.You can also enable the **Use Local Settings** option, which, if checked, stores runtime changes to a local copy of the remote configuration file. It will use this local file every time the HTML page that hosts the Viewer is loaded inside the Web browser.

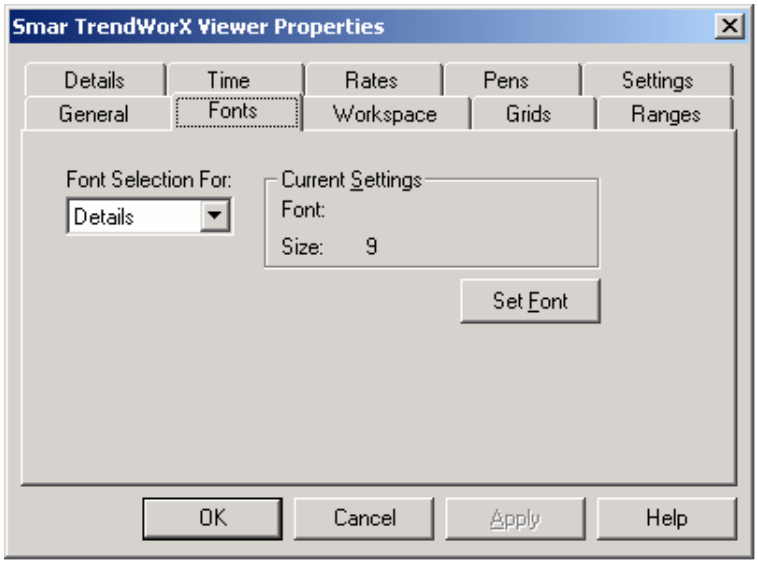
You can also select aliases to use for the configuration file. Clicking the **...** button and selecting **Global Alias Browser** from the pop-up menu opens the Global Alias Browser, as shown in the figure below. Select a global alias from the Global Alias Browser, which includes all global aliases in the global alias database. This eliminates the need to manually type in the alias name. All global aliases that are configured in the Global Alias Engine Configurator are conveniently available to choose from inside the browser. The tree control of the Global Alias Engine Configurator is mimicked in the tree control of the Global Alias Browser. Select a global alias by double-clicking the alias name (e.g. "Floor" in the figure below). The alias name appears at the top of the browser, which automatically adds the <# and #> delimiters to the alias name. Click the **OK** button.



Selecting an Alias From the Global Alias Browser

Fonts Tab

The **Fonts** tab of the **Properties** dialog box, shown below, sets the font type for the **Details, Ranges, Time Settings,** and **Title** sections of the **Trend** window. To select the section that you want to edit, choose it from the **Font Selection For** drop-down list and click **Set Font** to choose a font. The standard Windows **Font** dialog box appears, and you can select the font type, size, and style.



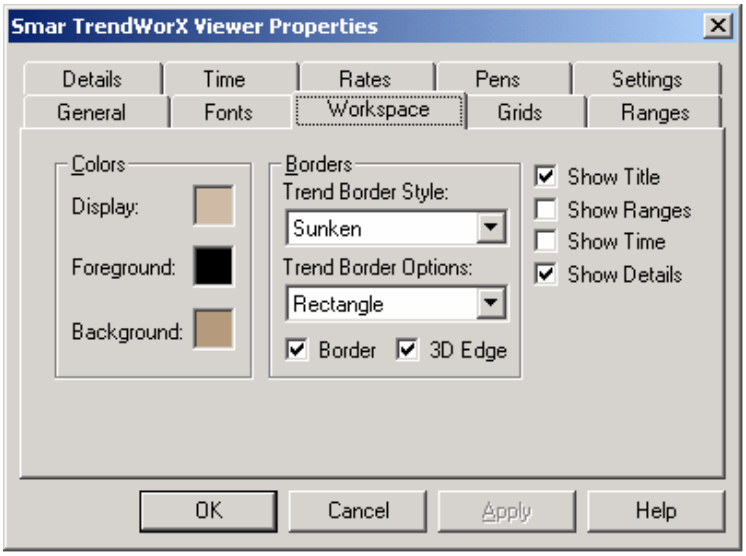
Properties Dialog Box: Fonts Tab

Circular Charts
You can also use the **Fonts** tab to change the fonts used in circular charts. Simply select the proper option in the **Font Selection For** drop-down list. Selecting **Ranges** from the drop-down list allows you to set the font for data labels on radial grids. You can also set the font and font size for **Time Settings** and **Title.**

Workspace Tab

The **Workspace** tab of the **Properties** dialog box, shown below, configures various cosmetic aspects of the trend display, such as showing range information and details about the trend.

You can select which components of the trend you want to appear on the display. Additionally, you can select **Trend Border Style** and the **Trend Border Options.** You can also give the border a three-dimensional look.



Properties Dialog Box: Workspace Tab

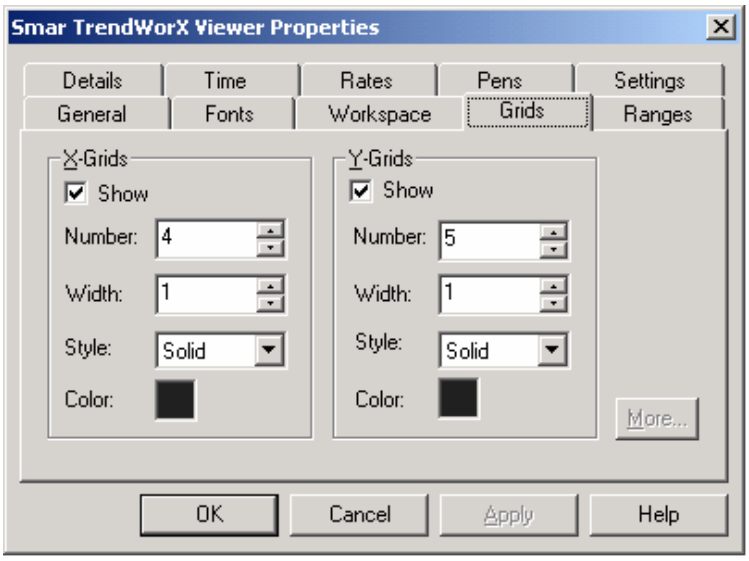
Colors
In the **Colors** section of the **Workspace** tab, you can choose the colors for the **Background, Foreground** (the title and text displaying the type of trend), and **Display** (the actual chart). To change the color, simply click the box corresponding to the area that you want to change. This opens a **Color** dialog box, which enables you to select a predetermined color. You may also select the **Define Custom Colors** button to create a color.

Borders
The **Borders** section of the **Workspace** tab defines the type of border and placement the display will have. There are four options for the **Trend Border Style:** Bumped, Etched, Raised, and Sunken. In the bumped style, only the border looks raised, while the etched style is mostly flat. In the raised style, the border looks as if it is coming out of the window. In the sunken style, the border looks as if it is going into the window. The **Trend Border Options** list enables you to select where you want the border to be placed: Bottom, Bottom Left, Bottom Right, Left, Rectangle, Right, Top, Top Left, or Top Right.

Grids Tab

The **Grids** tab of the **Properties** dialog box, shown below, manages the grid configuration for the trend display. Depending on the selected plot type, some options may or may not be available.

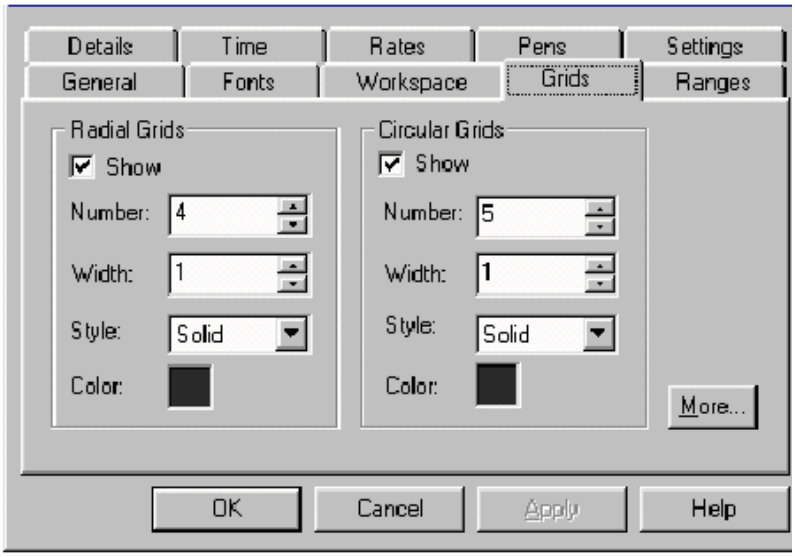
The **Grids** tab configures the appearance of the grid on the display. If the **Show** box is checked, the grid will appear on the display. The **Number** field specifies the number of lines you want to appear for each axis, and the **Width** field specifies how wide the lines are. You can select a style for the line from the following options: **Dashed, Dotted, Dotted Dash,** or **Solid.** As in the **Workspace** tab, you can select a color for the grid by clicking the color box and choosing a color. TrendWorx conveniently provides for separate configuration for the *x*-axis and *y*-axis, with the exception of the bar plot, which does not support *x*-axis grids.



Properties Dialog Box: Grids Tab

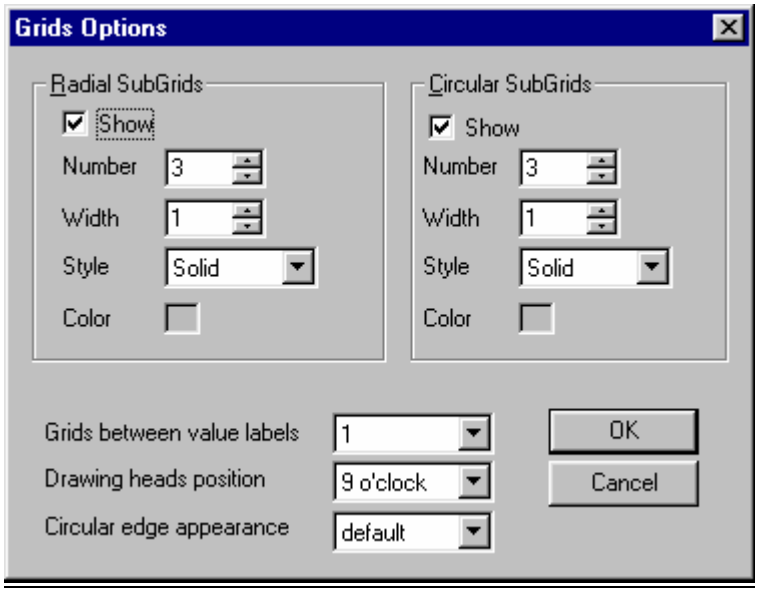
Circular Charts

If you are using a circular chart, the following dialog box appears. Select the **Grids** tab to modify the color and style of the radial grids and circular grids. Using this tab, you can elect to show or not to show radial and circular grids. You can also choose the **Number, Width, Style,** and **Color** of the grids.



Grids Tab for Circular Charts

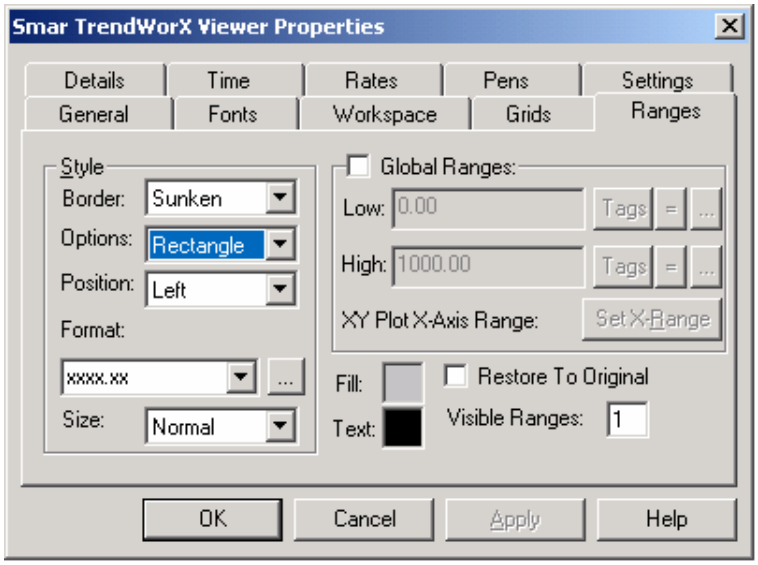
Click **More** to open the **Grids Options** dialog box, shown below, which enables you to change the number, width, style, and color of the radial and circular subgrids. You can elect to show or not to show (enable or disable) the radial and circular subgrids. You can choose the number, width, style and color of the radial and circular subgrids. You can also set the number of grids to be shown between value labels, whether they are grids or subgrids. You can set the position of the drawing heads by selecting one of the options from the **Drawing Heads Position** drop-down list. You can also select the edge thickness of the circle.



Grids Options Dialog Box for Circular Charts

Ranges Tab

The **Ranges** tab of the **Properties** dialog box, shown below, manages the Ranges Configuration for the trend display. Depending on the selected plot type, some options may or may not be available.

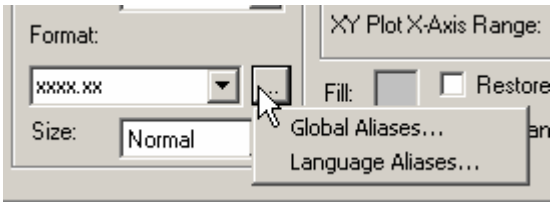


Properties Dialog Box: Ranges Tab

Style

The **Style** section of the **Ranges** tab defines the appearance of the ranges in the trend display. As in the **Workspace** tab, the **Border** and **Options** fields allow you to choose the border style and placement for ranges. The **Position** field determines where the ranges field will be placed in the **Trend** window (right or left), with the exception of the Strip Chart, in which the only range values are *x*-ranges that cannot be moved from left to right. The **Format** field determines how the numbers representing the ranges will appear (decimals or integers). The **Size** field indicates the size of the entire ranges filed in the trend display.

To select an alias to use for the **Format,** click the **...** button to the right of the text box and select either **Global Aliases** or **Language Aliases** from the pop-up menu, as shown in the figure below. This opens the respective alias browsers, allowing you to choose from a list of available aliases.

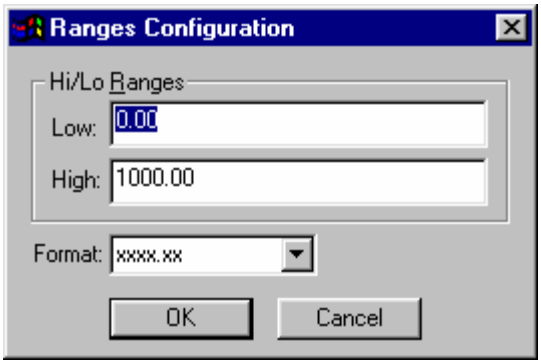


Selecting Aliases for the Format Field

Global Ranges
The **Global Ranges** section of the **Ranges** tab sets the ranges for the trend display. If **Global Ranges** is checked, all pens will be drawn using the same set of ranges. These can be constants, expressions, OPC tags, or global aliases. To select an OPC tag for the low or high ranges, click the **Tags** button. To select an expression, click the **=** button to open the Expression Editor. To select a global alias, click the **...** button and select **Global Aliases** from the pop-up menu. This opens the Global Alias browser, allowing you to choose from a list of available aliases.

In the Unicode version of the TrendWorx Viewer, if **Global Ranges** are enabled, the **Format** field can be language-aliased to produce the desired number formatting, font, and scaling (if a scaling expression is available in the Language Configurator).

If you are using an XY plot, the **Set X-Range** button will be available. Clicking this button opens the **Ranges Configuration** dialog box, which specifies the **High** and **Low** ranges, as well as the **Format,** for the *x*-axis.

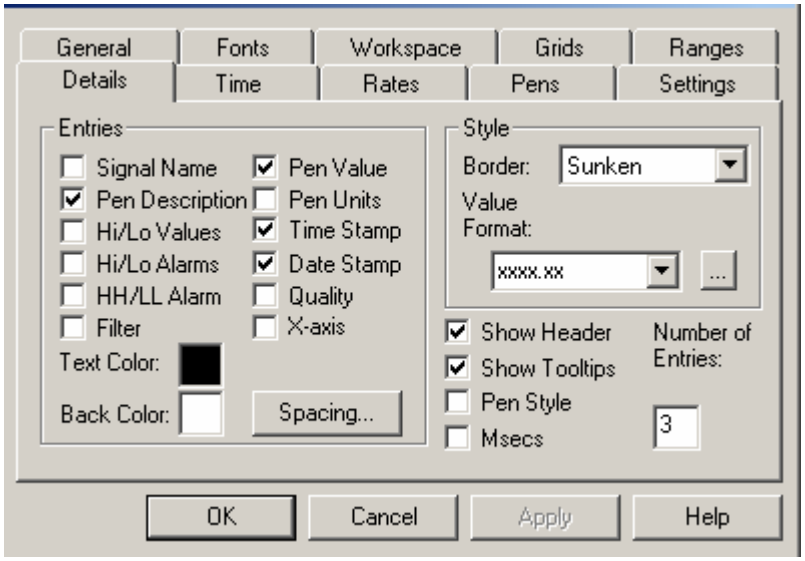


Ranges Configuration for XY Plots

Other Options
You can choose the **Fill** and **Text** color by clicking the corresponding box and selecting the color you want. The **Global Ranges** box is checked by default, but if you clear the selection, you will be able to change the number of visible pens. If **Restore To Original** is checked, TrendWorx maintains the ranges even if you change something in runtime. The **Visible Ranges** sets how many range scales will be visible in the trend display. When the **Global Ranges** option is enabled, you can define constant values for the global ranges or have them evaluated from OPC real-time tags or expressions.

Details Tab

The **Details** tab of the **Properties** dialog box, shown below, manages the detail display information area, and the enabled choices closely match the selected plotting type.



Properties Dialog Box: Details Tab

Entries

The Entries section of the Details tab provides the following list of items that may appear in the details section of the Trend window: Signal Name, Pen Description, Hi/Lo Values, Hi/Lo Alarms, HH/LL Alarm, *x*-Axis, Pen Value, Pen Unit, Time Stamp, Date Stamp, and Quality. The items will appear in the order that they are listed. For example, if Pen Value and Time Stamp are checked, Pen Value will always appear before Time Stamp in the window.

The **Show Header** item is listed in addition to the options above. If this box is checked, the header for the details section will appear, and you will be able to see what all the data in the display refer to. Otherwise the data will be displayed without any indication of what they correspond to. The **Filter** attribute can be used during historical replay to look at the averaging method used for data retrieval. The options enabled here are automatically used in the tool tip support of the viewer.

The **Spacing** button allows you to configure a default format for the **Details** window to be recalled during runtime mode.

Style

The **Style** section of the **Details** tab is similar to that of the **Ranges** tab, with a few additions. The time and date format is established using the Windows Registry settings for time and date, based on the International Language Resource .dll currently loaded in the TrendWorx Viewer ActiveX. You can also choose the **Border** attributes for the **Details** window.

In the Unicode version of the TrendWorx Viewer, the **Format** field can be language-aliased to produce the font for the **Details** window. Note that the formatting of the values of each pen is performed on a pen-by-pen basis, independently of the details formatting. To select an alias to use for the **Value Format,** click the **...** button to the left of the text box and select either **Global Aliases** or **Language Aliases** from the pop-up menu, as shown in the figure below. This opens the respective alias browsers, allowing you to choose from a list of available aliases.

Other Options

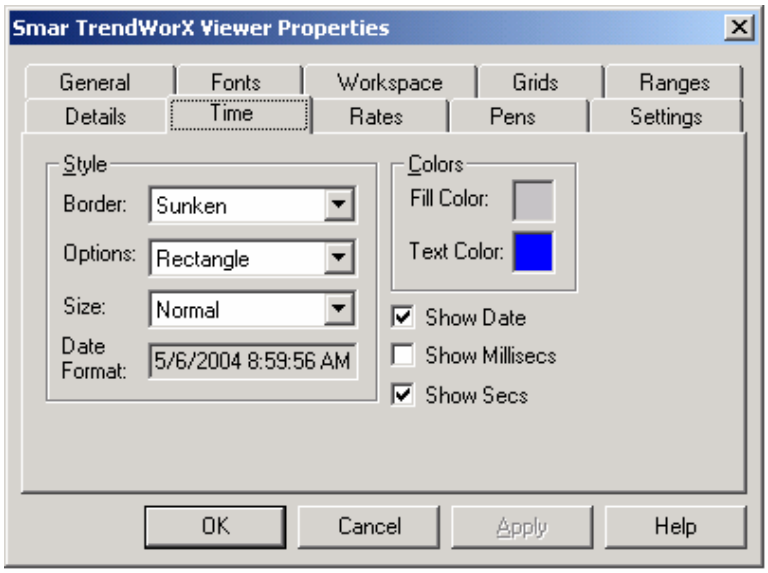
The remaining options allow you to change the number of visible pens, the fill color, and the text color and to choose whether to show tool tips.

The **Number of Entries** field displays the number of pens in the **Details** window of the Viewer. If more pens exist, the **Details** window will show a scroll bar for scrolling up or down. If **Show Header** is checked, the **Details** window header will be displayed. If **Show Tool Tips** is checked, tool tips indicating the sample values will be displayed as the cursor moves across the display area in freeze mode.

If **Msecs** is checked, the **Details** window will append the milliseconds value to each time stamp displayed. If **Pen Style** is checked, the **Details** window will draw a line in front of the pen description text in the same style, width, and color as the pen curve. This way, signals drawn with different pen styles can be easily identified in monochrome printouts.

Time Tab

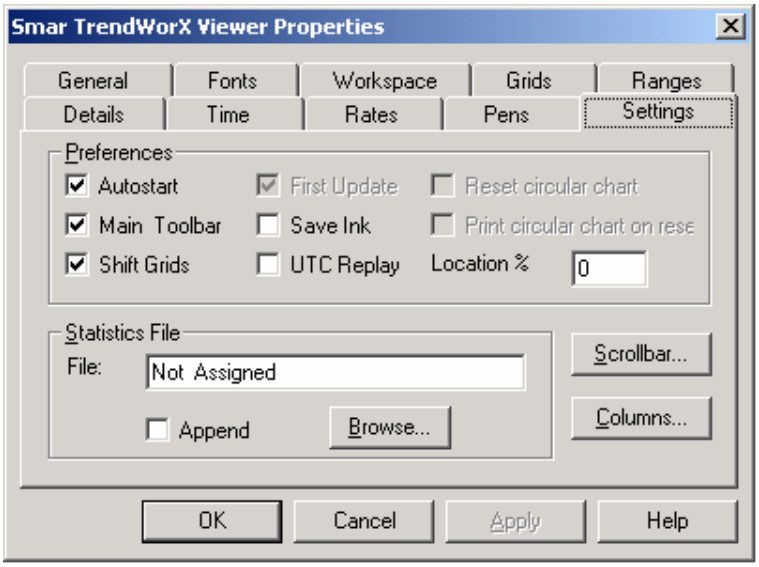
The **Time** tab of the **Properties** dialog box, shown below, configures the style of the time display inside the trend. You can select the border and size parameters, as well as the text and fill colors. You can also choose to show or not to show the date, seconds, and milliseconds during runtime mode.



Properties Dialog Box: Time Tab

Settings Tab

The **Settings** tab of the **Properties** dialog box, shown below, manages various aspects of the trend configuration.



