
PLC WorkShop™ for

Siemens S5™

Performance Series

Version 5.12

By FasTrak SoftWorks, Inc.



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Table Of Contents

1 - INTRODUCTION.....	1
Welcome to PLC WorkShop for Siemens S5 - Performance Series.....	1
What is PLC WorkShop?	2
Customer Support.....	3
How to Update the License Key	4
2 - INSTALLATION.....	5
Installing PLC WorkShop for S5 - Performance Series.....	5
Installing the FasTrak-Key	9
What is the FasTrak-Key?.....	9
Connecting the FasTrak-Key	9
Troubleshooting the FasTrak-Key	10
Connect the Communications Cable	10
3 - PLC WORKSHOP BASICS.....	11
The Landscape: PLC WorkShop Window.....	11
Window Description	12
Title Bar	12
Menu Bar.....	13
Toolbars.....	13
Multiple Program Windows	20
Status Bar.....	28
Working with Logic Programs	29
Fast PLC Connection	29
New Program.....	29
Open Program.....	30
Close Program	31
Merge	32
Import Documentation.....	33
Export Documentation.....	34
Text file format.....	35
Transfer to Online	35
File Program Compare.....	36
Recent Files	36
Exit PLC WorkShop	37
Shared Documentation Database.....	37

Save Program	39
Printing Logic Programs	39
Print	40
Print Preview	41
Print Logic	42
Print Documentation	43
Print Cross Reference	44
Print Tree Diagram	45
Print Summary Page	45
Output to Text File	45
Configuring Documentation Font	46
Editing Logic Programs	47
Cut & Copy	47
Paste, Paste Special, Paste with Rewire	47
Modify Address Documentation	49
New Address Documentation	49
Header Input Dialog	49
Clear	50
Delete	51
Delete STL	52
Delete Blocks	52
Insert	53
Find	53
Find Next/Previous	54
Select All	54
Undo Redo	54
4 - PLC WORKSHOP SETUP	55
Program Setup	56
Logic	56
Data	61
Documentation	62
Update Times	63
Colors	64
Application Setup	65
Communications Setup	66

Serial Port Setup	68
H1 Board	69
H1 Port Setup	70
FTH1Config for S5.....	71
Fast PLC Setup	74
Printer Setup	75
Page Setup	76
Print Page Setup for Output to Text File.....	77
5 - FASTRAK AUTHENTICATION AND NT SECURITY	79
Overview.....	79
Choosing a Security Type	79
FasTrak Authentication Security.....	81
FasTrak Authentication Log Setup	82
Security Setup	84
Administrator Options.....	84
Security Administration Dialog.....	85
User Security Setup Dialog.....	88
NT Authentication Security	90
Installing the Security Server.....	91
Workgroups and Domains	93
Adding Users and Groups to the Operating System.....	93
Configuring User Rights and Audit Policy.....	95
Configuring DCOM for NT Authentication Security	96
Security Configurator	101
6 - AUDITING	107
Setup.....	107
Activity Audit Setup.....	108
Security Audit Log Setup	109
7 - PROGRAMMING.....	113
Block Operations	113
New Block.....	113
Copy/Paste Block	113
Zoom Into Block	114
Zoom Out of Block.....	114
Zoom Next/Previous.....	114

Zoom Cursor	114
Logic Operations	115
New Segment.....	115
New Row.....	115
Toggle Branch.....	115
Switch to Statement List	115
Switch to Ladder	116
Validate and Enter	116
Edit Mode and Validate and Enter	116
Editing Commands	117
Selecting by Segment or by Parts.....	117
Toolbox.....	118
Typing Instructions.....	119
Using the Diagnostic Features	119
PLC Operations	119
PLC Status.....	120
Debug.....	121
Logic Status.....	129
Softkey Mode.....	129
8 - INSTRUCTIONS	131
Ladder Instructions.....	131
Relays	131
Timers/Counters.....	134
Compare	136
Compare Less Than.....	140
Math	146
Logic.....	147
Bit Operations	148
Flip Flops.....	149
Convert	150
Special	151
Statement List Instructions.....	152
Basic Operations	152
Supplementary Operations	158
System Operations	163

Operands	171
INDEX	173

1 - Introduction

Welcome to PLC WorkShop for Siemens S5 - Performance Series

PLC WorkShop for Siemens S5 - Performance Series is a powerful Windows-based tool for programming the S5 family of programmable logic controllers (PLCs). These help topics have been constructed to assume little about you, the user, except that when you have a question regarding this software you'll find the answer you need within this manual and the online help.