Properties Dialog Box: Settings Tab

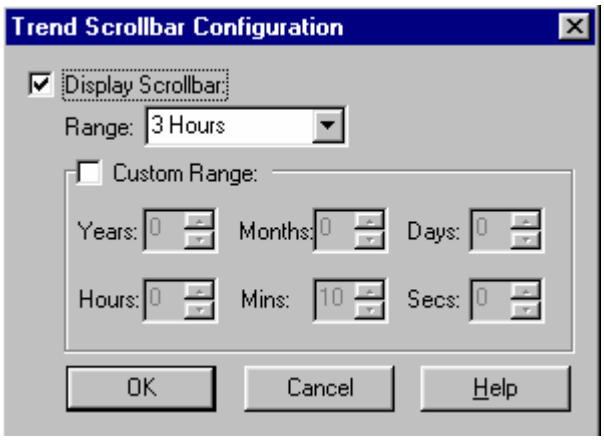
If **Autostart** is checked, the TrendWorx Viewer ActiveX will automatically enter animation mode when the container application switches from design mode to use mode. Note that in the TrendWorx and AlarmWorx containers, this option is disabled, and both applications will start the ActiveX Viewers through OLE Automation.

If **Main Toolbar** is checked, you can access the **Trend Viewer** toolbar during runtime mode. When **Shift Grids** is checked, the relative location of the grids on the axis is time-scale based. You can also enable the restoration of range information that may have been changed during runtime mode. Choosing startup determines a relative plot of each signal on the display based on the **Location %** value. The default value is 0, and the pen curve will begin plotting from the far right side of the trend display.

Under the **Statistics File** section, you can click the Browse button and select a .csv file for saving statistical information during runtime. Check **Append** if you want to append the statistical information to the .csv file or overwrite the existing one.

Selecting **Save Ink** will conserve ink while printing by not using the configured background color fill of the individual areas within the trend display. The curves and text, however, will be printed in the configured colors. Also, if you select **Print Circular Chart on Reset,** and the **Reset Circular Chart** after full period option is enabled, the TrendWorx Viewer will automatically print the circular chart display.

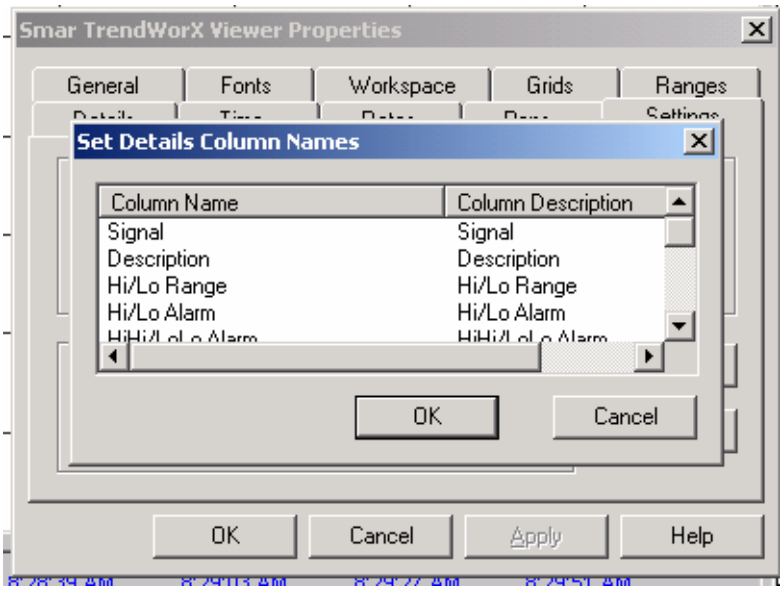
Click the **Scroll Bar** button to set the time range for how far back you will be able to scroll while in freeze mode. This opens the **Trend Scroll Bar Configuration** dialog box is displayed as shown below. If **Display Scrollbar** is checked, you must select a range for how far back you can scroll. By default, the scroll range is set at 3 hours, but the options of 10 seconds, 30 seconds, 1 minute, 2 minutes, 10 minutes, 30 minutes, 1 hour, 8 hours, 1 day, 5 days, 1 week, 1 month, 3 months, 6 months and 1 year are also available from this list. If you wish to enter a more-specific range you can check **Custom Range** and select the range in years, months, days, hours, minutes, and seconds.



Trend Scroll Bar Configuration Dialog Box

Clicking the **Columns** button on the **Settings** tab opens the **Set Details Column Names** dialog box, as shown in the figure below. This dialog specifies the column names for the details section of the Trend Viewer. Both the column names and descriptions are listed, but you can only modify column names. To change a column name, right-click on the name and select **Rename** from the pop-up menu, as shown in the figure below. Your changes are reflected in the Viewer.

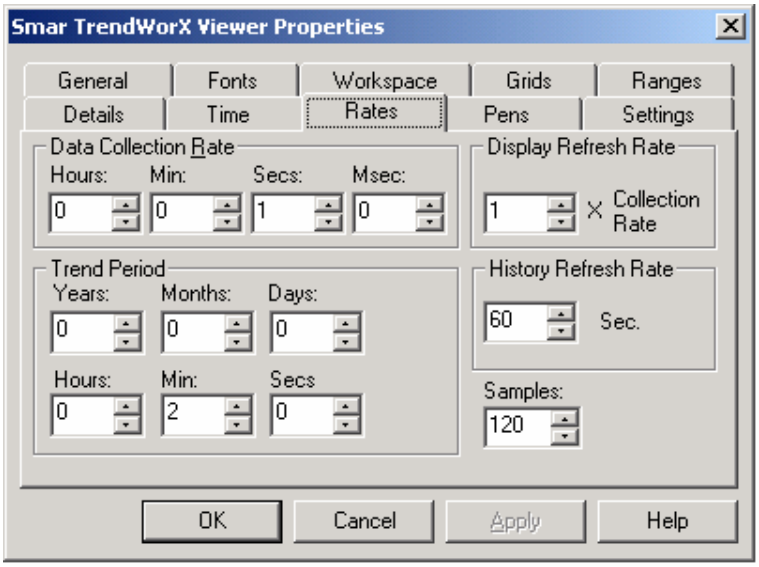
Note
When you right-click on a column name, you can also select a global alias from the Global Alias browser, or a language alias (Unicode version only) from the Language Alias browser.



Setting the Column Names for the Viewer

Rates Tab

In the **Rates** tab of the **Properties** dialog box, shown below, you can select the desired **Data-Collection Rate** and the number of **Samples,** among other variables. Currently the fastest data-collection rate is 10 milliseconds (ms). The update rate is calculated by inserting the variables on the **Rates** tab into an equation. Therefore, if you change one of these variables, all other variables will be updated automatically. Notice also that the data-collection rate is configured independently of the drawing action. The fastest display update rate is 50 ms, with the exception of bar plots, in which the display rate matches the data-collection period.



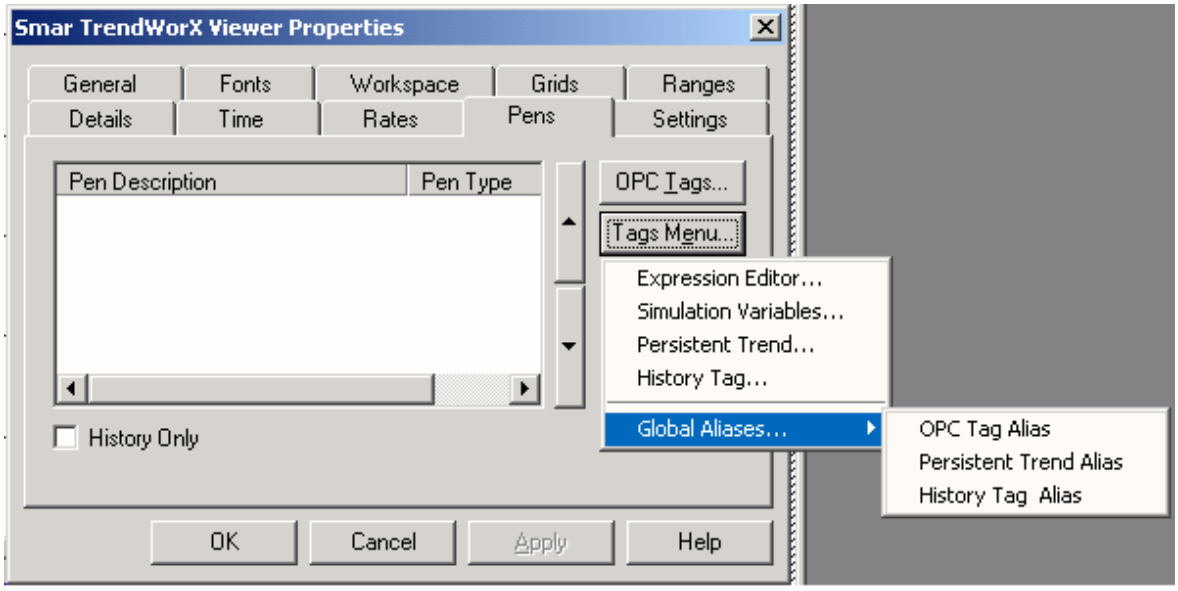
Properties Dialog Box: Rates Tab

The **Display Refresh Rate** controls the speed at which the signal curves will be drawn. If, for example, the data-collection rate is set to 250 ms and the **Display Refresh Rate** is set to 4, the samples will be collected at 250 ms, but the signal curve will be updated every second without loss of data. This is a great option to minimize system-resource usage.

The **History Refresh Rate** controls the frequency at which the historical pens will be refreshed with new historical data from the TrendWorx Historical Database. This can be used as an optimization and load-balancing tool. For example, if the TrendWorx SQL Server is configured to log to the database every 1 min., then the History Refresh Rate should be set to a maximum of 1 min.

Pens Tab

The **Pens** tab of the **Properties** dialog box, shown below, handles the signal connection, editing, and configuration for the data displayed in the trend. Clicking **OPC Tags** opens the **OPC Universal Tag Browser.**

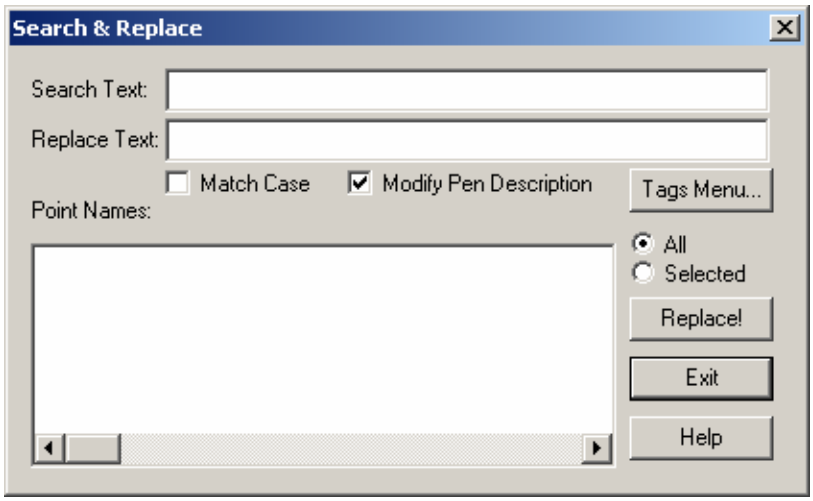


Properties Dialog Box: Pens Tab

To display only historical data, in freeze mode you must check **History Only.** Then you can make connections to OPC HDA servers. If this option is not set, you can make both real-time and historical tag connections on the same TrendWorx ActiveX Viewer. You can connect signals to pens, which are coming from an OPC server or are the result of a calculated expression to show the real-time data. This is illustrated in the following sections:

- OPC Tags
- Tags Menu
- Edit Button

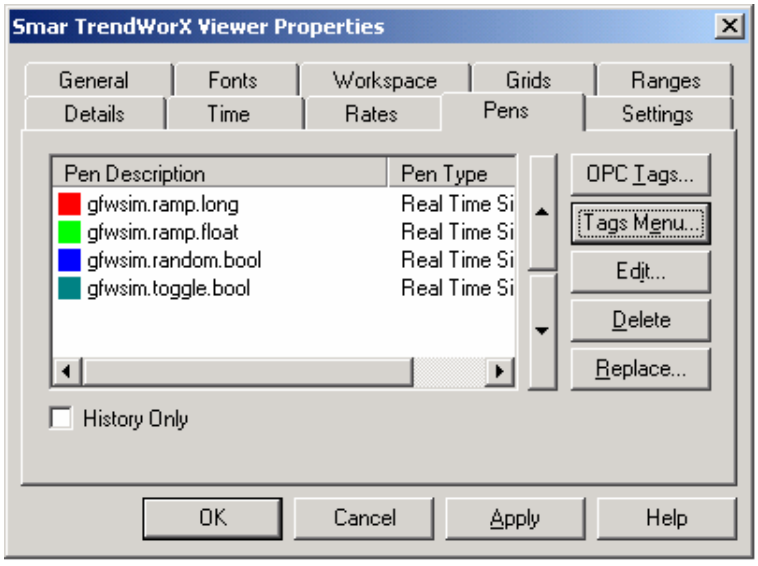
You can also delete, modify, and replace pens. To delete one or more pens, select the pen and then click **Delete** on the **Pens** tab. Then click **Yes** to delete the pen. To replace or modify the pen, click **Replace** on the **Pens** tab. This opens the **Search and Replace** dialog box, shown below. You can search for and replace text as needed to modify the pen.



Search and Replace Dialog Box

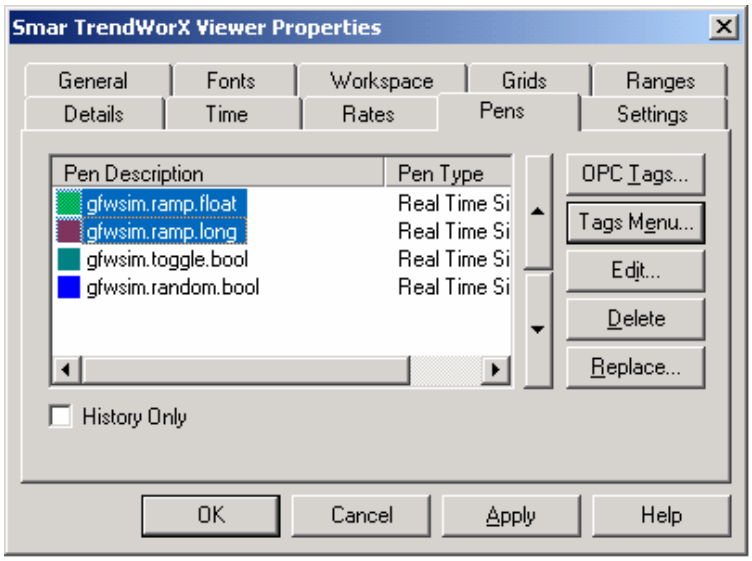
Reordering Trend Pens

The TrendWorx Viewer ActiveX now supports reordering of pens in configuration mode. In the **Pens** tab, select the trend pen(s) you would like to reposition, as shown in the figure below.



Reordering Trend Pens

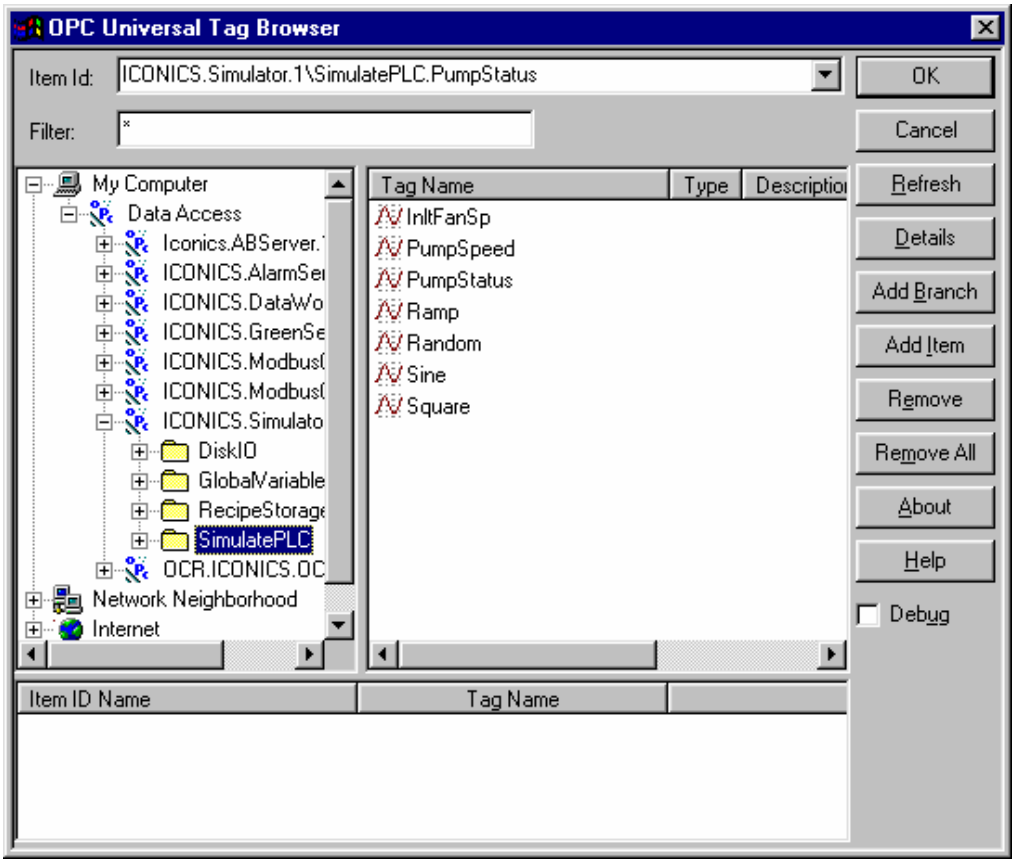
Then click the up or down arrow buttons to reposition the selected pen(s). The pens move up or down, as shown in the figure below.



Trend Pens Repositioned

OPC Tags

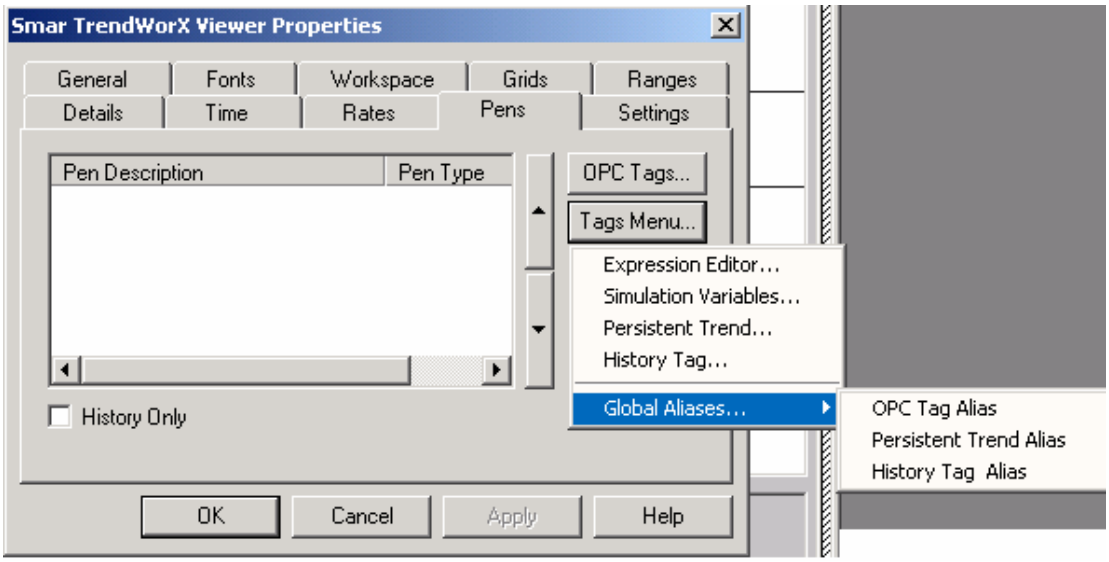
To make real-time connections from the **Pens** tab of the **Properties** dialog box, click the **OPC Tags** button. This opens the **OPC Universal Tag Browser,** which enables you to browse all available OPC servers and their signals, as shown below.



OPC Universal Tag Browser

You can make multiple tag connections through the OPC Universal Tag Browser. To do so, first expand the server "tree" and then select the tags you wish to connect from the expanded tree view. Then, select **Add Item** to place the selected tags on the bottom list control. Once all selections are made, click **OK** to establish the connections.

Tags Menu
Clicking **Tags Menu** in the **Pens** tab of the **Properties** dialog box opens the following menu, as shown in the figure below.



Tags Menu

The **Tags** menu contains the following basic options:

- Expression editor
- Simulation variables
- Persistent trend
- History tag

In addition to these options, the following new global alias options have been added to allow for global aliasing connections:

- OPC Tag Alias
- Persistent Trend Alias
- History Tag Alias

You can now select these options to connect to various alias types.

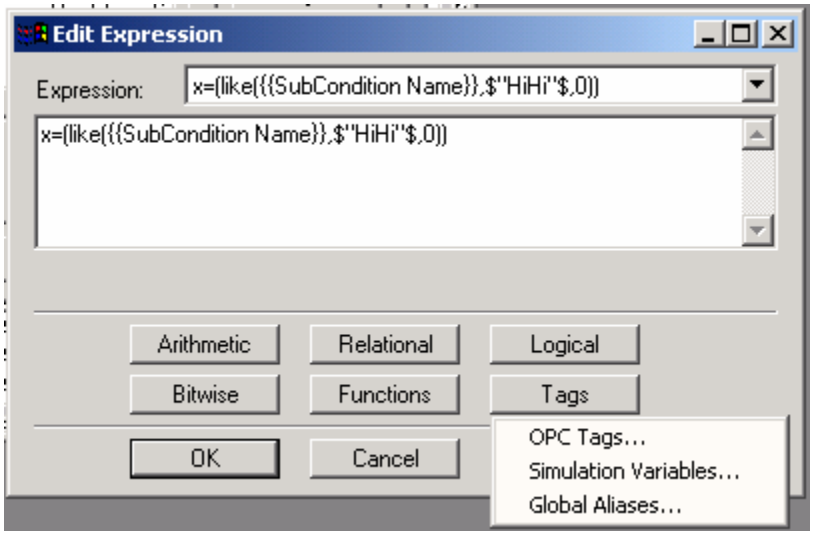
Selecting **OPC Tag Alias** opens the **Global Alias Browser,** where you can select from a list of configured global aliases.

If you select **Persistent Trend Alias,** you will be asked to edit the pen, after the alias connection is made, and alias the Persistent Trend group for proper operation.

If you select a **History Tag Alias** pen, you will be prompted to first pick a historical tag from an OPC HDA server and then select the alias to use. After the connection is made, you will be asked to edit the pen and select the remaining aliases.

Expression Editor

Selecting **Expression Editor** from the **Tags Menu** in the **Pens** tab of the **Properties** dialog box launches the **Edit Expression** dialog box, shown in the figure below. The Expression Editor is available to assist you in creating expressions for your ProcessView applications. The window is resizable and can be stretched as well as maximized or minimized. The drop-down list at the top of the **Edit Expression** dialog box keeps track of the last 50 expressions you have entered. The expression entered most recently is the first one in the drop-down list.



Edit Expression Dialog Box

Writing Expressions

An **expression** is a string that defines and evaluates a data connection between a client and an OPC server. During runtime mode, OPC servers resolve the data value for the expression. To indicate that a data connection is an expression, precede the string with the "**x=**" token, as shown below:

x={{SMAR.Simulator.1\SimulatePLC.PumpSpeed}}

You can either type your expressions directly into the text box of the **Edit Expression** dialog box, or you can use the symbols and functions provided that help you use the proper string syntax when writing expressions. The following categories are available:

- Arithmetic
- Relational
- Logical
- Bitwise
- Functions
- Tags

OPC Tags

An **OPC tag,** or data point, is a data connection between a client and an OPC server. OPC tags can be used in expressions when the tag is embedded between double brackets, as shown below:

{{tag_name**}}**

Example:

x={{SMAR.Simulator.1\SimulatePLC.PumpSpeed}}

You can use the Tag Browser to select OPC tags.

Aliases
An **alias** is a string that represents or describes an object or data point in a display. Both local and global aliases can be used in expressions.

Local Aliases
For local aliases within the expression, use the following syntax:

<<local_alias_name**>>**

Example:

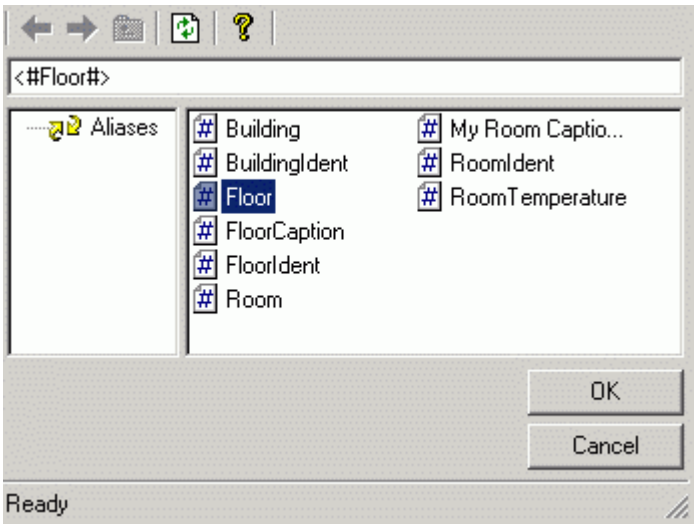
x=<<TankLevel>>

Global Aliases
For global aliases within the expression, use the following syntax:

<#global_alias_name#>

Example:
x=<#RoomTemperature#>

Selecting **Global Alias Browser** opens the Global Alias Browser, as shown in the figure below. Select a global alias from the Global Alias Browser, which includes all global aliases in the global alias database. This eliminates the need to manually type in the alias name. All global aliases that are configured in the Global Alias Engine Configurator are conveniently available to choose from inside the browser. The tree control of the Global Alias Engine Configurator is mimicked in the tree control of the Global Alias Browser. Select a global alias by double-clicking the alias name (e.g. "Floor" in the figure below). The alias name appears at the top of the browser, which automatically adds the <# and #> delimiters to the alias name. Click the **OK** button.



Selecting an Alias From the Global Alias Browser

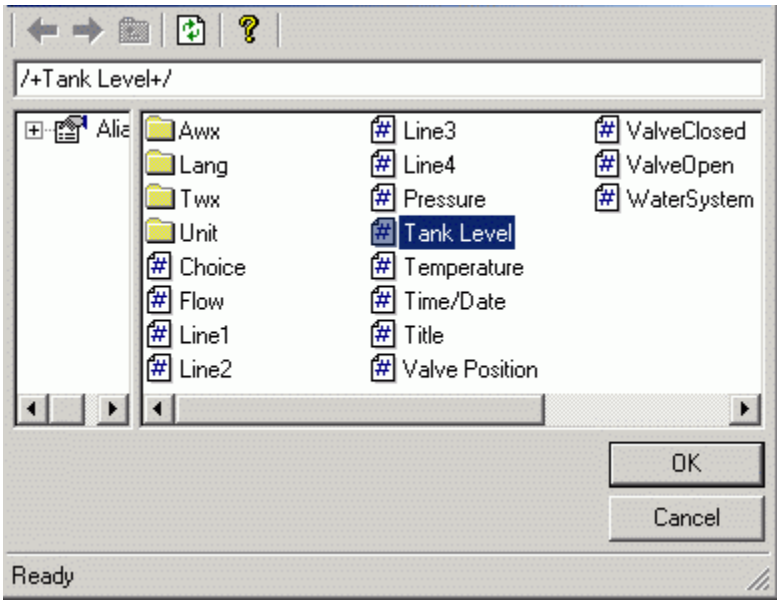
Language Aliases
For language aliases within the expression, use the following syntax:

<#language_alias_name**#>**

Example:
x=/+WaterSystem+/

Selecting **Language Alias Browser** from the pop-up menu opens the Language Alias Browser, as shown in the figure below. The browser includes all languages aliases in the language database. All language aliases that are configured in the Language Configurator are conveniently available to choose from inside the browser. The tree control of the Language Configurator is mimicked in the

tree control of the Language Alias Browser. Select a language alias by double-clicking the alias name. The alias name appears at the top of the browser, which automatically adds the /+ and +/ delimiters to the alias name. Click the **OK** button.



Selecting an Alias From the Language Alias Browser

Variables
Variables can be used in expressions. How the variable needs to be referred to depends on the type of variable. A local variable can be used in expressions when the variable is embedded between double tildes.

Local Variables
For local variables within the expression, use the following syntax:
~~local_variable_name~~

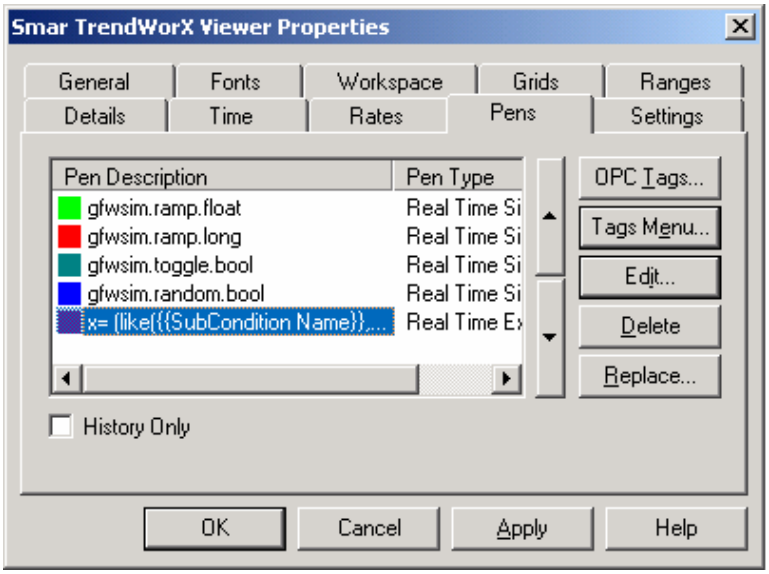
Example:
x=~~Setpoint~~

Simulation Variables
For simulation variables within the expression, use the following syntax:

{{simulation_variable_name**}}**

x={{gfwsim.random.long}}

Editing the Trend Pen
Once you have configured a pen, you can double-click the pen in the **Pens** tab list, as shown below. This opens the **Edit Trend Pen** dialog box, which allows you to edit many options specific to that pen.



Selecting Pens To Edit

Arithmetic
The symbols '+', '-', '*', '/' and '%' use the following format:
expression :: parameter **symbol** parameter

Where

Parameter	A local variable, an OPC tag, a constant, or another expression
Symbol	+ or - or * or / or %

Result

The expression results in a number of any type (float, long, etc.).

Examples

Symbol	Description	Example	Result
+	Addition	~~var1~~ + ~~var2~~	8+3 = 11
-	Subtraction	~~var1~~ - ~~var2~~	8-3 = 5
*	Multiplication	~~var1~~ * ~~var2~~	8*3 = 24
/	Division	~~var1~~ / ~~var2~~	8/3 = 2.66667
%	Calculates the remainder after division	~~var1~~ % ~~var2~~	8%3 = 2
(and)	Gives precedence to parts of the calculation	~~var1~~ / (~~var2~~ + ~~var3~~)	8/(3+2) = 1.6

Relational
Clicking **Relational** in the **Edit Expression** dialog box allows you to edit expressions using the following relational functions:

The symbols '<', '>', '<=', '>=', '==' and '!=' use the following format:

expression :: parameter **symbol** parameter

Where

Parameter	A local variable, an OPC tag, a constant, or another expression
Symbol	< or > or <= or >= or == or !=

Result
The expression results in a Boolean value (0 or 1).

Examples

Symbol	Description	Example	Result
<	Less than	~~var1~~ < ~~var2~~	8<3 = 0
>	Greater than	~~var1~~ > ~~var2~~	8>3 = 1
<=	Less than or equal to	~~var1~~ <= ~~var2~~	8<=3 = 0
>=	Greater than or equal to	~~var1~~ >= ~~var2~~	8>=3 = 1
==	Equal to	~~var1~~ == ~~var2~~	8==3 = 0
!=	Not equal to	~~var1~~ != ~~var2~~	8!=3 = 1

Logical
The symbols '&&' and '||' use the following format:

expression :: parameter **symbol** parameter

The symbol '!' uses the following format:

expression :: **symbol** parameter

Where

Parameter	A local variable, an OPC tag, a constant, or another expression
Symbol	&& or || or !

Result
The expression results in a Boolean value (0 or 1).

Truth table

~~var1~~	0		not 0	
~~var2~~	0	not 0	0	not 0
~~var1~~ && ~~var2~~	0	0	0	1
~~var1~~ || ~~var2~~	0	1	1	1
!~~var1~~	1	1	0	0

Examples

Symbol	Description	Example	Result
&&	And	~~var1~~ && ~~var2~~	8 && 3 = 1
||	Or	~~var1~~ || ~~var2~~	8 || 3 = 1
!	Not	!~~var1~~	!8 = 0

Bitwise
The symbols '&', '|', and '^' of the bitwise group use the following format:
expression :: parameter **symbol** parameter

The symbol '~' of the logical group uses the following format:
expression :: **symbol** parameter

The symbols 'shl' and 'shr' of the bitwise group use the following format:
expression :: **symbol** (value, shift by)

Where

Parameter	A local variable, an OPC tag, a constant, or another expression
Symbol	&& or || or ^ or shl or shr or ~

Result
The expression results in a number when the parameters used contain numbers.

Bit Table

	Binary (Decimal)	Binary (Decimal)
~~var1~~	0000.0000.0000.1000 (8)	0000.0000.0110.0000 (96)
~~var2~~	0000.0000.0000.1010 (10)	0000.0000.0000.1000 (8)
~~var1~~ & ~~var2~~	0000.0000.0000.1000 (8)	0000.0000.0000.0000 (0)
~~var1~~ | ~~var2~~	0000.0000.0000.1010 (10)	0000.0000.0110.1000 (104)
~~var1~~ ^ ~~var2~~	0000.0000.0000.0010 (2)	0000.0000.0110.1000 (104)
shl (~~var1~~,3)	0000.0000.0100.0000 (64)	0000.0011.0000.0000 (768)
shr (~~var1~~,3)	0000.0000.0000.0001 (1)	0000.0000.0000.1100 (12)
~(~~var1~~)	1111.1111.1111.0111 (-9)	1111.1100.1111.1111 (-97)
bittest(~~var1~~,3)	0000.0000.0000.0001 (1)	0000.0000.0000.0000 (0)

Examples

Symbol	Description	Example	Result
&	Bit And	~~var1~~ & ~~var2~~	8 && 3 = 0
|	Bit Or	~~var1~~ | ~~var2~~	8 || 3 = 11
^	Bit eXclusive Or	~~var1~~ ^ ~~var2~~	8^3=11
shl	Bit shift left	shl(~~var1~~,3)	8<<3=64
shr	Bit shift right	shr(~~var1~~,3)	8>>3=1
~	Not (two's complement)	~(~~var1~~)	!8 = -9
bittest	Bit Test	bittest (5 , 0)	1

Note
The bittest function requires you to specify the position of the bit to be tested. You must indicate that it starts from 0. In other words, a bit position of "0" indicates the "less significant" bit.

Functions

The symbols 'sin', 'asin', 'cos', 'acos', 'tan', 'atan', 'log', 'ln', 'exp', 'sqrt', 'abs', 'ceil', and 'floor' use the following format:

expression :: **symbol** (parameter)

The symbols 'pow', 'min', and 'max' use the following format:

expression :: **symbol** (parameter,parameter)

The symbol 'if' uses the following format:

expression :: **symbol** (parameter,parameter,parameter)

Where

Parameter	A local variable, an OPC tag, a constant, or another expression
Symbol	sin, asin, cos, acos, tan, atan, log, ln, exp, sqrt, abs, ceil, floor, min, max, pow, or if

Result

The expression results in a number.

Examples

Symbol	Description	Example	Result
sin	sine of an angle in radians	sin(~~var1~~)	sin(0.785)=0.71
cos	cosine of an angle in radians	cos(~~var1~~)	cos(0.785)=0.71
tan	tangent of an angle in radians	tan(~~var1~~)	tan(0.785)=1.0
asin	arc sine returns an angle in radians	asin(~~var1~~)	asin(0.5)=0.52
acos	arc cosine returns an angle in radians	acos(~~var1~~)	acos(0.5)=1.05
atan	arc tangent returns an angle in radians	atan(~~var1~~)	atan(1)=0.785
sqrt	Returns the square root	sqrt(~~var1~~)	sqrt(100)=10
pow	Returns value 1 raised to the power value 2	pow(~~var1~~,~~var2~~)	pow(100,1.5)=1000
log	10 based logarithm	log(~~var1~~)	log(100)=2
ln	*e* based logarithm	ln(~~var1~~)	ln(7.389)=2
exp	Exponential	exp(~~var1~~)	exp(2)=7.389
abs	Absolute value	abs(~~var1~~)	abs(-1)=1
ceil	Integer ceiling	ceil(~~var1~~)	ceil(7.39)=8
floor	Integer floor	floor(~~var1~~)	floor(7.39)=7
min	Lowest value of two	min(~~var1~~,~~var2~~)	min(10,5)=5
max	Highest value of two	max(~~var1~~,~~var2~~)	min(10,5)=10
if	Conditional statement	if(~~var1~~<~~var2~~, ~~var1~~,~~var2~~)	if(5<8,5,8)=5
like	Wildcard string compare	Like(string, pattern, casesensitive')	
quality	Quality of tag or expression	See below.	See below.
tostring	Type conversion	See below.	See below.
0x	Hexadecimal constant	x=0x11	17
0t	Octal constant	x=0t11	9
0b	Binary constant	x=0b11	3

Note
For the like operator: "string" equals the string to search in; "pattern" equals the string to search for (can include wildcards); nonzero for case-sensitive search; zero for case-insensitive search. String syntax is $"string"$.

You can use these special characters in pattern matches in string:

- ? Any single character.
- Zero or more characters.
- # Any single digit (0-9).
- [charlist] Any single character in charlist.
- [!charlist] Any single character not in charlist.

Quality
The **quality** option on the **Functions** menu of the **Expression Editor** is used to evaluate the quality of an OPC tag or an expression.

The following general syntax is used for quality expressions:

x=quality(expression)

Note
The "(expression)" can also be a simple expression composed of a single tag.

The **quality** function returns the OPC quality of the string between parentheses as one of the following results:

- 192: quality is GOOD
- 64: quality UNCERTAIN
- 0: quality BAD

Note
The OPC Foundation establishes the value ranges for quality. There are actually varying degrees of quality:

- GOOD: 192-252
- UNCERTAIN: 64-191
- BAD: 0-63

For more information, refer to the *OPC Data Access Custom Interface Standard* available for download at the OPC Foundation's Web site, www.opcfoundation.org/.

Example Quality Expression

Expression	Result
x=quality({{SMAR.Simulator.1\SimulatePLC.PumpStatus}})	192 (Quality GOOD)

The quality of an expression is determined through the evaluation of each single tag in the expression. Thus, if you have multiple tags in an expression (and each tag has a different quality), the result of the expression (i.e. 192 [GOOD], 64 [BAD], or 0 [UNCERTAIN]) corresponds to the quality of the tag with the lowest quality. If an expression contains a conditional statement (e.g. if, then, or else), then the result of the expression is affected only by the quality of the branch being executed.

Consider the following sample expression:

x= if (quality(tag1) == 192, tag1, tag2)

This expression can be read as follows:

"If the quality of tag 1 is GOOD (i.e. 192), then the expression result (x) is the value of tag 1. In all other cases (i.e. the quality of tag 1 is UNCERTAIN or BAD), the expression result (x) is the value of tag 2."

We can calculate the results for this expression using different qualities for tag 1 and tag 2, as shown in the figure below.

Case	Tag1 quality	Tag2 quality	Result	Result quality
1	GOOD	GOOD	Tag1	192 (GOOD)
2	GOOD	UNCERTAIN	Tag1	192 (GOOD)
3	GOOD	BAD	Tag1	192 (GOOD)
4	UNCERTAIN	GOOD	Tag2	192 (GOOD)
5	UNCERTAIN	UNCERTAIN	Tag2	64 (UNCERTAIN)
6	UNCERTAIN	BAD	Tag2	0 (BAD)
7	BAD	GOOD	Tag2	192 (GOOD)
8	BAD	UNCERTAIN	Tag2	64 (UNCERTAIN)
9	BAD	BAD	Tag2	0 (BAD)

In cases 1-3 above, the quality of tag1 is GOOD, and therefore the result of the expression is GOOD. Thus, the result of the expression is not affected by the quality of tag2 (the “else” branch of the expression), which is ignored.

In cases 4-6, the quality of tag1 is UNCERTAIN, and therefore the result of the expression is the quality of tag2.

In cases 7-9, the quality of tag1 is BAD, and therefore the result of the expression is the quality of tag2.

Note
The “quality()” function returns a value that represents the quality of the expression within the parentheses but is always GOOD_QUALITY. For example, if TAG1 is BAD_QUALITY then the expression “x=quality(TAG1)" will return 0 with GOOD_QUALITY.

The result of an expression is the minimum quality of the evaluated tag in the expression and is affected only by the quality of the conditional (if, then, or else) branch that is executed.

Consider the following sample expression:

x= if (TAG_01>0,TAG_02,TAG_03)

This expression can be read as follows:

"If the value of TAG_01 is greater than 0, then the expression result (x) is TAG_02. If the value of TAG_01 is less than or equal to 0, then the expression result (x) is TAG_03."

Let's assume that the following values and qualities for these tags:

TAG_01=5 with quality GOOD
TAG_02=6 with quality UNCERTAIN
TAG_03=7 with quality BAD

Because the value of TAG_01 is 5 (greater than 0), the expression result is TAG_02. Thus, the final expression result is 6, and the final expression quality is UNCERTAIN.

Type Conversion
The **tostring** option on the **Functions** menu of the **Expression Editor** takes the value of whatever item is in parentheses and converts it into a string as follows:

The value is +(value)+unit

It can be used to convert from number to string, and it can be very useful for string concatenation.

The proper syntax for the **tostring** option is:

x=$"The value is "$ + tostring(value) + $" unit"$

Note
In the expression above, the word "unit" is placeholder text for a user-specified unit of measurement or variable (e.g. Watt, inches, meters, etc.).

Example Expressions Type Conversion

Expression	Result
x=$"The value is "$ + tostring({{{gfwsim.ramp.float}}) + $" Watt"$	“The value is 543.2345152 Watt”

Constants
The **Functions** menu of the **Expression Editor** supports constant values, including hexadecimal, octal, and binary formats.

Example Expressions Using Constants

Expression	Result
x=0x11	17
x=0t11	9
x=0b11	3

The **Expression Editor** conveniently inserts the 0x and 0t and 0b prefixes for you so do not have to recall them.

Interpreting and Translating Constants

The examples below show how values are calculated for each type of constant.

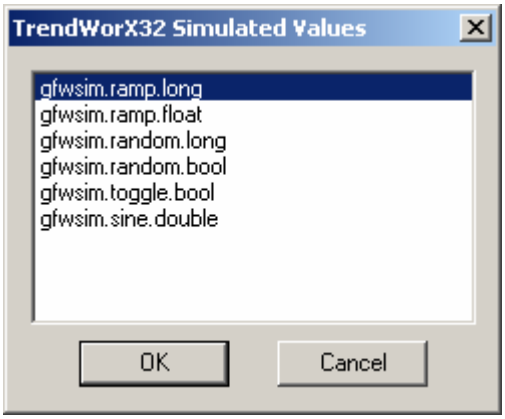
- **Hexadecimal:** 0x20A = 2 * (16^2) + 0 * (16^1) + 10 * (16^0) = 2*256 + 0*16 + 10 * 1 = 512 + 0 + 10 = 522
- **Octal:** 0t36= 3 * (7^1) + 6 *(7^0) = 3* 7 + 6* 1= 21 + 6 = 27
- **Binary:** 0b110 = 1 * (2^2) + 1 * (2^1) + 0 * (2^ 0) = 1 * 4 + 1 * 2 + 0 * 1 = 4+2+0 = 6

Simulation Variables

Selecting **Simulation Variables** from the **Tags** menu in the **Pens** tab of the **Properties** dialog box launches the **TrendWorx Simulated Values** dialog box, shown below, which lists all available simulated variables. Selecting one of these variables will create a pen attached to the simulated variable. These variables are helpful in testing the setup of your pens.

For simulation variables within an expression, use the following syntax:
{{simulation_variable_name**}}**

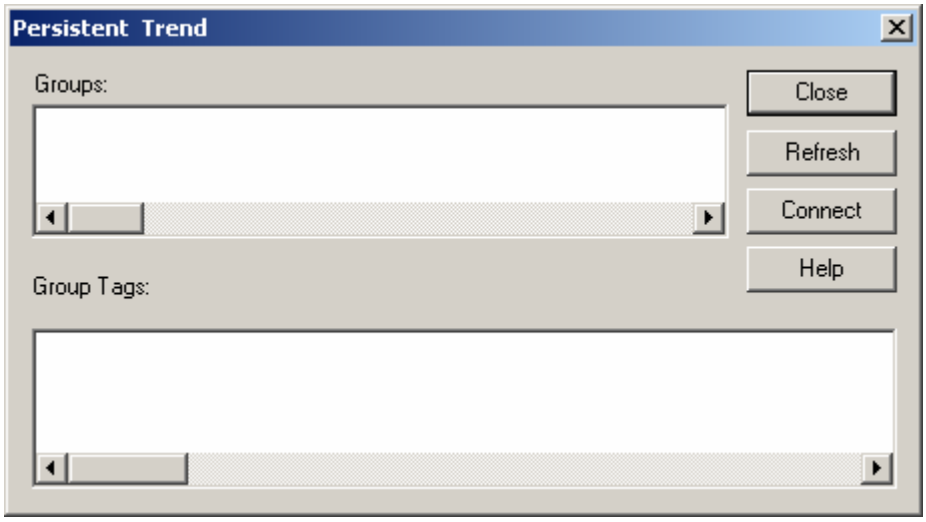
x={{gfwsim.random.long}}



Simulated Values Dialog Box

Persistent Trend

If the Smar Persistent Trending Automation Server is installed, configured, and running, selecting **Persistent Trend** from the **Tags** menu in the **Pens** tab of the **Properties** dialog box enables direct connections to the Persistent Trending server. A new dialog box appears, as shown below, showing all groups configured in the Persistent Trending server.



Persistent Trend Dialog Box

Double-clicking a group displays all signals configured for that specific group. You can select which signals to connect from the Persistent Trending server and click **Connect.** TrendWorx Viewer fills its buffer from the data existing in Persistent Trending prior to drawing.