Section	Description
1 - Introduction	Outlines help contents, Customer Support numbers and necessary hardware and software to run PLC WorkShop.
2 - Installation	Guides you through the installation procedures for the software and security.
3 - PLC WorkShop Basics	Describes PLC WorkShop for Windows features and helps you move through the Windows environment.
4 - PLC WorkShop Setup	Provides specific guidelines in setting up and customizing the software.
5 - FasTrak Authentication and Security	Provides instructions for establishing and using a Password Security Mode.
6 - Auditing	Outlines options for tracking program and setting changes.
7 - Programming	Gives you solid understanding of PLC WorkShop's easy to use programming features.
8 - Instructions	Gives detailed information about the PLC instructions including programming examples of both ladder logic and statement list.

What is PLC WorkShop?

PLC WorkShop is one of the world's most powerful and exciting programmable logic controller (PLC) programming applications. Designed to run flawlessly in today's 32-bit Windows operating systems, PLC Workshop is the only S5 software product on the market that fully supports all Windows operating systems, from Windows 95 through Windows XP. You can count on the speed and usability of PLC WorkShop, which allows for fast uploading and downloading of logic, data updating, cross referencing, and printing.

Offering timesaving editing features and convenient at-a-glance views, PLC WorkShop supports the entire line of Siemens S5 PLCs. It's easy to use, has built-in SCADA capabilities, and the ability to track program changes with Activity Audit Trail. In addition, PLC Workshop offers powerful security using NT authentication that incorporates one-time, server-based security configuration.

PLC WorkShop offers:

- Capability to use hot keys
- Ability to view multiple programs simultaneously online or offline
- Online Diagnostics, Power Flow, Logic Status, and Data Window for viewing data values
- Choice of communications including Serial with modem support and H1
- PLC Status dialogs providing information about operational status, configuration, error conditions, etc.

For more information on PLC WorkShop and other FasTrak products, contact Customer Support.

Customer Support

It's our goal that customers become proficient users of our software as quickly and easily as possible. With that in mind, FasTrak makes available a number of support options. Commonly asked questions can usually be answered with this manual, online help, or by visiting our website at www.fast-soft.com. Our website features easy-to-access FAQs, technical resources, and system documentation.

For real-time how-to help and advanced troubleshooting, contact FasTrak's customer support center and speak directly with a technical support representative. Our trained experts offer convenient, accurate and prompt assistance.

Customer Support	262.238.8088
Customer Support Fax	262.238.8080
Email	support@fast-soft.com
Website	www.fast-soft.com

You may also forward questions, comments, and suggestions to:

FasTrak SoftWorks, Inc.

P.O. Box 240065

Milwaukee, WI 53224

How to Update the License Key

This FasTrak product is protected by a security key or site license.

If your installation has a site license, you do not need a key. For site license information, contact your FasTrak software distributor or sales representative.

The security key connects to either a 25-pin parallel (printer) port or to a USB (Universal Serial Bus) port. The key is activated for updates for the term of the Maintenance Agreement. Existing software will run on an expired key indefinitely, but updates released after the expiration date will not.

When you renew your Maintenance Agreement, contact FasTrak SoftWorks by telephone or email for a Key Update Code.

To obtain the Key Update Code by email:

1. Connect your hardware key to your computer (parallel or USB port).
2. Run your FasTrak software. From the **Help** menu, select **Update Key** to access the **Security Key Update** window.
3. Copy the contents of the **Key License** field. Paste it into an email message. Note that the key license may be longer than the displayed part of the field. Repeat for each key, and write the key number(s) found on the label on your key(s) (4 digits and a letter) near the key license number(s).
4. Send the message to support@fast-soft.com
5. FasTrak SoftWorks will reply with a new **Key Update Code**.
6. Copy the **Key Update Code** from the email into the **Key Update Code** field, and click **OK**. Your key is now reprogrammed.