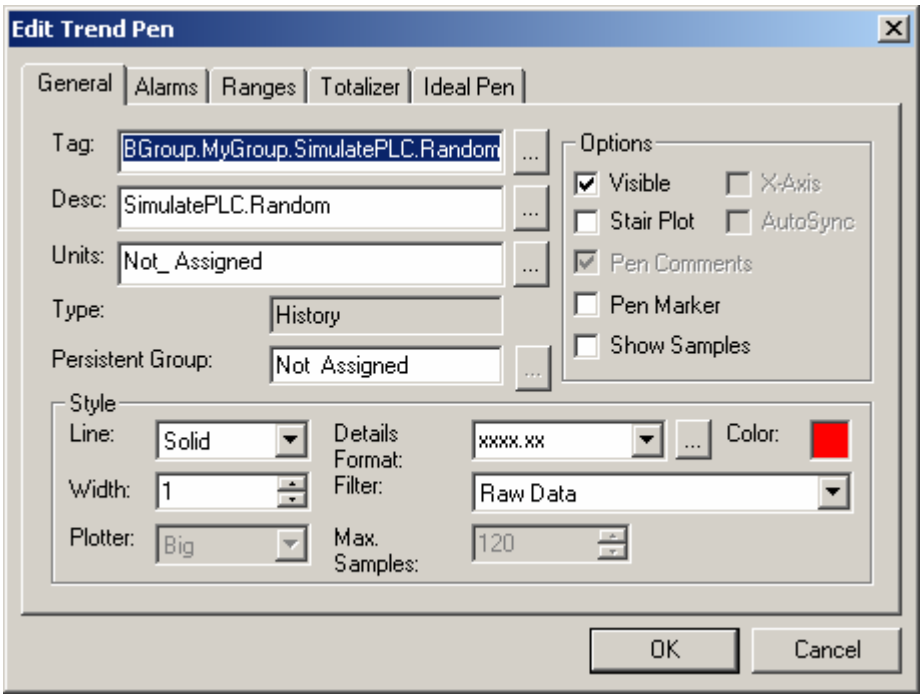
History Tag

Selecting **History Tag** from the **Tags** menu in the **Pens** tab of the **Properties** dialog box opens the **OPC Universal Tag Browser.** Then you can browse for OPC HDA tags**.**

Editing Pens

Clicking **Edit** in the **Pens** tab of the **Properties** dialog box opens the **Edit Trend Pen** dialog box, shown below, which contains the following tabs:

- General tab
- Alarms tab
- Ranges tab
- Totalizer tab
- Ideal Pens tab



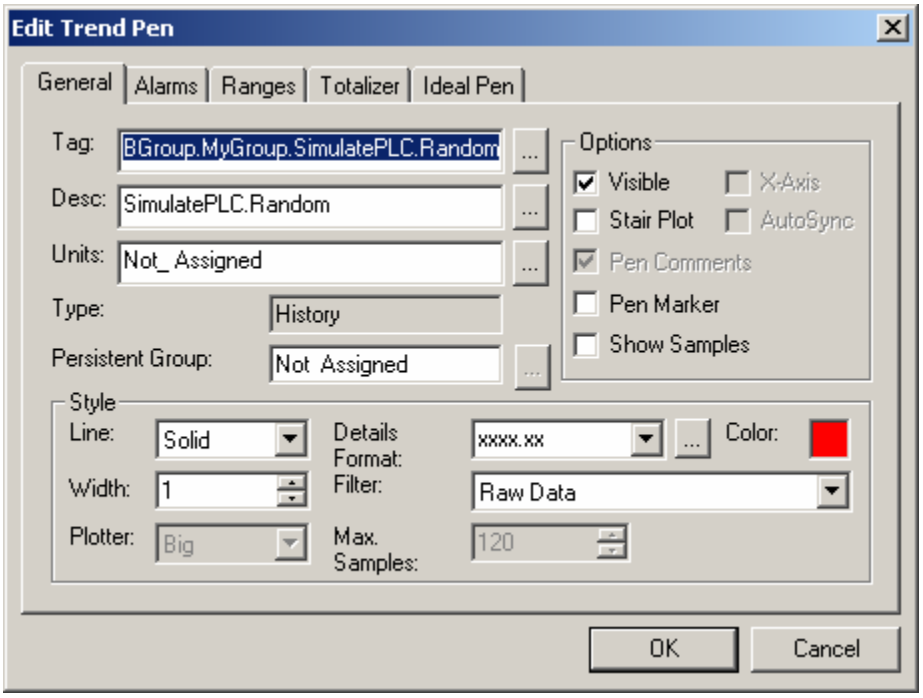
Edit Trend Pen Dialog Box

General Tab

The **General** tab, shown below, is the default tab of the **Edit Trend Pen** dialog box. This tab allows you to change the tag with which the selected is associated, the description of the pen, and the units assigned to the pen. It also provides various options and style settings for the pen.

In the Unicode version of TrendWorx Viewer, the **Description (Desc), Units,** and **Details Format** fields can be language-aliased. If the language alias for the units also has a related equation, this will result in the automatic range and value scaling for the pen upon switching languages.

To select an alias to use, click the **...** button to the right of the **Tag, Desc, Units, Persistent Group,** or **Details Format** fields and select either **Global Aliases** or **Language Aliases** from the pop-up menu. This opens the respective alias browsers, allowing you to choose from a list of available aliases.



Edit Trend Pen Dialog Box: General Tab

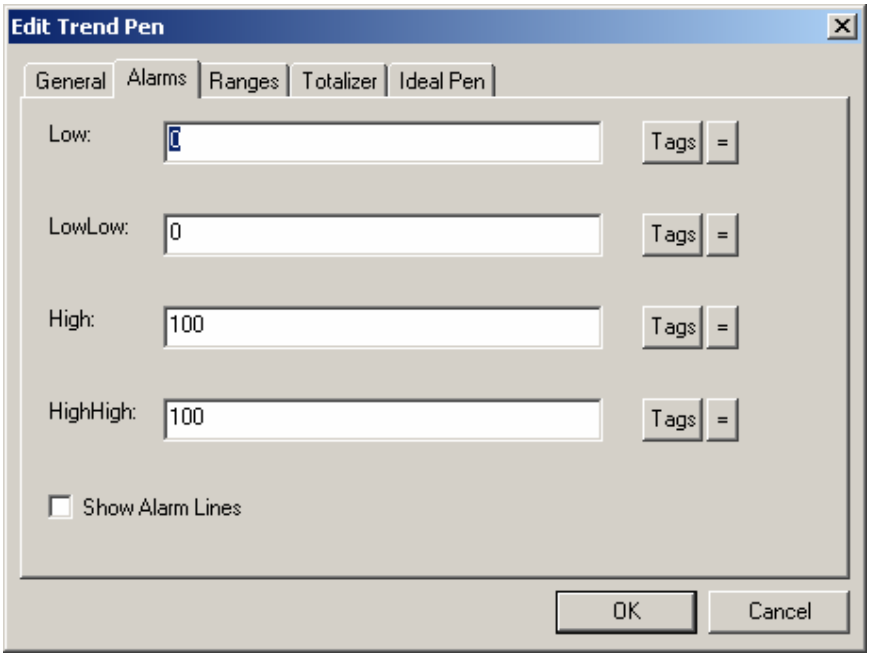
General Tab Functions

Function	Description
Options - Visible	Indicates whether the plot of the selected pen will be visible. If **Visible** is not checked, the Viewer will still buffer data for the pen, but it will not draw it.
Options - Stair Plot	Describes how the plot will appear. The **stair plot** uses a stepwise draw method to plot the trend. It is ideal for plotting slowly changing signals or setpoints.
Options - Pen Comments	If the pen being edited is a historical pen, then the **Pen Comments** check box will be enabled. If checked, when the TrendWorx Viewer ActiveX is in freeze mode, it will retrieve and display all related historical comments and batch information (if any).
Options - Pen Marker	Provides a marker for the pen on the right-hand side of the trend display indicating the last data point drawn on the graph.
Options - Show Samples	Inserts a circle around every point on the graph that represents an actual data point.
Options - X-Axis	Indicates the horizontal axis selection for XY plots.
Options - Auto Sync	This option applies to real-time pens. If enabled, it will shift the time axis of the pen so that the curve will be plotted within the current time frame of the Viewer. This option should be used when real-time pens are connected to remote OPC Data servers and there no network synchronization facility is applied.
Style - Line	Select a line style for the plot from the drop-down list: **Solid, Dashed, Dotted,** or **Dotted Dash.**
Style - Width	Determines the width of the plot line. If the line width is greater than 1, the **Line** field will be unavailable, and the **Solid** line style will be applied.
Style - Plotter	Used only for circular charts, determines the size of the plotter for the selected pen: small, medium, big, and huge.
Style - Color	Clicking the **Color** box will open the **Color** dialog box, from which you can select the color of the pen.

Function	Description
Details Format	Specifies how data will be displayed in the **Details** window of the Trend Viewer.
Filter	The **Filter** selection is mostly used for historical replay and corresponds to the averaging method used in retrieving historical data. For example, if **Filter** is set to **Last Sample,** the last sample of the historical data within each subinterval will be retrieved. The TrendWorx Viewer supports the **Raw Data** filter for historical replay as follows: • Select the **Raw Data** filter for a historical pen. • Select the **Max. Samples** to retrieve. • The upper value of the **Max. Samples** is taken from the registry setting: "HKEY_LOCAL_MACHINE\SOFTWARE\SMAR\TWXView32\Data Properties\Max Pen Samples" As a result, the TrendWorx Viewer will ask the TrendWorx SQL Server to retrieve the Max. Samples number of raw samples (no interpolated/extrapolated) from the historical data. If more data exist for the time interval for which the data were requested, an *X* mark will appear at the ends of the curve to indicate that not all samples were retrieved for the time interval of the request. This feature does require some configuration in order to prevent usage of large amounts of memory. A typical way to estimate the maximum number of samples data-logged for a period of time is to divide the time period by the data-collection rate of the signal configured in the data logger. If no dead band is configured, and the signal that is data-logged changes frequently, the result indicates an upper limit of samples data-logged for that period.

Alarms Tab

The **Alarms** tab of the **Edit Trend Pen** dialog box, shown below, sets the levels at which alarm lines will be drawn (if desired).



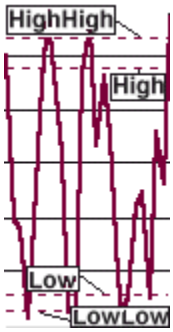
Edit Trend Pen Dialog Box: Alarms Tab

The TrendWorx Viewer ActiveX allows the connection of OPC Data Access tags to its alarm limits. The OPC-enabled alarm limits will hold the most current value of the alarm limits. The alarm limits can be a constant value, an OPC Data Access tag, or an expression.
In addition, the alarm limits are interfaced to the Global Alias and Language Alias servers. This functionality is not available in History Trend mode due to the nature of this specific historical replay mode. In addition, several OLE automation methods have been added to support this functionality:

- void SetPenLoAlarmString(BSTR PenName, BSTR AlarmString, BSTR PenType)
- void SetPenLoLoAlarmString(BSTR PenName, BSTR AlarmString, BSTR PenType)
- void SetPenHiAlarmString(BSTR PenName, BSTR AlarmString, BSTR PenType)
- void SetPenHiHiAlarmString(BSTR PenName, BSTR AlarmString, BSTR PenType)

If **Show Alarm Lines** is checked, dashed lines at the **Low, LowLow, High** and **HighHigh** marks will be inserted into the trend. A sample of this is shown below.

Note
If you desire buffering of alarm values, historical replay functionality, etc., you should not use the alarm lines support of the TrendWorx Viewer ActiveX, but rather use individual pens to represent each alarm line (limit).



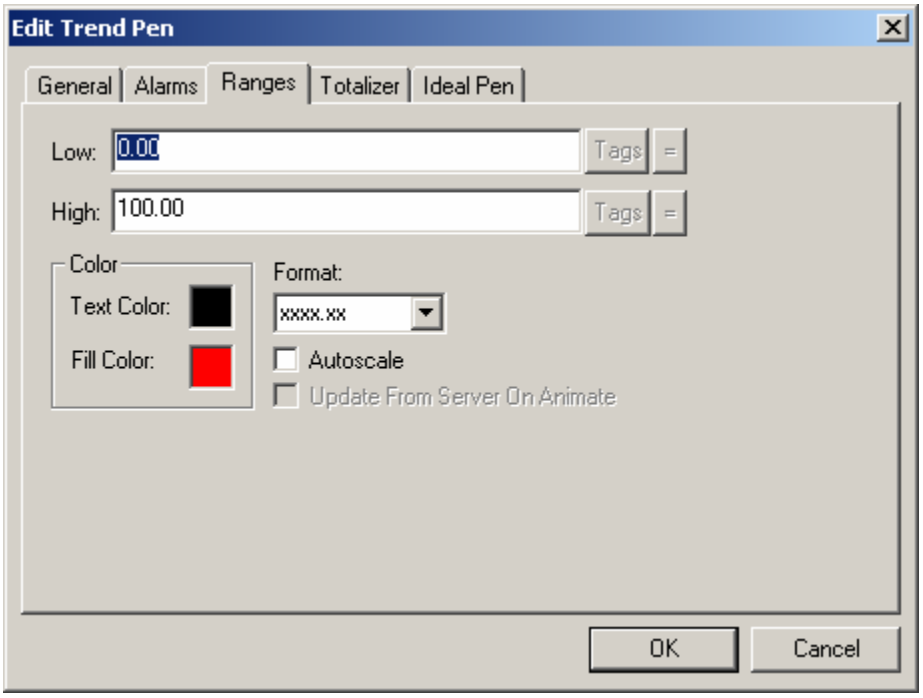
Alarm Lines Shown

Ranges Tab

The **Ranges** tab of the **Edit Trend Pen** dialog box, shown below, deals with the field to the left of the trend display and the relative scaling of the pen curves for drawing. This tab is available only if the **Global Ranges** option is not enabled.

The range values can be constants, expressions, OPC tags, or global aliases. To select an OPC tag for the low or high ranges, click the **Tags** button. To select an expression, click the **=** button to open the Expression Editor. To select a global alias, click the **...** button and select **Global Aliases** from the pop-up menu. This opens the **Global Alias** browser, allowing you to choose from a list of available aliases.

In the Unicode version of TrendWorx Viewer, the **Format** field can be language-aliased. The language alias will be used to determine the ranges format on the range scale, if the **Global Ranges** option is not selected. To select an alias to use, click the **...** button to the right of the **Format** text box and select either **Global Aliases** or **Language Aliases** from the pop-up menu. This opens the respective alias browsers, allowing you to choose from a list of available aliases.



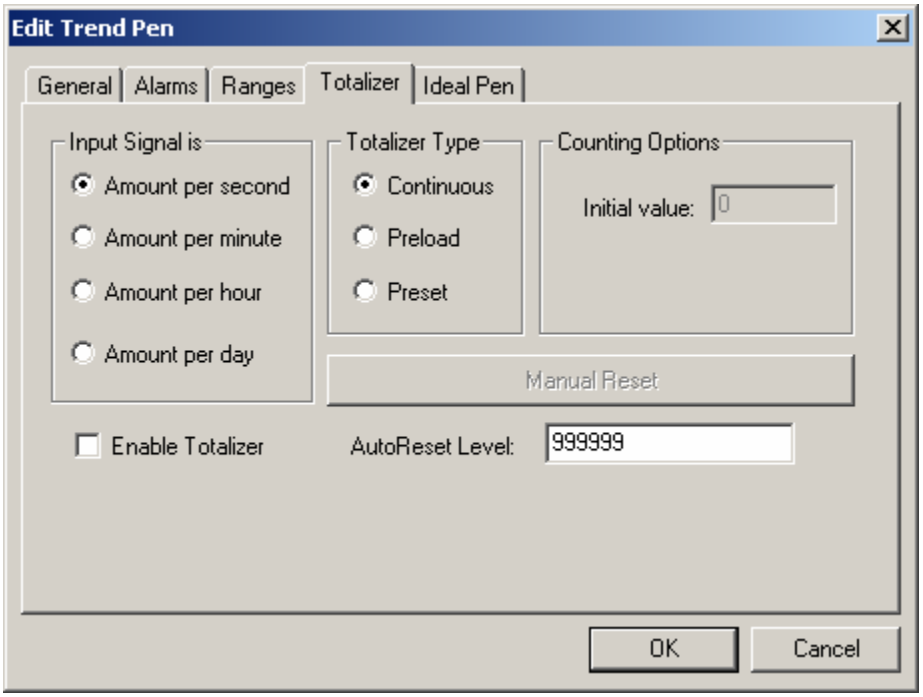
Edit Trend Pen Dialog Box: Ranges Tab

Ranges Tab Functions

Function	Description
Low	Sets the lowest visible point.
High	Sets the highest visible point.
Tags Button	Launches the **OPC Universal Tag Browser.**
= Button	Launches the Expression Editor.
... Button	Opens the alias browsers.
Text Color	Clicking the **Text Color** box will open the **Color** dialog box so that you can select a color for the text of the field.
Fill Color	Clicking the **Fill Color** box will open the **Color** dialog box so that you can select a color for the background of the field.
Format	Specifies how data will be displayed in the Ranges section of the Trend Viewer.
Autoscale	Disables the **Low** and **High** fields, and sets these limits automatically according to the values for the pens. Autoscaling, if checked, adjusts the range if the actual value is above or below the set limits. For example, if autoscaling is selected and the ranges are set from 0 (Low) to 200 (High) and the actual value is 250, then the ranges will autoscale to 0 to 280. The adjustment will be around 20 percent above the actual value.
Update From Server on Animate	If this option is enabled, the ranges of the pen are automatically updated from the OPC Data server or the OPC Historical servers upon entering animation mode.

Totalizer Tab

The **Totalizer** function calculates the total amount covered within a certain time period based on the rate represented by the signal; for example, flow (gallons per minute) and speed (miles per minute). The TrendWorx Viewer has Totalizer support on a per-pen basis, even for non-circular chart plot types.



Edit Trend Pen Dialog Box: Totalizer Tab

Totalizer Tab Functions

Function	Description
Input Signal - Amount Per Second	The signal represents data in seconds.
Input Signal - Amount Per Minute	The signal represents data in minutes.
Input Signal - Amount Per Hour	The signal represents data in hours.
Input Signal - Amount Per Day	The signal represents data in days.
Totalizer Type - Continuous	When **Continuous** is selected, the Totalizer will keep counting, starting from 0 until it comes to the end of the trend period, or until the integrated value exceeds the **Auto Reset Level** (a maximum limit).
Totalizer Type - Preload	When **Preload** is selected, the Totalizer commences counting from any value. This is especially useful when totalizing must be "held" (suspended) while a necessary operation is being performed. For example, the pipes are being cleaned and then started from a known value.
Totalizer Type – Preset	When **Preset** is selected, you simply specify a preset value. • If you are counting upwards, the value will obviously be positive. • If you are counting downwards, the preset value will be negative. A negative value would be relevant in a situation where a

Function	Description
Totalizer Type - Preset	reservoir is being drained, for example. Then the Totalizer function, if enabled for a circular chart, would help monitor the flow rate. • When counting upwards, when the total exceeds the preset value, it is reset. • When counting downwards, the preset value is reset at a point when it becomes negative.
Initial Value	Specifies a counting option.
Enable Totalizer	When **Enable Totalizer** is checked, the Totalizer will run according to the other configurations on this tab.
Manual Reset	In runtime mode, the **Manual Reset** button is available in the **Totalizer** tab. When it is reset, the system returns to its initial value, and everything else is disabled.
Auto Reset Level	Sets the level at which the system will automatically reset, returning to its initial value and disabling everything else.

If you select two pens connected to the same OPC tag and enable the Totalizer function for one, you can view the details—namely that the Totalizer function is enabled—in the output window.

When the signal is 0, the Totalizer will remain at the same value. When it is on, it will show the cumulative value.

The TrendWorx Viewer has Totalizer support on a per-pen basis, even for non-circular chart plot types.

Trend Viewer Toolbar

The **Trend Viewer** toolbar is the runtime user interface for the ActiveX. The toolbar offers you access to various runtime TrendWorx Viewer ActiveX functions and operations. To view or hide the toolbar, double-click the TrendWorx Viewer during runtime. You cannot view the toolbar in configuration mode.

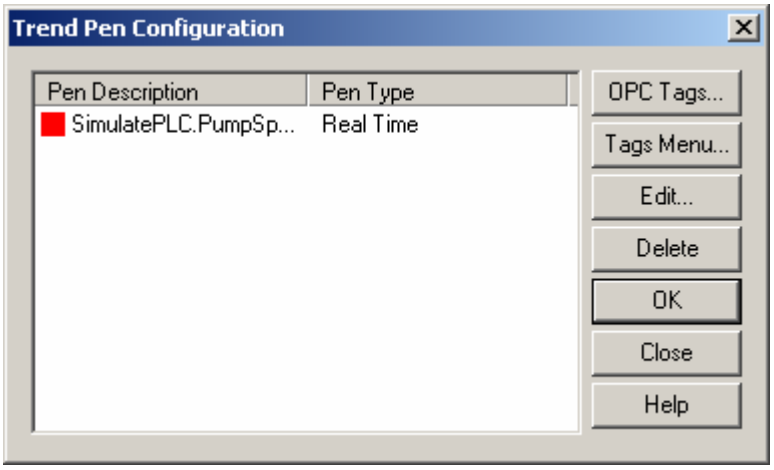
Trend Viewer Toolbar

The **Trend Viewer** toolbar contains the following buttons:

- Edit pens
- Edit trend
- Edit period
- Freeze mode
- Statistics
- Zoom trend
- Page back
- Cursor back
- Cursor forward
- Page forward
- Set right time
- Show comments
- Print trend
- Save trend

Edit Pens

Clicking the **Edit Pens** button, shown at left, on the **Trend Viewer** toolbar opens the **Trend Pen Configuration** dialog box, shown below.



Trend Pen Configuration Dialog Box

The **Trend Pen Configuration** dialog box contains the following buttons:

- OPC tags
- Tags menu
- Edit
- Delete

OPC Tags
To make real-time connections from the **Trend Pen Configuration** dialog box, click the **OPC Tags** button. This opens the **OPC Universal Tag Browser,** which enables you to browse all available OPC servers and their signals.

Tags Menu
Clicking **Tags Menu** in the **Trend Pen Configuration** dialog box opens the **Tags** menu, which contains the following options:

- Expression editor
- Simulation variables
- Persistent trend
- History tag

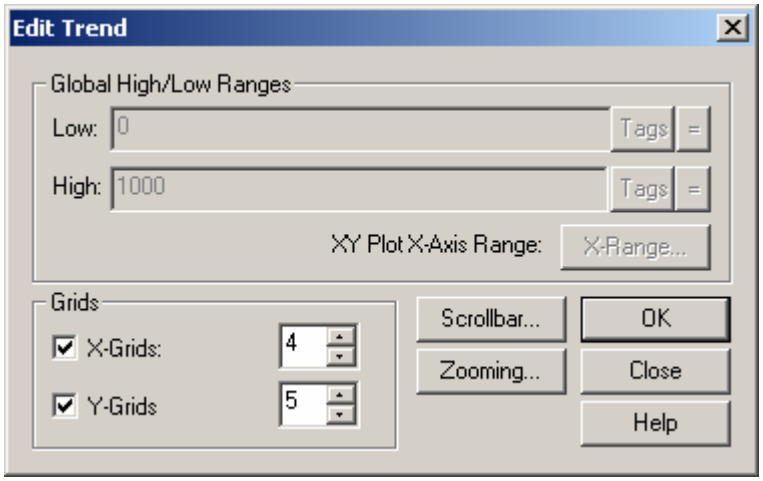
Editing Pens
Clicking **Edit** in the **Trend Pen Configuration** dialog box opens the **Edit Trend Pen** dialog box, which contains the following tabs:

- **General tab**
- **Alarm tab**
- **Ranges tab**
- **Totalizer tab**

Delete Button
You can also delete, modify, and replace pens. To delete one or more pens, select the pen and then click **Delete** on the **Trend Pen Configuration** dialog box. Then click **Yes** to delete the pen.

Edit Trend

Clicking the **Edit Trend** button on the **Trend Viewer** toolbar opens the **Edit Trend** dialog box, shown below.

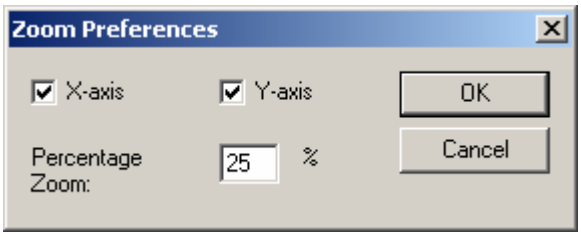


Edit Trend Dialog Box

The **Global High/Low Ranges** fields show the ranges that were assigned in the **Ranges** tab of the **Properties** dialog box. If the **Global Ranges** box was not checked on that tab, then this section of the **Edit Trend** dialog box will be unavailable.

The **Scroll Bar** button allows you to set the time range for how far back you will be able to scroll while in freeze mode.

To select the appropriate settings for the **Zoom Trend** button, click **Zooming** on the **Edit Trend** dialog box. This opens the **Zoom Preferences** dialog box, shown below. You can select how closely you want to zoom and which axis you want to use as a base for the zoom when you are using the point-and-click zoom function. If you use the "rubber band" zooming feature, these options will be ignored. In addition, these options take global effect for all the TrendWorx Viewers, and they are not saved on a per-individual Viewer ActiveX basis.