To obtain the Key Update Code by telephone:

1. Connect your hardware key to your computer (parallel or USB port).
2. Call FasTrak SoftWorks at 262.238.8088. Ask for a key update.
3. Run your FasTrak software. From the **Help** menu, select **Update Key** to bring up the **Security Key Update** window.
4. Read the contents of the **Key License** field to the representative. Note that the key license may be longer than the displayed part of the field.
5. Type the **Key Update Code** that the representative reads to you into the **Key Update Code** field, and click **OK**. Your key is now reprogrammed.

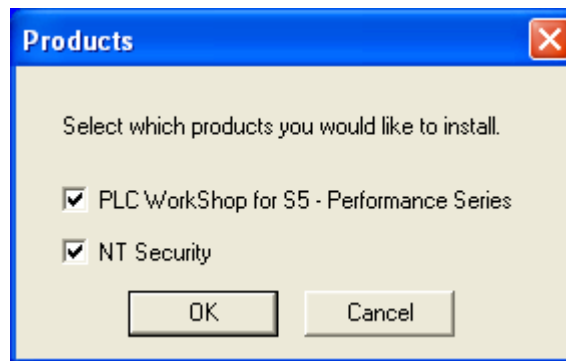
2 - Installation

Installing PLC WorkShop for S5 - Performance Series

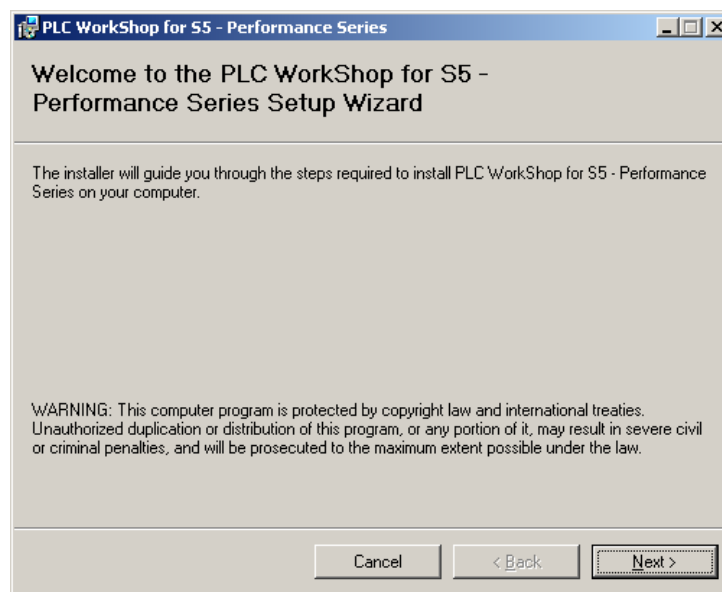
Before you begin installation, you should review the System Requirements section in the Introduction chapter.

To install PLC WorkShop, turn your computer on and start Windows. You may need to provide a user name and password to log in to a computer network. If you are unsure, contact your company's System Administrator or IT representative. Follow these steps to install the software:

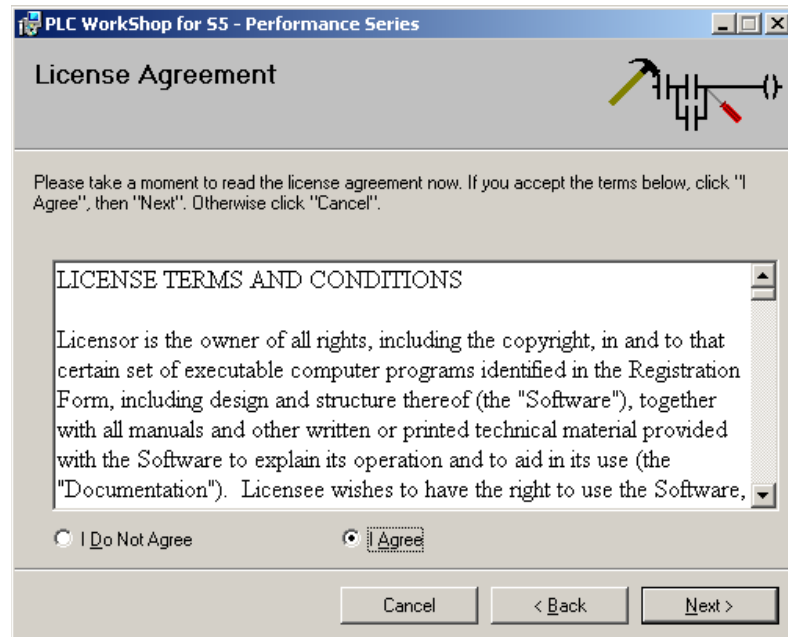
1. Insert the **PLC WorkShop for Siemens S5 - Performance Series** CD in your computer's CD-ROM drive.
2. The CD should start automatically. If not, click the Windows **Start** button. Then click **Run**, and type `x:\setup.exe`, where `x` is the letter for the CD-ROM drive. The **Products** dialog appears.



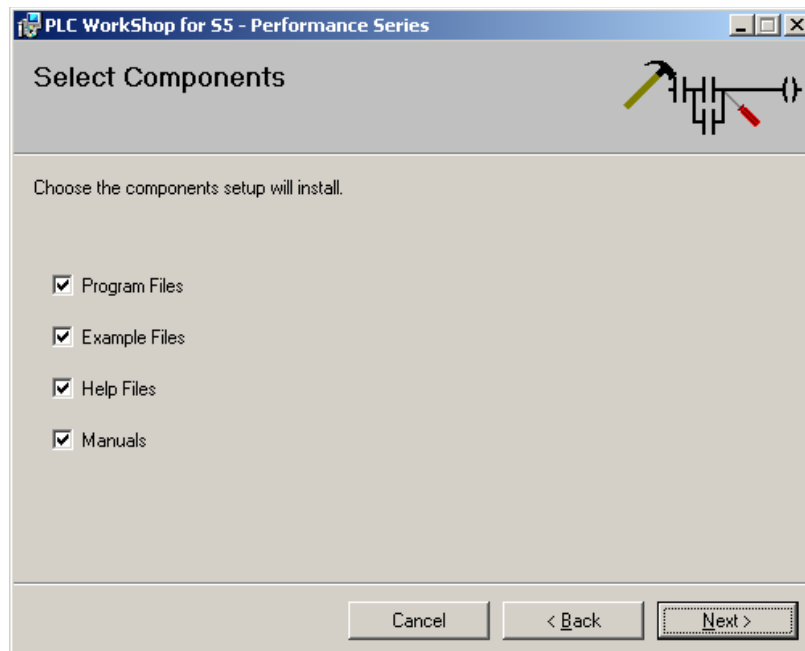
- Select the products to install and click **OK**.
 - **PLC Workshop for Siemens S5** is the main part of the product.
 - **NT Security** is an optional security system.
- 3. The **Setup Wizard** dialog appears.



- Read the copyright information and click the **Next** button.
- 4. The **License Agreement** dialog appears.

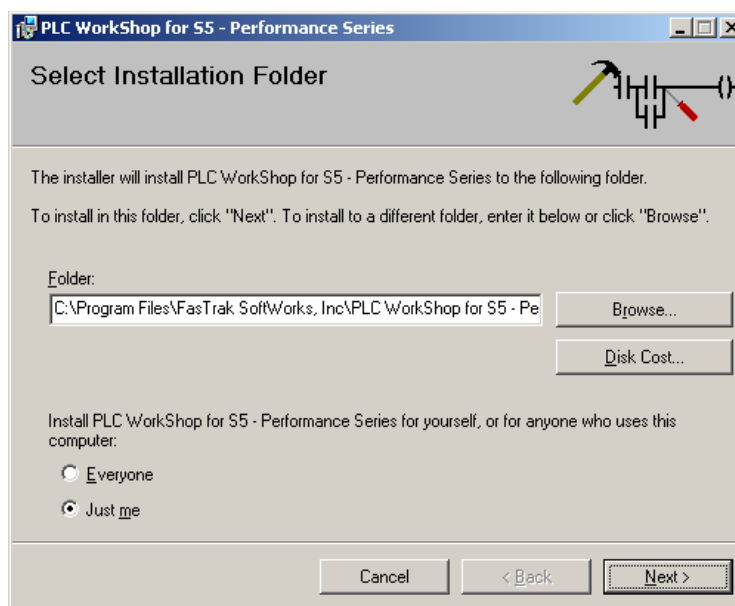


- Read the **License Agreement**. If you agree, select the **I Agree** radio button and click the **Next** button.
- 5. The **Select Components** dialog appears.