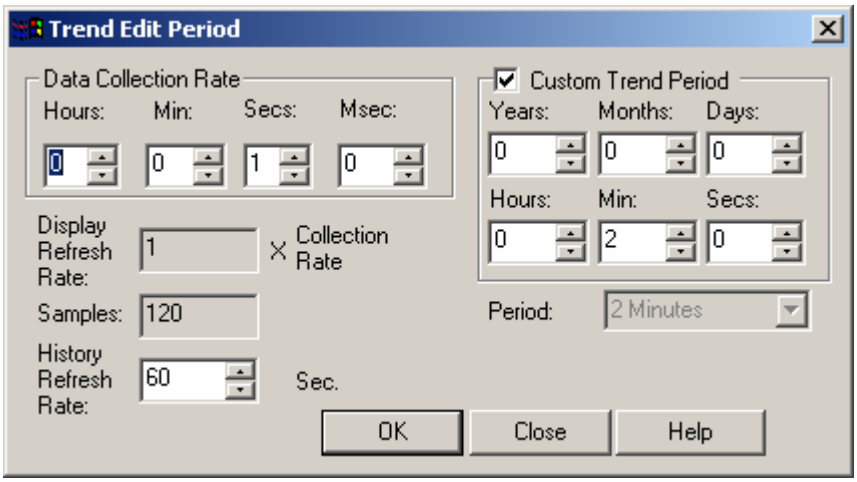


Zoom Preferences Dialog Box

The **Grids** section of the **Edit Trend** dialog box determines how many lines along the *x*-axis and *y*-axis make up the grid displayed in the **Trend** window.

Edit Period

Clicking the **Edit Period** button on the **Trend Viewer** toolbar opens the **Trend Edit Period** dialog box, shown below.



Trend Edit Period Dialog Box

The **Data-Collection Rate, Display Refresh Rate,** and **Samples** fields are set according to the settings made on the **Rates** tab of the **Properties** dialog box.

You can set the trend period and/or the data-collection rate using the **Trend Edit Period** dialog box. If you want to select a custom period, the **Custom Trend Period** option should be checked first. Otherwise, the **Period** field will be activated and by default this field is set at 2 minutes but the options of 10 seconds, 30 seconds, 1 minute, 10 minutes, 30 minutes, 1 hour, 3 hours, 8 hours, 1 day, 5 days, 1 week, 1 month, 3 months, 6 months, and 1 year are also available from this list.

During the **Period Change** operation, the TrendWorx Viewer ActiveX will try first to increase the number of samples on a per-pen basis to produce a higher trend time period frame for viewing data. If upon doing so it exceeds its maximum number of samples per pen, which is currently set to 7200, it will try to adjust the data resolution (data-collection rate) to produce the desired trend period.

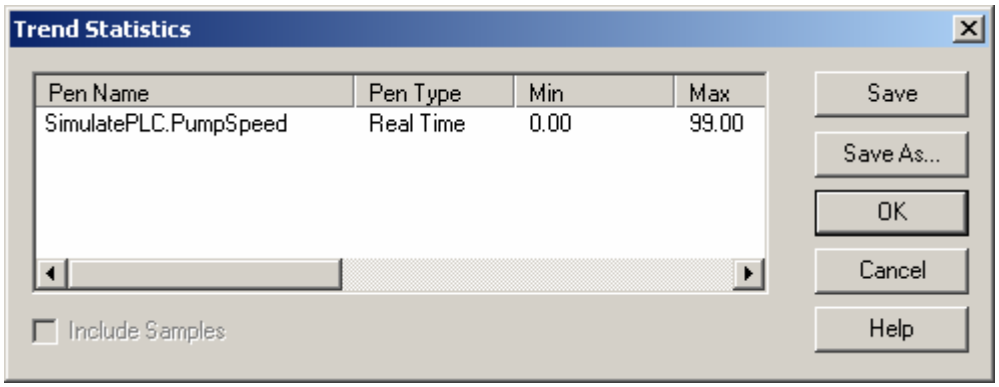
Freeze Mode

Clicking the **Freeze Mode** button on the Trend Viewer toolbar halts the trend display without stopping data collection in the TrendWorx Viewer. To unfreeze the display, simply click the **Freeze Mode** button again. While the display is in freeze mode, you can click on the display, and a black vertical cursor line will appear with circles in the color of the each pen where the line intersects the closest sample of the plot for that pen. By holding the left mouse button down, you can move the cursor line and view the sample values, time stamps, and other parameters in the **Details** window. In freeze mode, additional trending functions, such as zooming and paging, are available.

Note
If the TrendWorx Viewer has historical pens for which the **Show Comments** option has been enabled, freezing the display will also retrieve the historical comments and batch information (if available).

Statistics

Clicking the **Statistics** button on the **Trend Viewer** toolbar opens the **Trend Statistics** dialog box, shown below.



Trend Statistics Dialog Box

The **Trend Statistics** dialog box shows relative statistics for all pens in a Trend. In the case of bar plots, the statistics window shows the statistics profile of all signals combined. When the **Save** or **Save As** buttons are clicked, the **Save As** dialog box opens, and you are prompted to enter a file name for the statistics. The statistics will be saved in a .csv file. Checking **Include Samples** includes each pen's samples in the saved statistics file, along with any historical comments for the history pens (if available).

Zoom Trend

When you click the **Zoom Trend** button on the **Trend Viewer** toolbar in freeze mode, you can zoom in on the **Trend** window and perform the point-and-click zoom function. This enables you to zoom in on the trend display about the current location of the cursor line, using the desired settings for zooming configured in the **Edit Trend** dialog box. Clicking the left mouse button while pressing the **SHIFT** key or right-clicking the mouse inside the trend display zooms out of the trend display.

In addition to the point-and-click zoom function, the TrendWorx Viewer ActiveX also supports a "rubber band" or box zoom approach to zooming. While in freeze mode, you can press the **SHIFT** key down and press the left mouse button to select a desired area on which to zoom. Clicking the left mouse button while pressing the **SHIFT** key, or right-clicking the mouse inside the trend display, zooms out of the trend display.

Cursor Back/Cursor Forward

Clicking the **Cursor Back** and **Cursor Forward** buttons on the **Trend Viewer** in freeze mode moves the cursor line back and forth over the trend display. You can also move the cursor by clicking the left mouse button on the trend display, or by pressing the left and right arrow keys on the keyboard. The cursor function is available only when the trend display is in freeze mode.

The cursor enables you to select specific sample data points on the trend display. To get a detailed description about a specific sample data point in the trend, or to view historical comments and batch information, point to the sample using the mouse pointer, as shown in the figure above. Pressing the **SHIFT** key while clicking the **Cursor Back** and **Cursor Forward** buttons moves the cursor left or right, respectively, 10 samples (by default).

Page Back

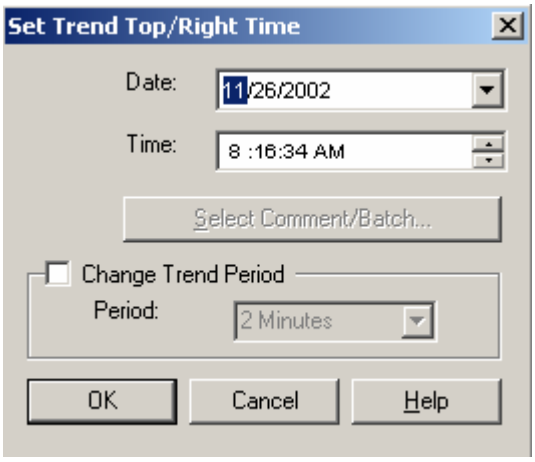
Clicking the **Page Back** button on the **Trend Viewer** toolbar shifts the trend display back from the cursor line by one trend period. This function is available only when the trend display is in freeze mode. The TrendWorx Viewer retrieves and displays historical and persistent trend data from the TrendWorx Persistent Trending memory buffers.

Page Forward

Clicking the **Page Forward** button on the **Trend Viewer** toolbar shifts the trend display forward from the cursor line by one trend period. This function is available only when the trend display is in freeze mode. The TrendWorx Viewer retrieves and displays historical and persistent trend data from the TrendWorx Persistent Trending memory buffers.

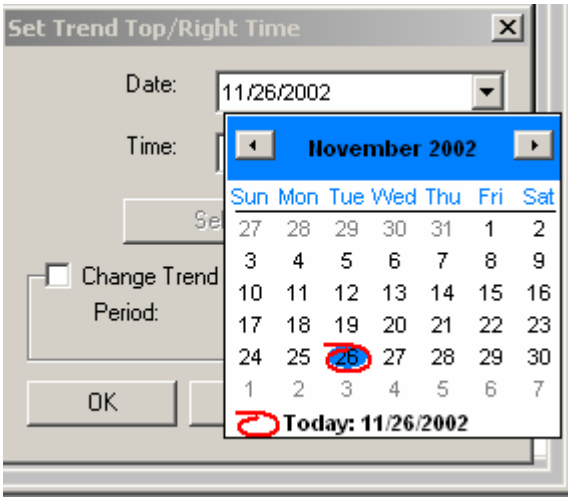
Set Right Time

Clicking the **Set Right Time** button on the **Trend Viewer** toolbar opens the **Set Trend Top/Right Time** dialog box, shown below. This dialog box enables you view a specific historical trend period. In freeze mode, this causes the TrendWorx Viewer to retrieve and display the selected historical and persistent trend data from the TrendWorx Persistent Trending memory buffers.



Set Trend Top/Right Time Dialog Box

To select a desired date for the trend period you want to view, click the down arrow in the **Date** field, and then choose a date from the calendar, as shown in the figure below. To select a desired time, highlight the hours, minutes, or seconds in the **Time** field. You can either type the desired hours, minutes, and seconds or click the arrows to scan the highlighted time field.



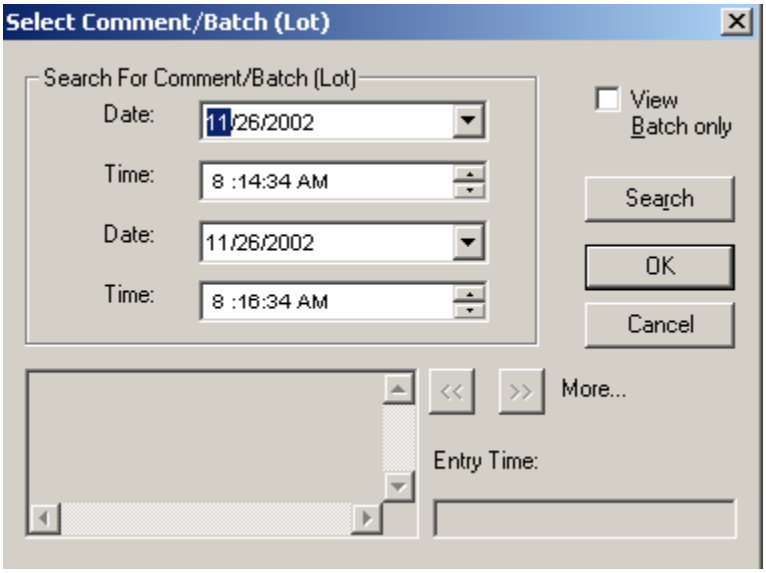
Choosing a Date From the Calendar

The **Set Trend Top/Right Time** dialog box has time and date pick controls as well as an interface to the historical operator comments and batch information. To use this feature, do the following:

1. Select a history pen from the details window.

2. Click the **Set Right Time** button on the **Trend Viewer** toolbar to open the **Set Trend Top/Right Time** dialog box. Click the **Select Comment/Batch** button.

3. This opens the **Select Comment/Batch (Lot)** dialog box, shown below, which allows you to search for a specific batch entry or operator comment within a time range.



Select Comment/Batch (Lot) Dialog Box

In the Select Comment/Batch (Lot) dialog box:

1. Select a start time and date. To select the date, click the down arrow in the **Date** field, and then choose a date from the calendar.

2. Select an end time and date.

3. Click **Search** to initiate the search.

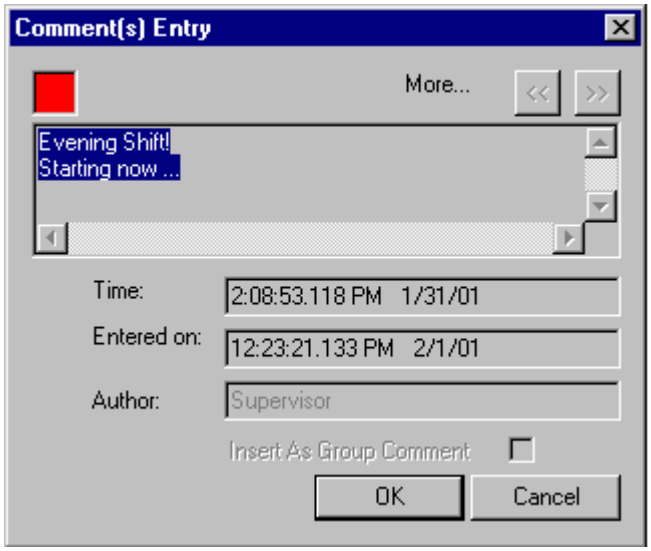
4. Once the search is completed, use the **<<** and **>>** buttons to scroll through multiple operator comments and batch entries.

4. When you locate the desired one, click **OK.**

Note
Selecting the **View Batch Only** option filters out the historical operator comments so that only the related batch (lot) entries are displayed.

Show Comments

If historical pens are configured in the TrendWorx Viewer, clicking the **Show Comments** button on the **Trend Viewer** toolbar places the Viewer in freeze mode and retrieves all historical operator comments and batch information available. You can then select a historical pen from the **Details** window or double-click the comment icon to display the following the **Comment(s) Entry** dialog box, shown below.



Comment(s) Entry Dialog Box

If more than one comment exists in the same area, the **<<** and **>>** buttons will be enabled. These buttons allow you to scroll through all available comments.

Note
Historical comments are not supported for XY plots and bar plots. Historical comments are integrated into the ToolTip support as well as the historical replay and ideal pen functionality.

Print Trend

Clicking the **Print Trend** button on the **Trend Viewer** toolbar opens the Windows **Print** dialog box, which allows you to print the currently selected TrendWorx Viewer. The printout will also include a header that provides some information about the trend, such as the settings and the name of the computer in which the trend originated.

Save Trend

If the TrendWorx Viewer is configured to save its configuration into a .v32 file, independently of the container, WebHMI users will have the option in runtime mode to save current settings into the preconfigured file using the **Save Trend** button on the **Trend Viewer** toolbar. In the case of a WebHMI application, this also will be the configuration file to be loaded whenever the HTML page is refreshed.

Note
The **Save Trend** function on the Trend Viewer toolbar is integrated into the Security Server and is ONLY available to WebHMI users. It is not supported in displays that use global aliases.

Historical Replay

The TrendWorx Viewer is interfaced through the OPC Historical Data Access specification to the SMAR TrendWorx SQL Server, as well as to other third-party historical servers supporting the specification.

The TrendWorx Viewer ActiveX Version 7.0 has been updated to be compliant with the latest OPC HDA release specification 1.2. In general, the OPC HDA specification is an extended OPC specification, which includes an increased number of interfaces and methods, not all of them being mandatory. On the other hand, the TrendWorx Viewer ActiveX trend client requires an advanced HDA server implementation to support its rich user interface. Since not all OPC HDA servers will support the TrendWorx Viewer's required advanced interface set, and since there is currently no available way to classify OPC HDA server functionality (or equivalently, compliance levels), the TrendWorx Viewer ActiveX has integrated minimal OPC HDA server capability information, which will either modify its user interface or warn the user if the third-party OPC HDA server does not

support the required interfaces. However, the TrendWorx Viewer ActiveX will not compensate for the lack of implementation of used OPC HDA interfaces or methods by combining supported method calls to produce the same end result. For version 7.0, the following additional OPC HDA compliance development effort has been done:

- **Detection of Connection Point Support:** The TrendWorx Viewer ActiveX supports two methods of historical replay. In Auto Updating mode (default), mixed real time and historical signals can be configured and updated in real time via asynchronous methods calls. In History Only mode, only historical signals can be configured and they are updated via user interface requests (or VBA automation) and no asynchronous requests will be processed. If the OPC HDA server does not support connection points, then the second historical replay mode should be used.

- **Detection of Max Returned Samples:** If the OPC HDA server does not support return of the number of historical samples configured in the TrendWorx Viewer ActiveX based on data collection and the trend display period, a warning message will notify the user to change the trend period settings.

- **Detection of OPC HDA Aggregates:** Each historical pen can utilize a historical data retrieval filter (called "aggregate"). Starting from version 7.0, the TrendWorx Viewer will retrieve the OPC HDA server supported aggregates and allow editing of the historical pen to select the desired aggregate. If the OPC HDA server does not support any aggregates, the only historical data retrieval filter supported will be the **Raw Data** filter.

- **Detection of OPC HDA Server Annotation Support:** The TrendWorx Viewer ActiveX trend client will detect if OPC HDA servers support annotations, and it will modify its user interface accordingly.

In terms of historical replay and reporting, the following key changes have been made:

- Data filter selection other than Raw will result in data time stamped at the beginning of each subinterval.

- When retrieving data using data filters other than Raw, subintervals for which there are no data because of no data-logging activity will be marked as “empty” slots at the corresponding time with an empty (VT_EMPTY) value. You can check the returned qualities for further processing.

- The historical qualities supported are as follows:

  - OPCHDA_EXTRADATA 0x0001
    - More data may exist
  - OPCHDA_INTERPOLATED 0x0002
    - Interpolated data value
  - OPCHDA_RAW 0x0004
    - Raw data value
  - OPCHDA_CALCULATED 0x0008
    - Calculated data value
  - OPCHDA_NOBOUND 0x0010
    - No data found to provide upper or lower bound
  - OPCHDA_NODATA 0x0020
    - No data collected. Archiving not active
  - OPCHDA_DATALOST 0x0040
    - Calculation started/stopped/lost
  - OPCHDA_CONVERSION 0x0080
    - Scaling / conversion error
  - OPCHDA_PARTIAL 0x0100
    - Aggregate value is for an incomplete interval

Critical Note
Because of the new compliance changes in historical replay and reporting, a version 7.0 historical replay or reporting may not produce identical results to existing 6.1x version reports and or historical replay screen captures for the same signals and time periods. Two modes of historical replay are supported:

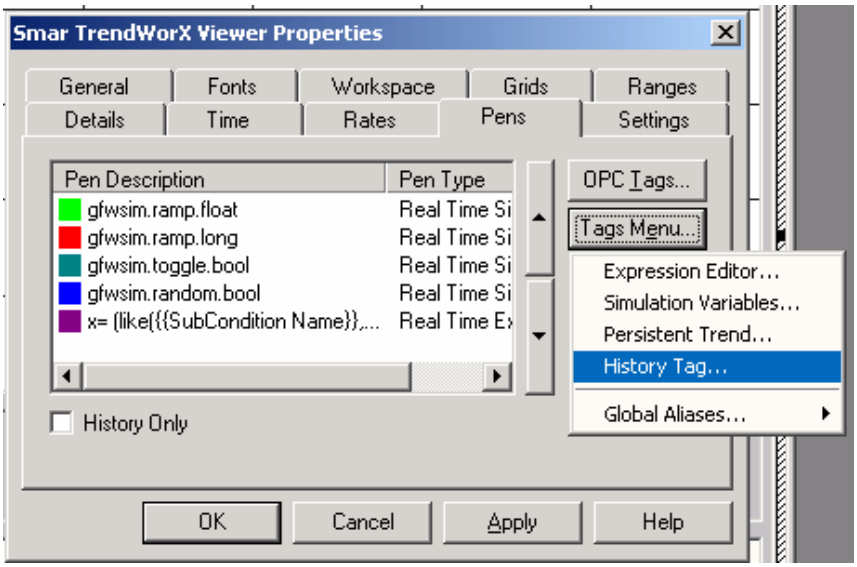
1. Mixed replay of signals
2. History only replay (in freeze mode)

Mixed Replay

In **mixed replay,** which is the default mode, you can connect real-time OPC signals, persistent trending signals, and historical signals. All the signals will auto update, and the historical signals will be refreshed with new historical data as they become available. You can control the frequency of historical data updates by modifying the **History Refresh Rate** option in the **Rates** tab of the **Properties** dialog box of the TrendWorx Viewer. This should be set close to the data-logging frequency (i.e. the **Log to Disk** option in the TrendWorx Configurator).

History Only Replay

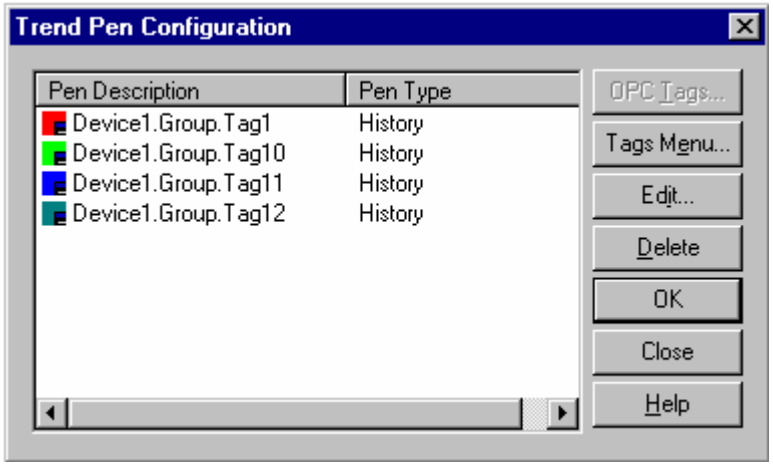
To configure the Viewer for **History Only Replay,** you must first check **History Only** in the **Pens** tab of the **Properties** dialog box, as shown in the figure below, prior to making any signal connections. In this mode, you can only connect to historical data. Once the Viewer is committed to animation (runtime) mode, it will populate the screen with the historical data and automatically set the Viewer into freeze mode. You can then retrieve historical data by scrolling back using the scroll bar. In addition, for finer control over historical replay, you can double-click the time window or click the **Set Right Time** button on the **Trend Viewer** toolbar to set the Viewer's right historical time of reference.



Historical Signal Connections

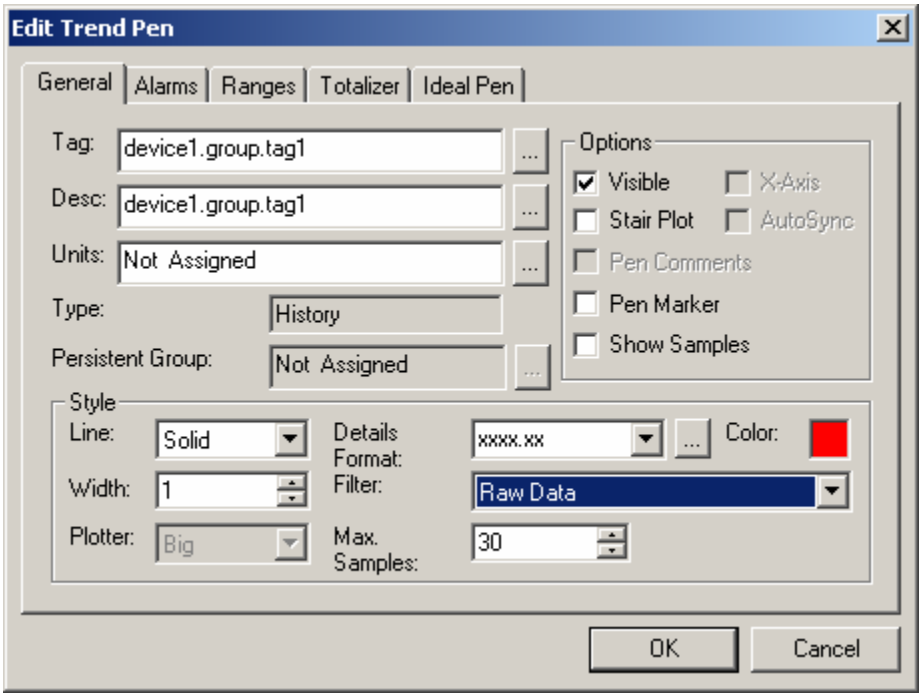
Adding historical pens. To add historical pens, click **Tags Menu** and select **History Tags** to open the **OPC Universal Tag Browser,** which allows you to browse all of the installed historical servers locally or remotely.