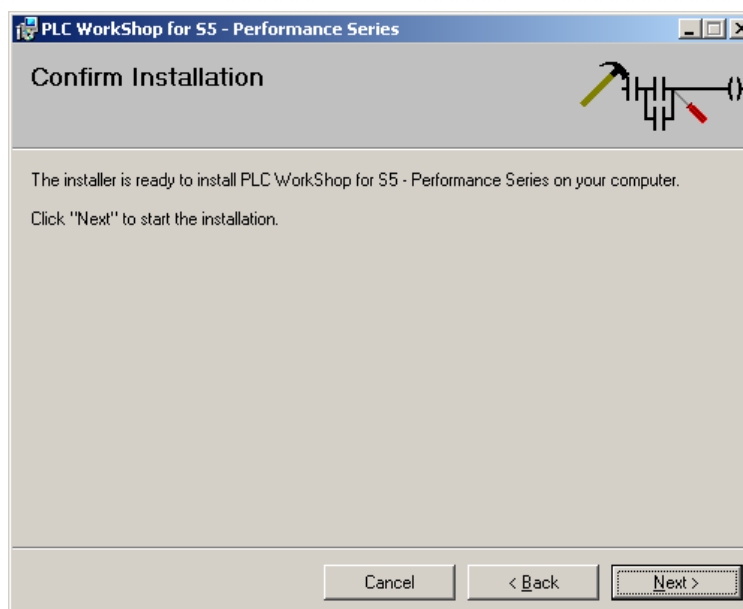


- Select the components to install and click the **Next** button.
 - Check **Program Files** and **Help Files** to install PLC WorkShop.
 - Check the **Example Files** box to install an example of an S5 program.

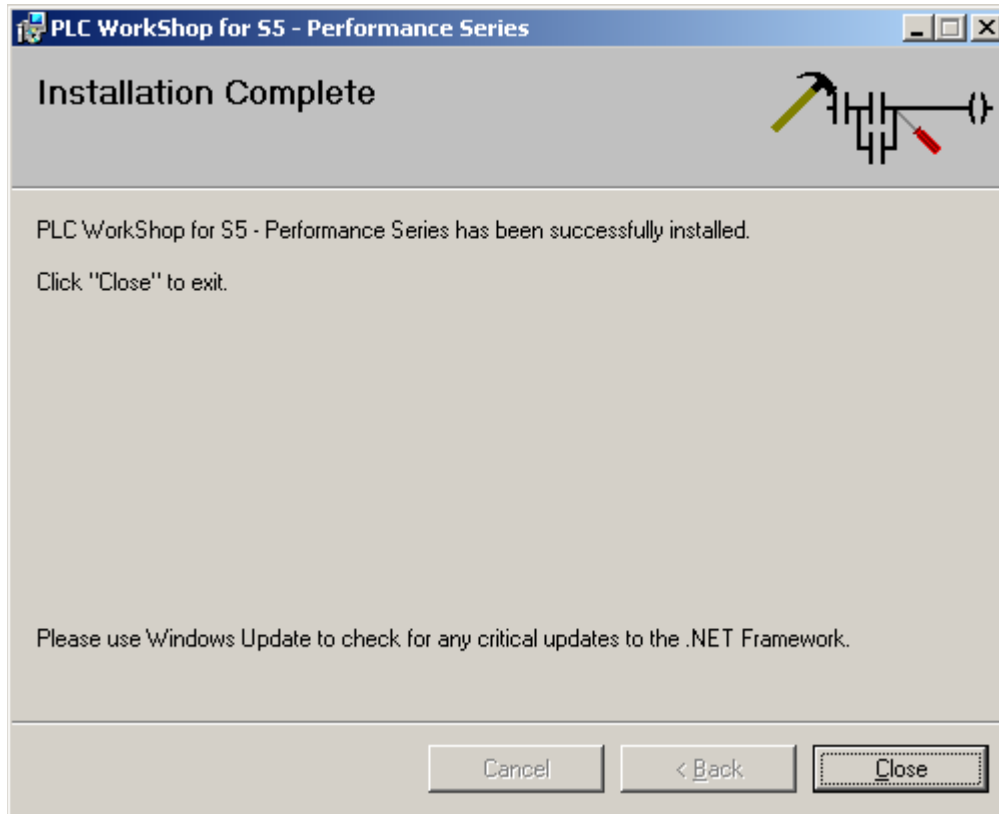
- Check the **Manuals** box to install this PLC WorkShop manual in Adobe Acrobat (PDF) format.
6. The **Select Installation Folder** dialog appears.