If the TrendWorx Viewer is in runtime mode, click the **Edit Pens** button on the **Trend Viewer** toolbar to open the **Trend Pen Configuration** dialog box for historical pens, as shown below.



Configuring Historical Pens

Editing historical pens. To edit historical pens, click **Edit** in the **Trend Pen Configuration** dialog box. This opens the **Edit Trend Pen** dialog box, as shown below. When editing a historical pen, you can configure the averaging mechanism used in retrieving historical data. You can always change this option within runtime mode, either through the user interface or OLE Automation, to focus on various aspects of the historical replay.



Editing Historical Pens

Pen Filters

The various choices of the pen filter determine how historical data will be retrieved. For example, if the Viewer is configured to replay data for one hour, with a data resolution of 1 min., the historical data retrieval mechanism will divide one hour's worth of data into bins of 1 min. each, and then it will average the data according to the desired filter. If **Filter** is set to **Average,** it will compute the average of all samples per bin to yield a single pen sample to be drawn on the screen. If **Filter** is set to **Last Sample,** the last sample that falls within each bin will be plotted on the screen.

In addition to the standard data filters, the TrendWorx Viewer supports the **Raw Data** filter for historical replay as follows:

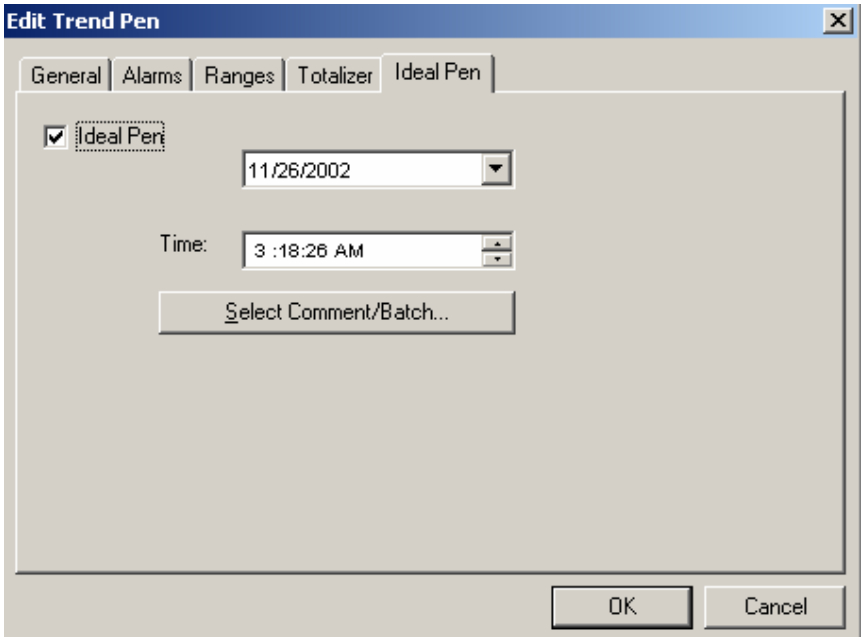
1. Select the **Raw Data** filter for a historical pen.
2. Specify the **Max. Samples** to retrieve.
3. The upper value of the **Max. Samples** is taken from the following registry setting:

HKEY_LOCAL_MACHINE\SOFTWARE\SMAR\TWXView32\Data Properties\Max Pen Samples
As a result, the TrendWorx Viewer will ask the TrendWorx SQL Server to retrieve the Max. Samples number of raw samples (no interpolated/extrapolated) from the historical data. If more data exist for the time interval for which the data were requested, an *X* mark will appear at the ends of the curve to indicate that not all samples were retrieved for the time interval of the request. This feature does require some configuration in order to prevent usage of large amounts of memory. A typical way to estimate the maximum number of samples data-logged for a period of time is to divide the time period by the data-collection rate of the signal configured in the data logger. If no dead band is configured, and the data-logged signal changes frequently, the result indicates an upper limit of samples data-logged for that period.

In the case of bar plots, the historical replay results in a time-averaged sample across the preconfigured trend period in configuration mode. That is, if the period is set to one hour, the bar plot type will display the averaged sample over the last hour.

Ideal Pens

Any historical pen can be configured as an ideal pen, and there is no limitation on the number of ideal pens per TrendWorx Viewer. As shown in the figure below, an **Ideal Pen** configuration tab is automatically inserted in the **Edit Trend Pen** dialog box to allow you to select ideal pens and to set their starting time and date. Upon entering animation mode, the TrendWorx Viewer will populate the ideal pens with historical data starting at the selected time and date, while all other nonideal historical pens will update with current data from the TrendWorx historical databases. To select a desired date for the trend period you want to view, click the down arrow in the **Date** field, and then choose a date from the calendar. This feature allows for powerful comparisons of past historical data with current historical data for the same historical pen.



Ideal Pen Configuration

You can set (or reset) any historical pen as an ideal pen at any time during animation mode, and you can modify its starting time and date. The **Ideal Pen** has time and date pick controls as well as an interface to the historical operator comments and batch information. To use this feature:

1. Select a history pen from the **Details** window of the trend display.
2. Right-click to display the pop-up menu.
3. Select **Edit** to display the **Edit Trend Pen** dialog box.

Alternatively, you can:

1. Click the **Edit Pens** button on the **Trend Viewer** toolbar to open the **Trend Pen Configuration** dialog box.
2. Select a historical pen from the list.
3. Click **Edit** to display the **Edit Trend Pen** dialog box.

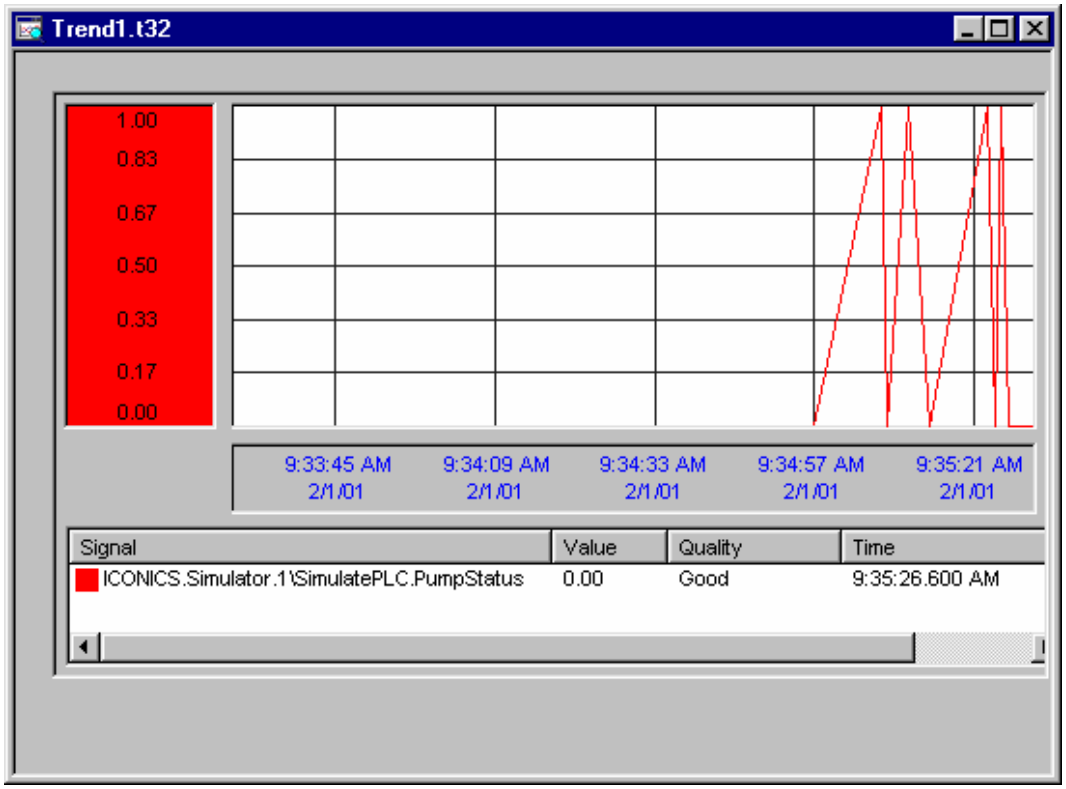
In the Select Comment/Batch (Lot) dialog box:

1. Select a start time and date. To select a desired date for the trend period you want to view, click the down arrow in the **Date** field, and then choose a date from the calendar.
2. Select an end time and date.
3. Click **Search** to initiate the search.
4. Once the search is completed, use the **<<** and **>>** buttons to scroll through multiple operator comments and batch entries.
5. When you locate the desired one, click **OK.**

Note
Selecting the **View Batch Only** option filters out the historical operator comments so that only the related batch (lot) entries are displayed.

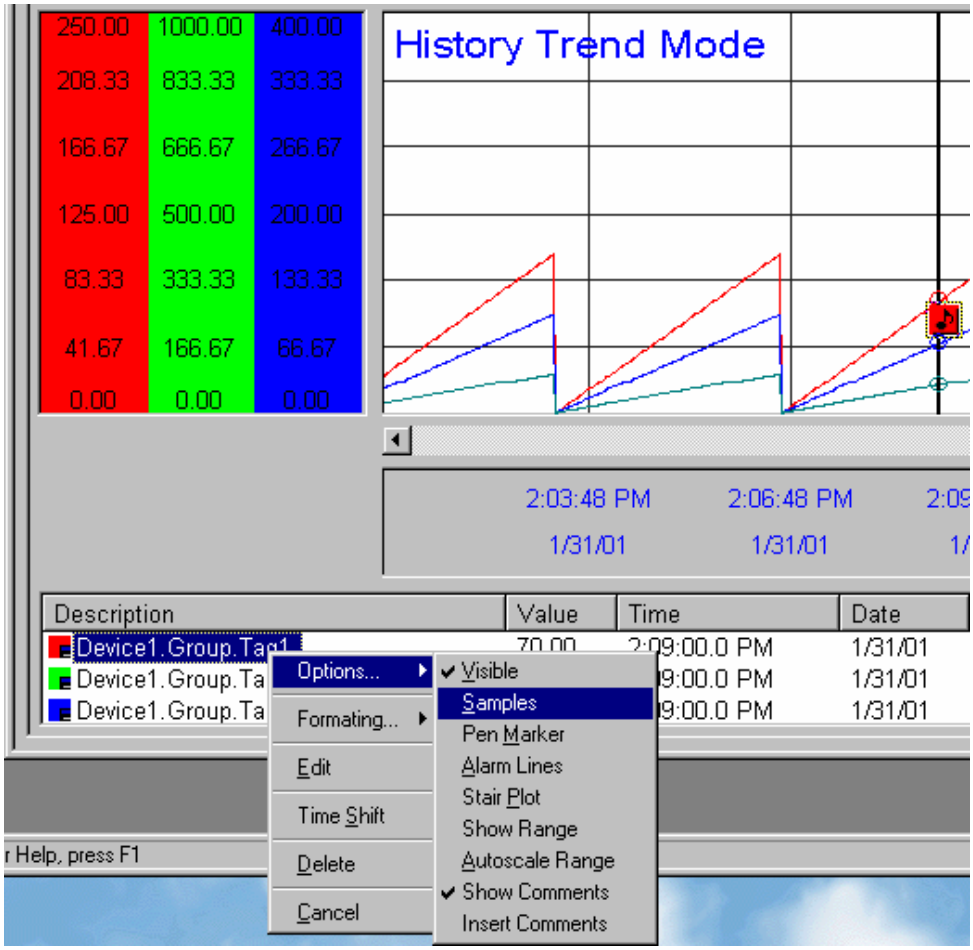
Editing Historical Pens
During runtime mode, you can edit a historical pen and change the filter type to obtain a different plot. For example, you can use **Max** to view the trend at its peaks. Note that the **MaxTime** and **MinTime** options retrieve the actual maximum and minimum values within the resample interval, as well as the actual time stamps at which these maximum and minimum values occurred.

Quality Status
The Viewer has integrated quality status support for both Historical Data Access and OPC Data Access tags. If **Quality** is checked in the **Details** tab of the **Properties** dialog box, the Viewer will display quality status information for each sample in the **Details** window of the trend display, as shown in the figure below.



Quality Status in the Details Window

In addition to the standard OPC Data Access qualities, the Viewer supports the Historical Data Access quality specification to indicate time intervals where data logging stopped, actual (raw) data samples, or calculated samples. During runtime mode, the **Details** window supports extended functionality on a per-pen basis or a group of pens (if selected).



Details Window Menu

Options for Pens

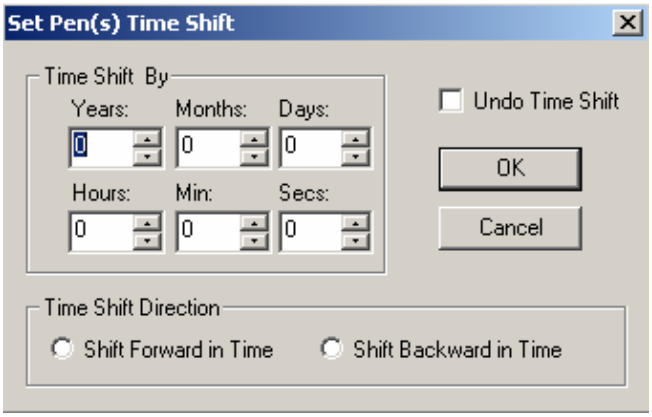
As shown in the figure above, you can select single or multiple pens from the **Details** window. When you right-click a pen, a pop-up menu opens, as shown in the figure above. The **Options** submenu lists the following trend display options and actions for the selected pen:

- **Visible:** Shows/hides the pen in the Details view of the Trend Viewer.
- **Samples:** Retrieves historical data samples.
- **Pen marker:** Shows/hides the pen marker in the Details view of the Trend Viewer.
- **Alarm lines:** Shows/hides the dashed alarm lines at the **Low, LowLow, High** and **HighHigh** in the Details view of the Trend Viewer.
- **Stair plot:** Uses a stepwise draw method to plot the trend. This is ideal for plotting slowly changing signals or setpoints.
- **Show range:** Displays the range values for the pen in the Trend Viewer.
- **Autoscale range:** Disables the **Low** and **High** fields, and sets these limits automatically according to the values for the pens. Autoscaling, if checked on the **Ranges** tab, adjusts the range if the actual value is above or below the set limits. For example, if autoscaling is selected and the ranges are set from 0 (Low) to 200 (High) and the actual value is 250, then the ranges will autoscale to 0 to 280. The adjustment will be around 20 percent above the actual value.
- **Show comments:** If historical pens are configured in the TrendWorx Viewer, selecting **Show Comments** places the Viewer in freeze mode and retrieves all historical operator comments and batch information available.
- **Insert comments:** Displays the **Comment(s) Entry** dialog box for historical pens. This option is available only in freeze mode.

Note that the same functionality is also available for real-time trending.

Time Shifting

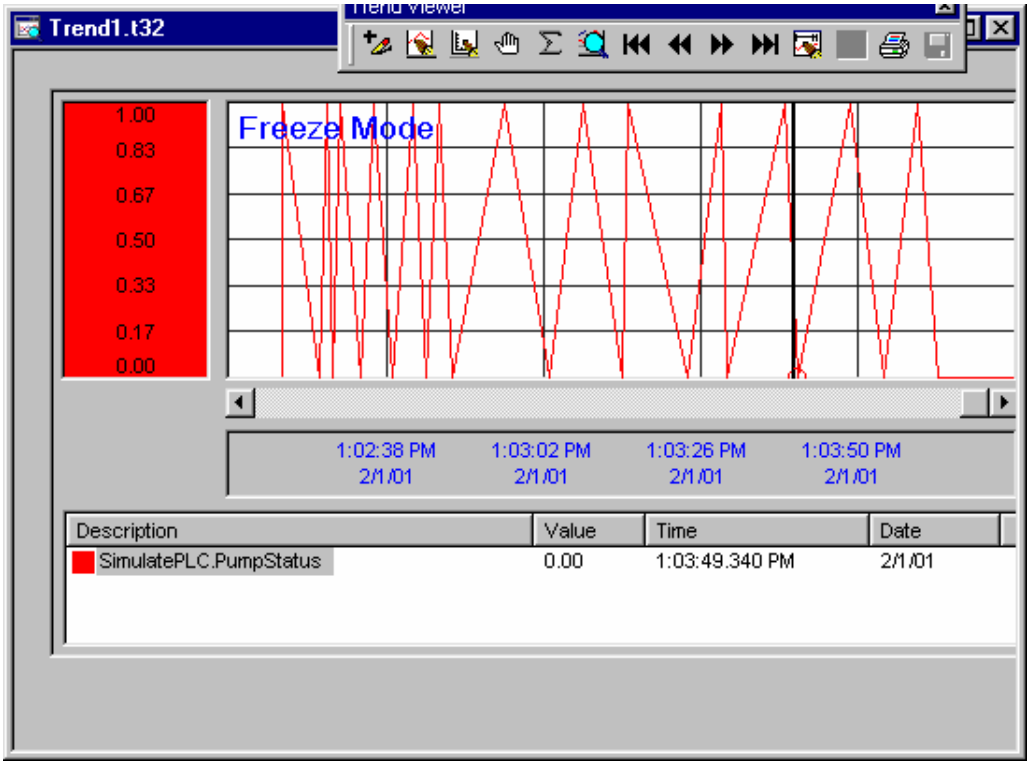
One feature of historical replay is the time shifting of pens in freeze mode. This allows for direct comparison of pens regardless of the time axis settings. To use time shifting, select the desired pen(s) from the **Details** window. Then right-click and select **Time Shift** from the pop-up menu. This opens the **Set Pen(s) Time Shift** dialog box, shown below.



Set Pen(s) Time Shift Dialog Box

You can then choose the interval and direction for the time shift. When you click **OK,** the selected pens will be redrawn to display refreshed historical or real-time data. The time shift operation can be undone at any time by clicking **Undo Time Shift.**

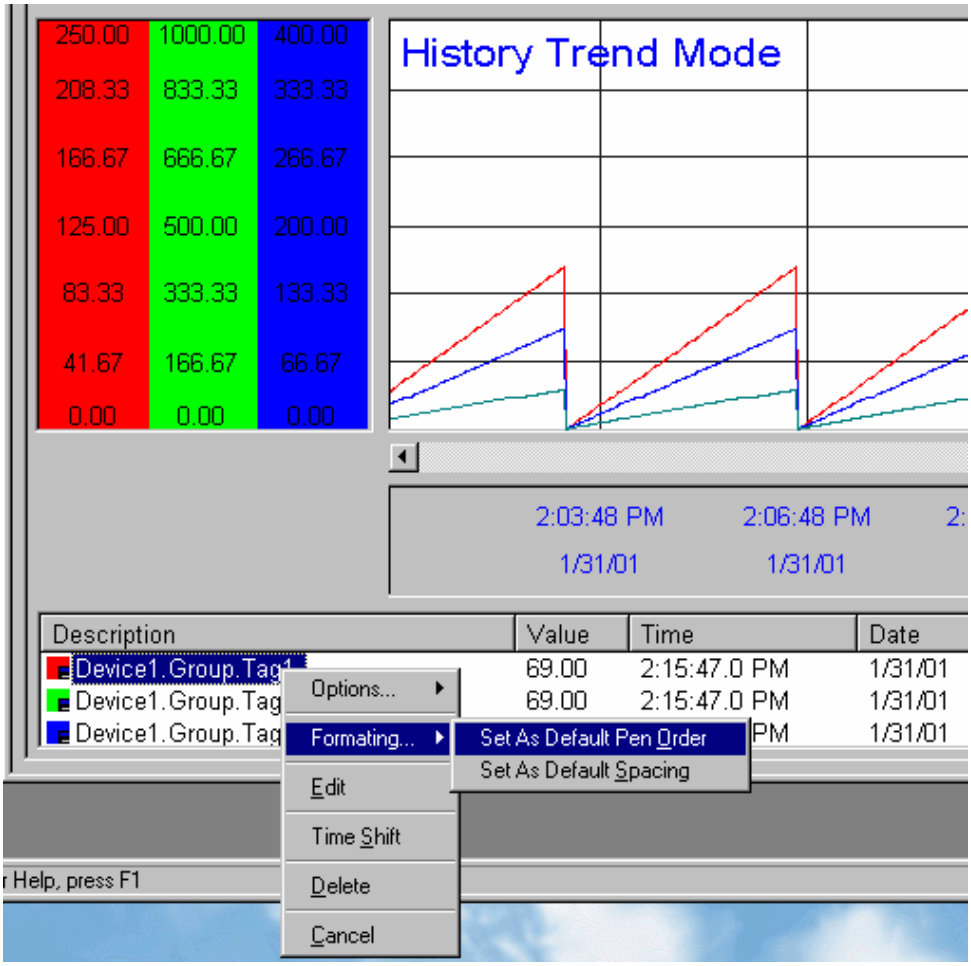
Graphical time shifting. There is also a graphical interface for performing time shifting. Again, you need to select the desired pen(s) from the **Details** window. To perform graphical time shifting, press the **CTRL** key and move the mouse within the trend display area while pressing the left mouse button. The time shifting cursor appears, and you can shift backward or forward in time based on which direction you move the mouse.



Graphical Time Shifting

Formatting Pens

If you do not select any pens but still right-click inside the **Details** window, the formatting options appear in the pop-up menu, as shown in the figure below. You can elect to restore the default settings for the pens.



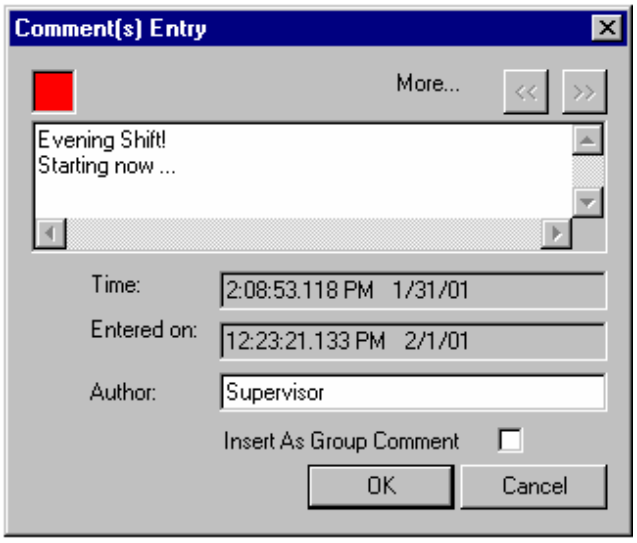
Pen Formatting

Operator Comments

As an operator, you can insert historical comments (operator comments) into any historical pen or group of pens. To perform this task, do the following:

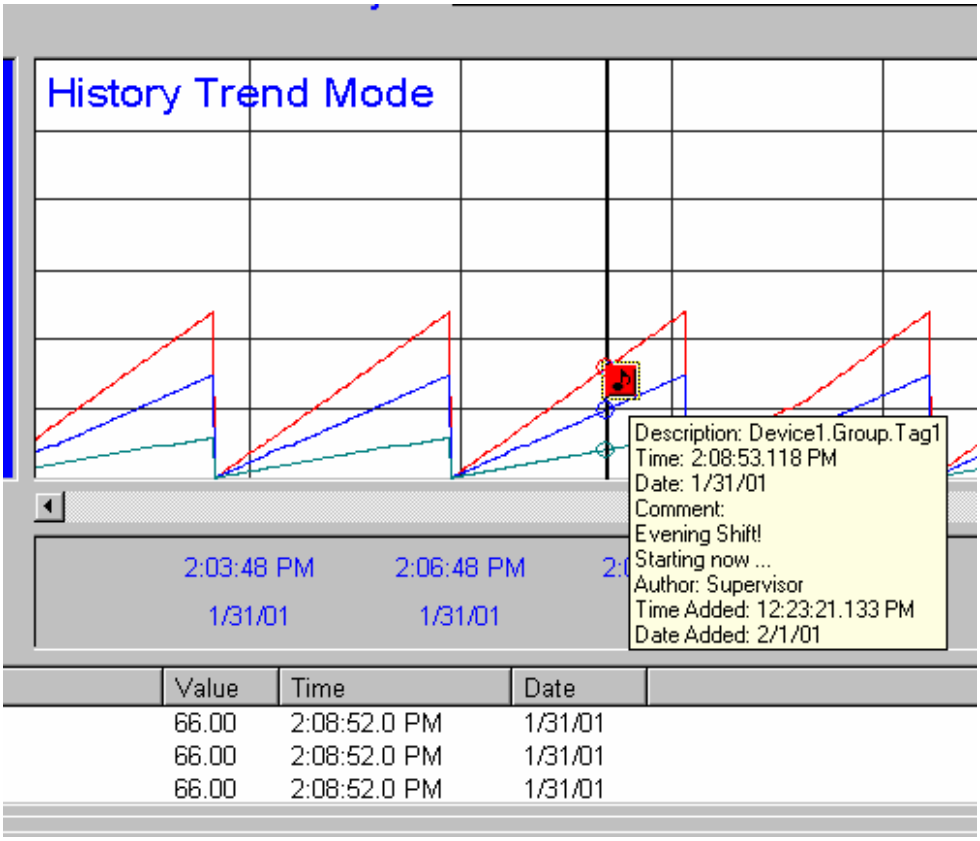
1. Move the cursor to where you want the comment to be inserted.
2. Select a historical pen in the **Details** window.
3. Right-click to open the pop-up menu.
4. From the **Options** submenu, select **Insert Comment.** This opens the **Comment(s) Entry** dialog box, shown below.
5. Type in a comment (it can be multiline).
6. Type in a name for the operator entering the comment (by default is the currently logged-in user).
7. Select **Insert As Group Comment,** if desired, to enter the comment for all the historical tags that belong to the same TrendWorx Configurator logging group as the currently selected historical pen.
8. Click **OK.**

Note
Historical comments are integrated into the SMAR Security Server. When the operator opens the **Comment(s) Entry** dialog box, the Viewer ActiveX will get the currently logged-in user(s) within the SMAR Security Server. If users are logged in, the Viewer ActiveX will set the author of the comment to be the logged-in user(s), and it will not allow the operator to modify the author field. If there are no logged-in users, the **Comment(s) Entry** dialog box will use the current Windows user and Node name, and it will allow the operator to modify the comment author field.



Comment(s) Entry Dialog Box

If the **Show Comments** option is enabled for the historical pen, the inserted comment will be visible on the screen, as shown below.

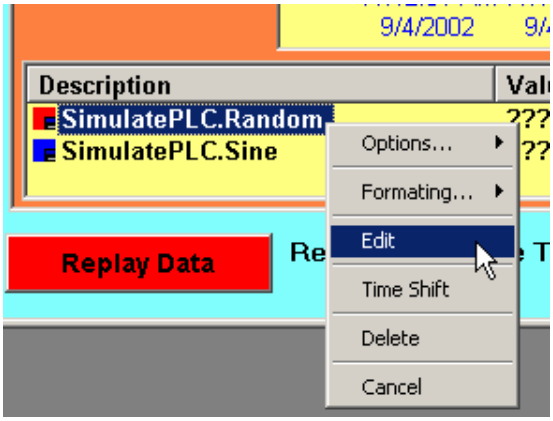


Operator Comments in the Trend Display

Editing Pens During Runtime Mode

To edit a pen during runtime mode, right-click on the pen in the Trend Viewer and select from the following pop-up menu items, as shown in the figure below:

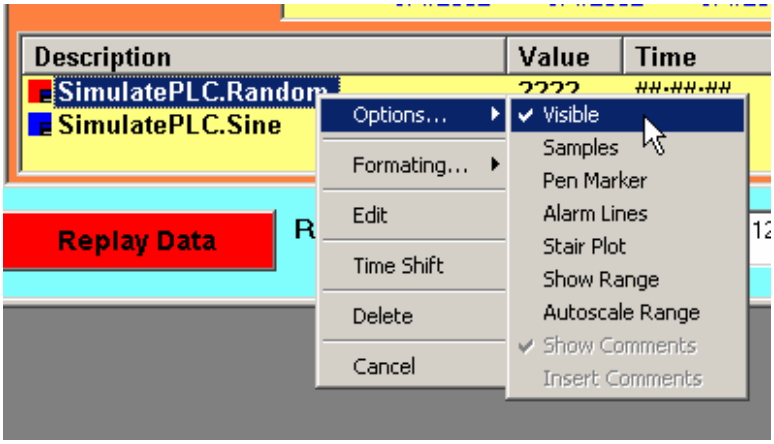
- **Options:** Specifies various options and actions for viewing the selected pen during runtime mode.
- **Formatting:** Restores the default settings for the pen during runtime mode.
- **Edit:** Opens the **Edit Trend Pen** dialog box.
- **Time Shift:** Sets the interval and direction for the time shift.
- **Delete:** Removes the pen from the Trend Viewer.



Editing Pens During Runtime Mode

Pen Options During Runtime Mode

To view the options for pens during runtime mode, right-click the desired pen(s) in the **Details** window and select **Options** from the pop-up menu, as shown in the figure below.



Setting Pen Options in Runtime Mode

The **Options** submenu lists the following trend display options and actions for the selected pen:

- **Visible:** Shows/hides the pen in the Details view of the Trend Viewer.
- **Samples:** Retrieves historical data samples.
- **Pen marker:** Shows/hides the pen marker in the Details view of the Trend Viewer.
- **Alarm lines:** Shows/hides the dashed alarm lines at the **Low, LowLow, High** and **HighHigh** in the Details view of the Trend Viewer.

- **Stair plot:** Uses a stepwise draw method to plot the trend. This is ideal for plotting slowly changing signals or setpoints.
- **Show range:** Displays the range values for the pen in the Trend Viewer.
- **Autoscale range:** Disables the **Low** and **High** fields, and sets these limits automatically according to the values for the pens. Autoscaling, if checked on the **Ranges** tab, adjusts the range if the actual value is above or below the set limits. For example, if autoscaling is selected and the ranges are set from 0 (Low) to 200 (High) and the actual value is 250, then the ranges will autoscale to 0 to 280. The adjustment will be around 20 percent above the actual value.
- **Show comments:** If historical pens are configured in the TrendWorx Viewer, selecting **Show Comments** places the Viewer in freeze mode and retrieves all historical operator comments and batch information available.
- **Insert comments:** Displays the **Comment(s) Entry** dialog box for historical pens. This option is available only in freeze mode.

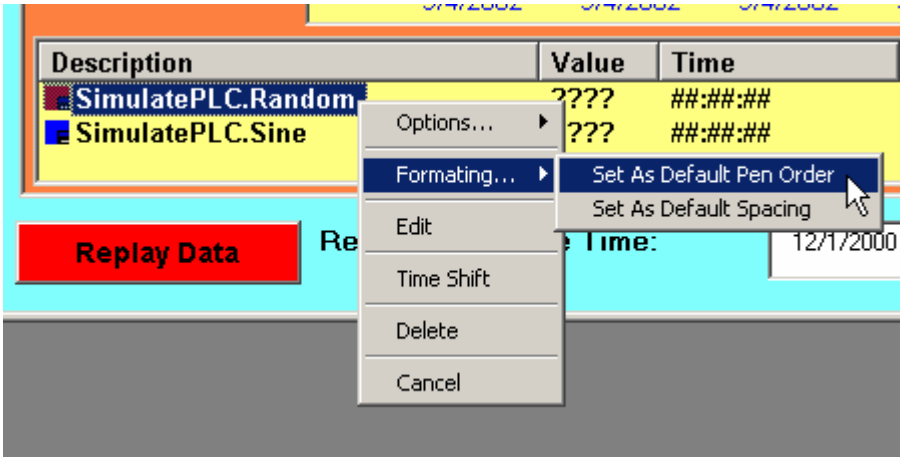
Note
The same functionality is also available for real-time trending.

Formatting Pens During Runtime Mode

To restore the default settings for a pen during runtime mode, right-click the desired pen(s) in the **Details** window and select **Formatting** from the pop-up menu, as shown in the figure below. Choose from the following:

- **Set As Default Pen Order:** Restores the default order (arrangement) of the pen in the Details window during runtime mode.
- **Set As Default Spacing:** Restores the default spacing parameters format for the pen in the Details window during runtime mode.

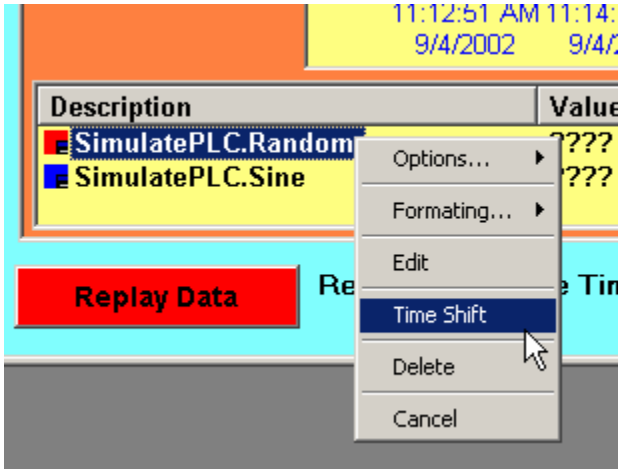
Note
The TrendWorx Viewer ActiveX supports reordering of pens in configuration mode. In the **Pens** tab, select the trend pen(s) you would like to reposition, as shown in the figure below. The **Spacing** button on the **Details** tab allows you to configure a default format for the Details window to be recalled during runtime mode.



Formatting Pens During Runtime Mode

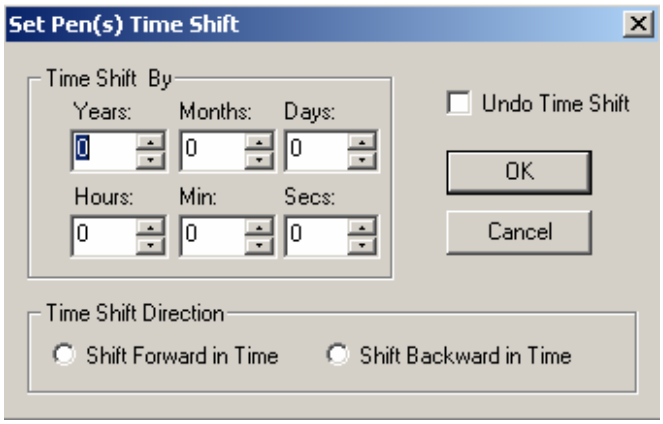
Time Shifting Pens During Runtime Mode

One feature of historical replay is the time shifting of pens in freeze mode. This allows for direct comparison of pens regardless of the time axis settings. To enable time shifting:
Right-click the desired pen(s) in the **Details** window and select **Time Shift** from the pop-up menu, as shown in the figure below.



Time Shifting Pens During Runtime Mode

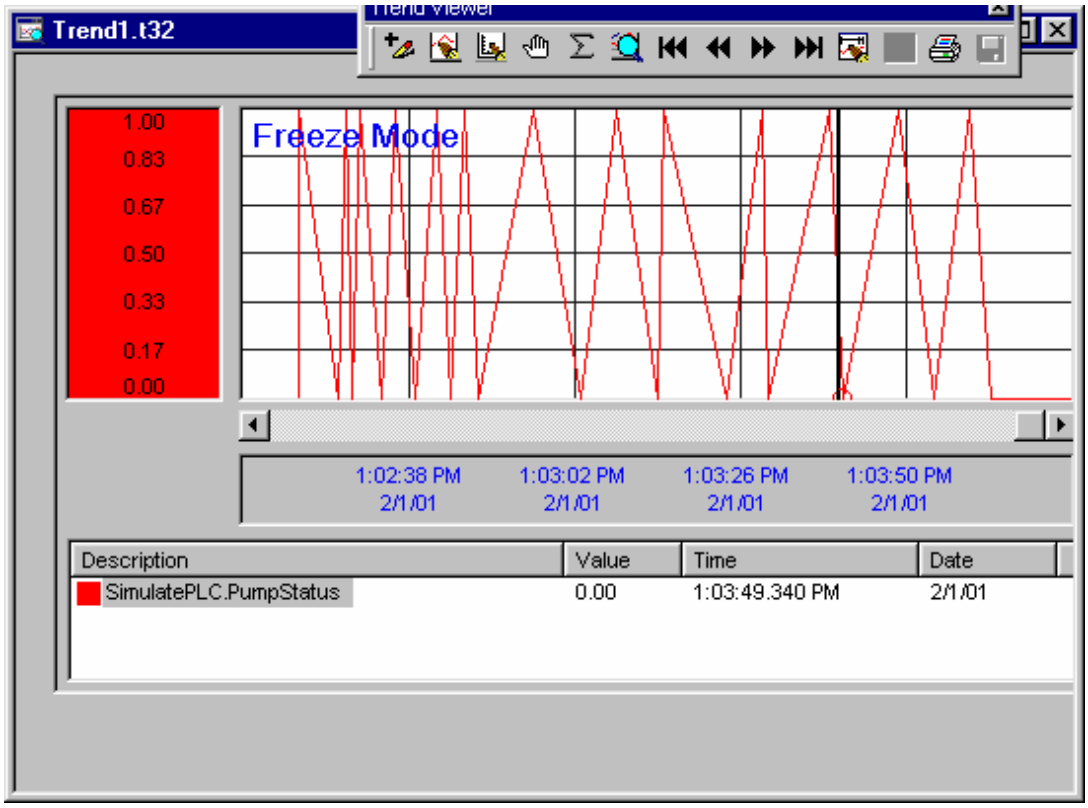
This opens the **Set Pen(s) Time Shift** dialog box, as shown below. Choose the interval and direction for the time shift. When you click **OK,** the selected pens will be redrawn to display refreshed historical or real-time data. The time shift operation can be undone at any time by clicking **Undo Time Shift.**



Setting the Time Shift Parameters for Pens

Graphical Time Shifting

There is also a graphical interface for performing time shifting. Again, you need to select the desired pen(s) from the **Details** window. To perform graphical time shifting, press the **CTRL** key and move the mouse within the trend display area while pressing the left mouse button. The time shifting cursor appears, and you can shift backward or forward in time based on which direction you move the mouse, as shown in the figure below.



Graphical Time Shifting

OLE Automation

This section describes the OLE Automation interfaces for the TrendWorx Viewer.

Interfaces

Each ActiveX exposes a set of objects, which are used to configure and automate the control. Each object categorizes an area of functionality. The following objects are exposed by the TrendWorx Viewer ActiveX:

- IOTitle
- IORanges
- IOTimeSettings
- IODetails
- IOPen
- IOGrids

Properties and Methods for the TrendWorx Viewer ActiveX

The following properties and methods are categorized by the object in which they exist.

Viewer: Properties

boolean AutoStartRuntime	Toggles the runtime mode when the container application switches from design mode to active mode. Default: TRUE
boolean ShowTitle	Determines whether the main title is displayed. Default: FALSE
boolean ShowRanges	Determines whether the ranges field is displayed. Default: TRUE
boolean ShowDetails	Determines whether the details field is displayed. Default: TRUE
BSTR PlotType	Determines plot type. Values are: time plot, XY plot, logarithmic plot, strip chart, bar plot, and circular chart. Default: time plot
BSTR BorderEdge	Determines trend border area settings. Values are: sunken, raised, etched, and bumped. Default: Sunken
BSTR BorderOptions	Determines trend border area options. Values are: rectangle, left, bottom, right, top, top left, top right, bottom left, and bottom right. Default: Rectangle
OLE_COLOR DispColor	Determines trend curve area color.
OLE_COLOR BackColor	Determines background color.
LPFONTDISP TimeFont	Dispatches interface to the time field font.
LPFONTDISP DetailsFont	Dispatches interface to the detail field font.
LPFONTDISP MainFont	Dispatches interface to the main (title) font.
boolean ShowTimeInfo	Determines if the time field is displayed. Default: TRUE
boolean MainToolbar	Enables/disables **Trend Viewer** toolbar. Default: TRUE
boolean FreezeMode	Enables/disables freeze mode.
short NumberOfPens	Returns number of currently configured pens.
LPFONTDISP RangesFont	Dispatch interface to the range field font.
BSTR FileName	Gets/sets file name for saving configuration data. "Set" is not supported while in runtime mode.

boolean URLPathUsed	Enables/disables use of URL path for asynchronous downloads. Default: FALSE
BSTR URLPathName	Gets/sets URL path name.
BSTR StatisticsFile	Gets/sets the .csv/.txt file used for statistical information storage. "Set" is not supported while in runtime mode.
boolean StatFileAppend	Enables/disables append mode for statistical file. Default: FALSE
boolean GlobalRanges	Enables/disables the use of global ranges. Not supported in runtime (animation) mode. Default: FALSE
boolean ShiftGrids	Enables/disables the shifting of grids during runtime. Not supported in runtime (animation) mode. Default: TRUE
double StartUp	Gets/sets initial offset for plotting of curves. Default: 0
short CursorStep	Gets/sets the cursor step for stepping in freeze mode. Default: 10
LPDISPATCH Title	Dispatch interface to Title object.
LPDISPATCH Details	Dispatch interface to Details object.
LPDISPATCH Ranges	Dispatch interface to ranges object.
LPDISPATCH TimeSettings	Dispatch interface to Time Settings object.
LPDISPATCH XGrids	Dispatch interface to X Grids object.
LPDISPATCH YGrids	Dispatch interface to Y Grids object.
boolean RestoreRanges	Enables/disables restoring of ranges modified during runtime. Not supported in runtime (animation) mode Default: FALSE
long LanguageID	Gets/sets the Language ID for loading a multilingual resource .dll.
boolean FillBackColor	Enables/disables the color fill of trend display areas. This should be used prior to and after printing (within the container) to conserve color ink on the printer.
long ScrollBarRange	Sets the range of the scrollbar (in seconds). Default: 10,800 seconds (3 hours)
boolean FullChartReset	Resets Circular Chart after a full trend period elapses.

	"Set" is not supported while in runtime mode. Default: FALSE
long ReadyState	Signals controls state changes in loading configuration data. Used for asynchronous download of configuration data
short Appearance	Determines TrendWorx Viewer ActiveX appearance (3D edge or not). Default: TRUE
short BorderStyle	Determines TrendWorx Viewer ActiveX appearance (border or not). Default: TRUE
OLE_COLOR ForeColor	Determines title color and main display text color.
boolean UseLocalSettings	Sets the Local Settings support. If the TrendWorx Viewer is configured to save its configuration into a .v32 file, independently of the container, you will have the option in runtime mode to save current settings into the preconfigured file. In the case of a Web HMI application, this will also be the configuration file to be loaded whenever the HTML page is refreshed. Default: FALSE

Viewer: Methods

boolean AddRealTimePen(BSTRPenName)	Adds a real-time pen, which can be an OPC data tag, expression tag, and internal simulation point. For OPC data tags, the "PenName" has to match exactly the string that the Tag Browser would produce for the same tag.
boolean SetXAxis (BSTR PenName)	Used in XY plots to select a pen for *x*-axis. The "PenName" here represents the description text for the desired pen, as it would appear in the Details window.
VARIANT GetPenNames()	Returns a variant string array of all pen description text as it appears in the Details window of the Viewer ActiveX.
boolean EnterAnimate()	Enters runtime (Animate) mode.
boolean ExitAnimate()	Exits runtime (Animate) mode.
boolean GetAnimateMode()	Returns TRUE if the Viewer is currently in animation mode. Otherwise it returns FALSE.
boolean DeletePen (BSTR PenName, BSTR PenType)	Deletes the pen that has "PenName" as its description text. Valid types are: real time, history, and custom.
void SetPenHiRangeString (BSTR PenName, BSTR RangeString, BSTR PenType)	Sets the point name for high range of the pen with description text matching "PenName." Not supported for historical pens
void SetPenLoRangeString (BSTR PenName, BSTR RangeString, BSTR PenType)	Sets the point name for low range of the pen with description text matching "PenName." Not supported for historical pens
LPDISPATCH GetPen (BSTR PenName, BSTR PenType)	Returns dispatch interface of the pen with description text matching "PenName." You must release the interface when done. Valid types are: real time, history, and custom.
boolean SetDetailsFromPen (BSTR PenName, BSTR PenType)	Populates details information from the pen with description text matching "PenName." Valid types are: real time, history, and custom.

boolean ComputeStat()	Computes and stores statistical info for the pens configured in the Viewer ActiveX. Supported only in runtime (animation) mode.
void SetHiRangeString (BSTR RangeString)	Sets point name for high range of range object. Not supported in history-only mode.
void SetLowRangeString (BSTR RangeString)	Sets point name for low range of range object. Not supported in history-only mode.
boolean ReplacePoint(BSTR PointName, BSTR OldString, BSTR NewString, boolean DoPenText)	Use to replace pen point names and pen descriptions if desired ("DoPenText" set to TRUE). "PointName" is the actual (existing) point name. "OldString" is a substring of the "PointName." "NewString" is its substitute string, and if "DoPenText" is set to TRUE, the corresponding pen description text will be replaced as well. Not supported in runtime (animation) mode.
void SetPointValue(BSTR PointName, double PointValue, DATE PointTDate)	Use to feed custom data for an assigned pen. "PointName" is the full point name by which the pen connection was made. Supported only in runtime (animation) mode.
void ChangeWinPeriod (long NewPeriod)	Changes the trend period into the desired "NewPeriod," given in seconds. Not supported for bar plots and XY plots.
boolean SetTrendRightTDate (DATE RightTDate)	In freeze mode, sets the trend's right time and date.
boolean AddRealTimeBgPen(BSTR PenName, BSTR TWXBgGroupName)	Adds a real-time pen from Persistent Trending, which can be an OPC data tag, expression tag, and internal simulation point. For OPC data tags, the "PenName" has to match exactly the string that the Tag Browser would produce for the same tag. "TWXBgGroupName" is the name of the configured Persistent Group.
void DeleteAllPens ()	Deletes all pens from the TrendWorx Viewer ActiveX.
boolean AddCustomPen (BSTR PenName)	Adds a custom pen for displaying custom data. You are responsible for supplying data to be displayed by the pen, using the "SetPenValues" method.
Boolean SetPenValues (BSTR PenName, VARIANT* PenValues, VARIANT* PenTDates, VARIANT* PenMSecs, VARIANT* PenQuality)	Fills a custom pen with user data. "PenName" is the description text of the pen, as it appears in the Details window. "PenValues" is an array of doubles. "PenTDates" is an array of date values corresponding to the "PenValues." "PenMSecs" is an array of milliseconds subdivisions corresponding to the "PenTDates" values. "PenQuality" is an array of OPC-defined qualities.
DATE GetRightTime()	Returns the Viewer ActiveX "right" time and date. Supported only in runtime (animation) mode.
boolean SetHistTrendMode(Boolean Mode)	Toggles history-only mode of the Viewer ActiveX. Supported only in configuration mode.
boolean GetHistTrendMode()	Retrieves the status of history replay mode of the Viewer ActiveX.
boolean AddHistoryPen(BSTR PenName)	Adds a history pen to the Viewer ActiveX. The "PenName" string should be the same as the one produced by the Tag Browser when browsing historical servers.
boolean UpdateHistoryPens()	Forces an update of all historical signals. Typically this would be called after setting the Viewer's right reference time. Supported only in freeze mode

boolean SetPenFilter(BSTR PenName, short PenFilter)	Sets the data filter type for a pen with description text matching "PenName." Used for historical pens. Valid "PenFilter" types are: OHDA_RAW = 0 OHDA_AVG = 1 OHDA_MIN = 2 OHDA_MAX = 3 OHDA_STDEV= 4 OHDA_LAST = 5 OHDA_MINTIME = 6 OHDA_MAXTIME = 7
void RefreshDetails()	Forces a refresh of the Details window. Since each pen is an individual object, any change in the pen's properties through OLE Automation may not be directly updated in the Details window. Using this ensures that all pen property changes will be reflected properly in the Details window. It is supported only in runtime (animate) mode
void ShowStat()	Shows the statistical window of the Viewer. Supported only in runtime (animation) mode.
boolean DoZoom(short nPercent, boolean bYaxis, boolean bXaxis)	Zoom in on the Viewer. If both "bYAxis" and "bXAxis" are set, then the zoom action will be applied to both axes. For an ordinary time plot, this means both range and time zooming. The "nPercent" parameter controls the zoom factor. If set to 0 (zero), it zooms out of the Viewer. Supported only in freeze mode.
boolean LoadSaveFile(BSTR FileName, short Load)	Loads or saves a Viewer ActiveX configuration file.
void SetFirstUpdateMode(boolean bMode)	If "bMode" is TRUE, in freeze mode the Viewer ActiveX will not update historical pens upon connection. You will have to call the "UpdateHistoryPens" method.
long GetPenCount()	Returns the number of configured pens.
LPDISPATCH GetPenByIndex(long PenIndex)	Returns the pen object, where "PenIndex" is the order of the pen as it appears in the Details window.
boolean ShowPenInRanges(long PenIndex)	Fills in the ranges display with the ranges of the pen, where "PenIndex" is the order of the pen as it appears in the Details window. Not supported if Global Ranges option is enabled.
long AddRealTimePen2(BSTR PenName)	Adds a real-time pen, which can be an OPC data tag, expression tag, and internal simulation point. For OPC data tags, the "PenName" has to match exactly the string that the Tag Browser would produce for the same tag. It returns the index of the pen added.
long AddHistoryPen2(BSTR PenName)	Adds a history pen to the Viewer ActiveX. The "PenName" string should be the same as the one produced by the Tag Browser when browsing historical servers. It returns the index of the pen added.
long AddRealTimeBgPen2(BSTR PenName, BSTR TWXBgGroupName)	Adds a real-time pen from Persistent Trending, which can be an OPC data tag, expression tag, and internal simulation point. For OPC data tags, the "PenName" has to match exactly the string that the Tag Browser would produce for the same tag. "TWXBgGroupName" is the name of the configured Persistent Group. It returns the index of the pen added.
long AddCustomPen2 (BSTR PenName)	Adds a custom pen for displaying custom data. It returns the index of the pen added.
boolean SetPenTimeShift(long PenIndex, long TimeShift)	Sets the time shift for the pen with index "PenIndex" by "TimeShift" seconds. Not supported for XY plots. Supported only in freeze mode.

long GetPenTimeShift(long PenIndex)	Returns the time shift for the pen with index "PenIndex" in seconds. Not supported for XY plots. Supported only in freeze mode.
boolean RefreshIdealPen(long PenIndex)	Refreshes the ideal pen, with index "PenIndex," with new historical data based on its ideal pen settings.
boolean DeletePen2(long PenIndex)	Deletes the pen with index "PenIndex."
boolean SetPenFilter2(long PenIndex, short PenFilter)	Sets the data filter type for a pen with index "PenIndex." Used for historical pens. Valid "PenFilter" types are: OHDA_RAW = 0 OHDA_AVG = 1 OHDA_MIN = 2 OHDA_MAX = 3 OHDA_STDEV= 4 OHDA_LAST = 5 OHDA_MINTIME = 6 OHDA_MAXTIME = 7
void ToggleMainToolbar()	Toggles Trend Viewer toolbar if enabled. Supported only in runtime (animation) mode.
void ToggleMainToolbar2(long top, long left)	Toggles Trend Viewer toolbar if enabled and positions it at the top, left coordinates. Supported only in runtime (animation) mode.
void AboutBox().	Displays the Viewer's About Box.
void Refresh()	Standard refresh method. Call after visual modifications.
boolean PrintTrend(boolean bShowPrinterDlg)	Prints the TrendWorx Viewer display. If "bShowPrinterDlg" is set to TRUE, the Windows Print dialog box will be evoked. Otherwise, the default Windows printer will be used.
boolean SetInkSaveMode(boolean bMode)	Sets the ink saving mode during printouts. If TRUE, during the printing process all of the Viewer background area colors will be ignored to save ink.
boolean GetInkSaveMode()	Returns the current status of the ink-saving mode.
boolean ResetPenTotalizer(long PenIndex)	Resets a pen's Totalizer function support. The "PenIndex" is the order of the pen.
void SetUTCReplayMode(boolean bMode)	Sets the UTC historical replay mode. Supported only for a history chart Viewer. If TRUE, all curves are drawn using UTC time stamping.
boolean GetUTCReplayMode()	Returns TRUE if the Viewer is replaying historical data in UTC mode.
boolean GetSampleInfo(long PenIndex, VARIANT* SampleValue, DATE* SampleTDate, VARIANT* SampleMSecs, VARIANT* SampleQual, VARIANT* SampleHDAQual, VARIANT* HistoricalSample)	Returns sample information for the current location of the cursor in freeze mode or zoom mode for the pen with index "PenIndex."
void SetCircularPrintMode(boolean bAutoPrint)	Sets the automatic print mode of circular charts upon a full trend period reset. If "bAutoPrint" is set to TRUE, the Viewer will print trend display upon full chart reset.
boolean GetCircularPrintMode()	Returns the current automatic print mode of circular charts.

void MoveCursorForward()	In freeze mode, moves the cursor one step forward in time.
void MoveCursorBackwards()	In freeze mode, moves the cursor one step backward in time.
boolean MoveCursorToTime(DATE timeDate)	In freeze mode, moves the cursor to a particular position on the time axis.
long ChangeTrendDataRate(long trendDataRate)	Changes Viewer data-collection rate in animation (runtime) mode. "TrendDataRate" is the desired data-collection rate in milliseconds.
boolean GetPenValues(BSTR PenName, VARIANT* PenValues, VARIANT* PenTDates, VARIANT* PenMSecs, VARIANT* PenQuality)	Returns in variant arrays the current samples in memory buffers of the pen with point name (or description) "PenName."
void SetPenComments(long PenIndex, boolean Mode)	Sets the historical comment and batch information mode of a historical pen with index "PenIndex." If "Mode" is TRUE, it enables the display of historical comments.
boolean GetPenComments(long PenIndex, VARIANT* SourceTDates, VARIANT* SourceMsec, VARIANT* Notes, VARIANT* NoteTDates, VARIANT* NoteMSecs, VARIANT* Authors)	Retrieves the associated (if any) historical operator comments and batch information with the pen having index "PenIndex." Returns variant arrays with all the information, including authors. Supported only in animation runtime mode and for a history pen.
boolean InsertPenComment(long PenIndex, DATE CommentTDate, BSTR Author, boolean GroupComment, BSTR CommentText)	Inserts a historical comment for the historical pen with index "PenIndex." If "GroupComment" is set to TRUE, the inserted comment will be visible by all historical signals of the same data-logging group as the historical pen.
boolean ShowComments()	Toggles in animation (runtime) mode and batch information. If used, the Viewer will be placed in freeze mode, and all historical comments as well as batch information for the historical pens will be retrieved.
void SetPenLoAlarmString(BSTR PenName, BSTR AlarmString, BSTR PenType) void SetPenLoLoAlarmString(BSTR PenName, BSTR AlarmString, BSTR PenType) void SetPenHiAlarmString(BSTR PenName, BSTR AlarmString, BSTR PenType) void SetPenHiHiAlarmString(BSTR PenName, BSTR AlarmString, BSTR PenType)	The TrendWorx Viewer ActiveX allows the connection of OPC Data Access tags to its alarm limits. The OPC-enabled alarm limits will hold the most current value of the alarm limits. The alarm limits can be a constant value, an OPC Data Access tag, or an expression. In addition, the alarm limits are interfaced to the Global Alias and Language Alias servers. This functionality is not available in History Trend mode due to the nature of this specific historical replay mode. These OLE automation methods have been added to support this functionality.

ProjectWorx Support

Several new OLE Automation methods have been added to facilitate ProjectWorx deployment and WebHMI enhanced support:

1. **ReplaceStringInString(**
   StringToReplace as String,
   OldSubstring as String,
   NewSubstring as String
) as String

2. **ReplaceHost(**
   OldHostName as String,
   NewHostName as String
) as Long

3. **ReplaceFilePath(**
   OldSubstring as String,
   NewSubstring as String
) as Long

4. **ReplaceTag(**
   OldSubstring as String,
   NewSubstring as String
) as Long

5. **ReplaceHostEx(**
   OldHostNameSubstring as String,
   NewHostNameSubstring as String
   MatchCase as Boolean,
   MatchWholeWord as Boolean
) as Long

The ReplaceHostEx with parameters MatchCase=False & MatchWholeWord=True works exactly the same as the ReplaceHost() function.

Events Fired

ReadyStateChange	Fired when the Viewer has finished initializing its state.
InAnimateMode	Fired when the Viewer has entered automation mode.
UnableToCreateThread	Fired when the Viewer cannot create a background trend upon entering animation mode.
OutOfAnimateMode	Fired when the Viewer exits automation mode.
DatabaseChanged	Fired when there are configuration changes, such as adding or deleting a pen.
ErrorInLoadingData	Fired when the Viewer encounters errors upon loading its configuration data through a .v32 file.
RightTimeChanged	Fired when the "right" reference time of the Viewer changed while in freeze mode.
void CursorChangedPos()	Fired in freeze mode as the cursor changes position. You can call the "GetSampleInfo" method to retrieve detailed sample information on a per-pen basis.

Properties and Methods for Supporting Objects

Title Objects

Title Objects: Properties

boolean ShowTitle	Determines whether the main title is displayed. Default: TRUE
BSTR TitleText	The main title of the Viewer ActiveX.

Title Objects: Methods

Time Settings Objects

Time Settings Objects: Properties

boolean ShowDate	Determines whether date information is displayed in the Viewer's time field. Default: TRUE
boolean ShowMilliSecs	Shows milliseconds divisions on time axis. Default: FALSE
boolean ShowTimeInfo	Determines whether the time field is displayed. Default: TRUE
BSTR BorderEdge	Visual appearance of time display. Values are: sunken, raised, etched, and bumped. Default: Sunken
BSTR BorderOptions	Visual appearance options of time display. Values are: rectangle, left, bottom, right, top, top left, top right, bottom left, and bottom right. Default: Rectangle
BSTR DateFormat	Not used in the current version.
BSTR Size	Size for time display. It can be large, normal, or small. Default: Normal
long DataUpdatePeriod	This is the data-collection rate in milliseconds. "Set" is not supported in runtime (animation) mode.
long DataTotalPeriod	This is the trend period in seconds. "Set" is not supported in runtime (animation) mode.
long Samples	This is the number of samples per pen. "Set" is not supported in runtime (animation) mode.
long DataDisplayMult	Gets/sets drawing intervals relative to data collection.
OLE_COLOR FillColor	Color for filling time area.

OLE_COLOR TextColor	Color for text displayed.
long HistoryRefreshRate	Gets/sets the history refresh rate for which historical pens will be refreshed, regardless of the data-collection rate. Ideally, it should be configured to be as close as possible to the logging-to-disk interval set in the TrendWorx Configurator.

Time Settings Objects: Methods

Ranges Objects

Ranges Objects: Properties

boolean OverHighRange	Gets/sets override for high range. If set TRUE, the high-range value will be computed from a tag or expression.
boolean OverLowRange **Short VisiblePens**	Gets/sets override for low range. If set TRUE, the low-range value will be computed from a tag or expression. Gets/sets the number of visible pen ranges on the ranges display area (if the **Global Ranges** option is not selected).
boolean ShowRanges	Determines whether the range field is displayed. Default: TRUE
BSTR BorderEdge	Visual appearance of range display. Values are: sunken, raised, etched, and bumped. Default: Sunken
BSTR BorderOptions	Visual appearance options of range display. Values are: rectangle, left, bottom, right, top, top left, top right, bottom left, and bottom right. Default: Rectangle
BSTR NumberFormat	Gets/sets number format for range values.
BSTR Position	Gets/sets position of range display. It can be right or left.
BSTR XNumberFormat	Gets/sets number format for *x*-axis range values in XY plots.
double XHigh	Gets/sets high-range value for *x*-axis in XY plots.
double XLow	Gets/sets low-range value for *x*-axis in XY plots.
double High	Gets/sets high-range value.
double Low	Gets/sets low-range value.
OLE_COLOR FillColor	Gets/sets fill color of range display.
OLE_COLOR TextColor BSTR Size	Size for time display. It can be large, normal, or small. Default: Normal

Ranges Objects: Methods

Pen Objects

Pen Objects: Properties

boolean Autoscale	Autoscales the pen.
boolean EnableAlarmLines	Enables drawing of alarm lines**.**
boolean OverHighRange	Gets/sets override for high range. If set TRUE, the high-range value will be computed from a tag or expression.
boolean OverLowRange	Gets/sets override for low range. If set TRUE, the low-range value will be computed from a tag or expression.
boolean PenVisible	Determines whether a pen is to be drawn.
boolean PenXAxis	Gets/sets a pen *x*-axis in XY-plots.
boolean ShowMarkers	If TRUE, a triangular marker is displayed at the position of the last known sample value.
boolean ShowSamples	Indicates real samples.
boolean Stairplot	Enables step-wise plotting mode.
boolean UpdateServerRanges	Controls the initial update of the ranges from the server.
BSTR DetailsFormat	The format type for the details.
BSTR PenPointName	The pen signal point name.
BSTR PenStyle	Gets/sets the pen style, (e.g. solid, dotted, dashed).
BSTR PenText	Pen description.
BSTR PenUnits	Pen engineering units.
BSTR RangeFormat	The format type for showing ranges.
BSTR TWXBgGroupName	The Persistent Trend group name.
double AlarmHigh	High alarm value for pen.
double AlarmHiHi	High-high alarm value for pen.
double AlarmLoLo	Low-low alarm value for pen**.**
double AlarmLow	Low alarm value for pen.
double HighLimit	High limit value.
double LowLimit	Low limit value.
long NumberOfSamples	Gets number of samples for the pen.
OLE_COLOR DetailColor	The fill color to be used in the **Details** window.
OLE_COLOR PenColor	Gets/sets the color associated with the pen.
OLE_COLOR RangeColor	The fill color to be used in the range window.
OLE_COLOR RangeTextColor	The color to be used for text in the range window.

short HistoryFilter	Returns the filter type for the historical data.
short PenWidth	The width of the pen in logical units. Default: 1
BSTR PenType	Returns the type of the pen, such as real-time, history, and custom. Read only property.
short HistoryFilter	Returns the history filter for the pen. Possible values are: Raw = 0 Average = 1 Minimum = 2 Maximum = 3 Standard deviation = 4 Last sample = 5 Minimum with actual time = 6 Maximum with actual time = 7
double AutoResetLevel	Gets/sets the autoreset value for a pen in configuration mode, if the totalizer mode is enabled.
double PreLoadValue	Gets/sets the preload value for a pen in configuration mode, if the totalizer mode is enabled.
double PresetValue	Gets/sets the preset value for a pen in configuration mode, if the totalizer mode is enabled.
double IntegrationFactor	Gets/sets the Integration factor value for a pen in configuration mode, if the totalizer mode is enabled. Possible values are: 1.0 (integration constant computed in seconds) 60.0 (integration constant computed in minutes) 3660.0 (integration constant computed in hours) 86400.0 (integration constant computed in days)
long IntegrationDir	Gets/sets the integration direction value for a pen in configuration mode, if the totalizer mode is enabled. Possible values are: 0 (Totalizer counts upward from 0.) 1 (Totalizer counts downward to 0.)
long TotalizerMode	Gets/sets the totalizer mode value for a pen in configuration mode if the totalizer mode is enabled. Possible values are:

	0 (continuous mode) 1 (preload mode) 2 (preset)
boolean EnableTotalizer	Enables/disables the totalizer mode for a pen in configuration mode.
long PlotterMark	Gets/sets the totalizer plotter mark size for the pen's curve, if the totalizer mode is enabled. Possible values are: No marker = 0 Tiny = 1 Small = 2 Medium = 3 Big = 4 Huge = 5
long TotalizerUnits	Gets/sets the totalizer units value for a pen in configuration mode, if the totalizer mode is enabled. Possible values are: 0 (integration factor computed in seconds; units are seconds) 1 (integration factor computed in minutes; units are minutes) 2 (integration factor computed in hours; units are hours) 3 (integration factor computed in days; units are days)
boolean IdealPenMode	Gets/sets the ideal pen mode for a historical pen.
boolean AutoTimeSync	Gets/sets the autosync mode for a real time pen.

Pen Objects: Methods

boolean GetPenStat(double* Max, double* Min, double* Avg, double* StdDev, long* NumSamples)	Returns the associated statistical values for the pen using the visible samples at the current state of the pen.
boolean IsHistoryPen()	Returns TRUE if the pen is historical.
boolean SetIdealDate(DATE Date)	Sets the ideal date for a historical ideal pen. This is the reference starting time of the ideal pen.
DATE GetIdealDate()	Sets the Ideal date for a historical ideal pen. This is the reference starting time of the ideal pen.

Details Objects

Details Objects: Properties

boolean ShowDetails	Determines whether the details field is displayed. Default: TRUE
boolean ShowPenDate	Determines whether a pen's date information is displayed.
boolean ShowPenHiHiLoLoAlarm	Determines whether a pen's "HiHi" and ""LoLo" alarm information is displayed.
boolean ShowPenHiLo	Determines whether a pen's "Hi/Lo" information is displayed.
boolean ShowPenHiLoAlarm	Determines whether a pen's "Hi/Lo" alarm information is displayed.
boolean ShowPenPoint	Determines whether a pen's information is displayed.
boolean ShowPenText	Determines whether a pen's text is displayed.
boolean ShowPenTime	Determines whether a pen's time information is displayed.
boolean ShowPenUnits	Determines whether a pen's units are displayed.
boolean ShowPenValidity	Determines whether signal quality will be displayed.
boolean ShowPenValue	Determines whether a pen's value is displayed.
boolean ShowTooltips	TRUE if plot ToolTips are to be shown for the currently focused pen (when in freeze mode).
boolean ShowXAxis	Determines whether *x*-axis values are shown for XY plots.
BSTR BorderEdge	Visual appearance of the **Details** window.
BSTR BorderOptions	Visual appearance of the **Details** window.
Short Visible Pens	Gets/sets the number of visible pen details to be drawn in the **Details** window.
BSTR NumberFormat	Gets/sets the number format of the pen.
BSTR Size	Gets/sets the size of the **Details** window.
OLE_COLOR FillColor	The background color of the **Details** window.
OLE_COLOR TextColor	The color of all text in the **Details** window.
boolean ShowHeader	Enables/disables the display of the header in the **Details** window.
boolean ShowFilter	Enables/disables the display of the data filter in the **Details** window.
boolean ShowMSecs	Enables/disables the display of milliseconds in the time column of the details window.
boolean ShowPenStyle	Enables/disables the display of the pen's style in the **Details** window, rather than the squares filled in the color of the pen.

Details Objects: Methods

Grid Objects

Grid Objects: Properties

boolean ShowGrids	Determines whether grids are displayed in the Viewer's main display area. Default: TRUE.
BSTR GridStyle	Gets/sets grid style, such as solid, dotted, and dashed.
OLE_COLOR GridColor	The color of the grid.
short GridNumber	Gets/sets grid number
short GridWidth	The grid width in logical units.
short SubGridNumber	Gets/sets the subgrid number for the Viewer in configuration mode, if the circular chart mode is enabled.
short SubGridWidth	Gets/sets the subgrid width for the Viewer, if the circular chart mode is enabled.
BSTR SubGridStyle	Gets/sets the subgrid style for the Viewer, if the circular chart mode is enabled.
boolean ShowSubGrid	Enables/disables the display of the subgrids number for the Viewer, if the circular chart mode is enabled.
OLE_COLOR SubGridColor	Gets/sets the subgrid color the for Viewer, if the circular chart mode is enabled.
short GridsBetweenLabels	Gets/sets the grids between labels value in the Viewer, if the circular chart mode is enabled.
short CircularEdgeMode	Gets/sets the circular edge appearance for the Viewer, if the circular chart mode is enabled. Possible values are: 0 (No edge) 1 (Default) 2 (Thick)

Grid Objects: Methods

Code Samples

Using the Component Inside Visual Basic
The TrendWorx Viewer ActiveX easily integrates into any Visual C++ or Visual Basic container application. The following are some code samples for using the TrendWorx Viewer ActiveX inside Visual Basic:

a. Disable Global Ranges and animate the component

```
With TWXViewer1
        .GlobalRanges = False
        .EnterAnimate
End With
```

b. Freeze the Trend

```
With TWXViewer1
        .FreezeMode = True
End With
```

c. Unfreeze the Trend

```
With TWXViewer1
        .FreezeMode = False
End With
```

d. Modify X- axis Grid Style

```
Dim xGrids As Object
'Get XGrids Interface
Set xGrids = TWXViewer1.xGrids
With xGrids
        .GridStyle = "Dotted"
        .GridNumber = 8
End With

' Call Refresh method
TWXViewer1.Refresh
'Release Interface
Set xGrids = Nothing
```

e. A full script

```
' Get Pen Names
Dim penNames As Variant
Dim Count As Integer
Dim penDel As String
penNames = TWXViewer1.GetPenNames
'Show to the user
For Count = 1 To UBound(penNames)
        penDel = penNames(Count)
        MsgBox (penDel)
Next Count
' Now disable pen drawing for last pen
Dim pen As Object
'Get Pen's Interface
Set pen = TWXViewer1.GetPen(penDel, "Real Time")
MsgBox ("Hiding Last Pen !")
'Hide Pen
With pen
        .PenVisible = False
End With

'Call refresh method
TWXViewer1.Refresh
MsgBox ("Showing Last Pen !")
'Show pen again
With pen
        .PenVisible = True
End With

'Call Refresh method
TWXViewer1.Refresh
MsgBox ("Deleting  Last Pen !")
'Now delete this pen
'Release Pen Interface
Set pen = Nothing
'Delete pen
TWXViewer1.DeletePen penDel, "Real Time"
'Call refresh method
TWXViewer1.Refresh
```

f. Exit Runtime (Animate Mode)

```
With TWXViewer1
        .ExitAnimate
End With
```

Note
All of the OLE Automation objects exposed by the TrendWorx Viewer ActiveX are already created when the component is installed. The programmer should get their interface and not try to create them.

When you programmatically obtain an interface to one of TrendWorx objects, the reference count for that interface is increased. Therefore, you should always release the corresponding interface once it is not needed anymore. In addition, you should *always* check for "null" (or "nothing" in Visual Basic) interface pointers. Depending on the state of the TrendWorx Viewer component and the configured security settings, you may not have access to a certain object, and the returned interface in this case is a "null" interface.

VBA Examples

Note
TrendWorx includes a set of VBA examples under the "\SMAR\PROCESSVIEW\Examples\TrendWorx Examples" directory. The following folders located inside the "Examples" directory are associated with the Viewer.

Aliasing. The files in this folder demonstrate the use of the OLE Automation interface of the TrendWorx Viewer ActiveX within a VBA-enabled application, such as GraphWorx, in aliasing.

Real-Time Trend Configuration. The files in this folder demonstrate the use of the OLE Automation interface of the TrendWorx Viewer ActiveX within a VBA-enabled application, such as GraphWorx. It demonstrates how to add pens "on the fly" by reading the pen configuration from a Microsoft Access database (.mdb) file and utilizing the OLE Automation properties of the TrendWorx ActiveX through VBA scripts.

TrendWorx VBA Examples. This folder contains several TrendWorx displays that demonstrate the rich VBA OLE Automation support of the TrendWorx Viewer Trend ActiveX Control.

TrendWorx Data Logging and Reporting. This folder contains sample TrendWorx data-logging configuration, a sample historical database, as well as sample reporting and historical replay displays.