- Select the location where the software will be installed and click the **Next** button.
 - Click the **Browse** button to select another **Folder**.
 - To locate a drive with enough disk space, click the **Disk Cost** button.
 - To install PLC WorkShop for any user on the computer, select the **Everyone** radio button. To install PLC WorkShop so it can only be used by the currently logged in user, select the **Just me** radio button.
7. The **Confirm Installation** dialog appears.



- To make any changes, click the **Back** button. To confirm that all the options you have selected are correct, click the **Next** button.
- 8. The **Installation Complete** dialog appears.



- Click the **Close** button to complete the installation.

Installing the FasTrak-Key

What is the FasTrak-Key?

The PLC WorkShop software is copy protected with a device called the FasTrak-KEY included in your shipment. To use PLC WorkShop online and save logic programs, connect the FasTrak-KEY to a parallel port (LPT1-LPT3) or USB port on your computer.



NOTE: Installation of the FasTrak-KEY must be completed before you run PLC WorkShop. If a FasTrak-KEY is not detected, PLC WorkShop will run in Demo mode with limited functionality.

Connecting the FasTrak-Key

To install the FasTrak-Key, follow the steps below:

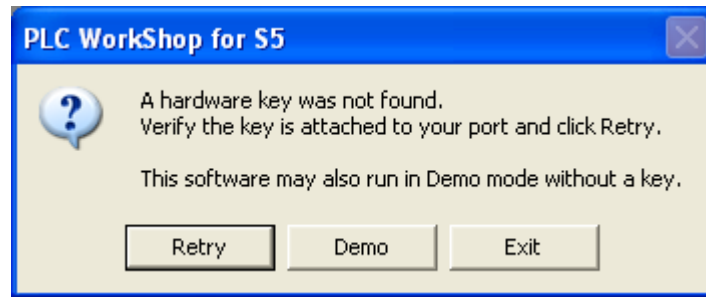
1. Determine which parallel port you will connect the FasTrak-Key to.
2. Disconnect other security devices or cables attached to that port.
3. Connect the FasTrak-Key to the port.
4. Attach other cables to the FasTrak-Key, if necessary. If the device you attach to the FasTrak-Key is a parallel printer, make sure the printer is turned on before starting WorkShop.

NOTE: The FasTrak-Key must be the first device attached to the parallel port. Other devices or cables can then be attached to the FasTrak-Key.

Troubleshooting the FasTrak-Key

Following is an error message associated with the FasTrak-KEY, possible causes, and solutions.

Message



Possible Causes

- PLC WorkShop was started without the FasTrak-KEY attached to the parallel or USB port.
- A port driver may be missing.
- If running Windows NT, the NT driver may not be loaded.

Solution

Check to see that:

- The FasTrak-KEY is connected to a parallel or USB port.
- The FasTrak-KEY is the first device attached to the port.
- Any parallel printers attached to a parallel port are turned on.
- The port driver has been installed:
 1. Go to www.fast-soft.com and select the **Downloads \ Drivers and Utilities** menu item.
 2. Click the **FT-Key Driver** link to download the file **SSD5411-32bit.exe**. Once the file is downloaded, browse to the location of the file and double-click the file to execute.

Connect the Communications Cable

The PLC communications cable connects the serial COM port of the personal computer to the PLC. This enables you to transfer programs and data from the computer's memory (Offline) to the PLC and vice versa. This cable has a **25-pin** or **9-pin** connector (computer end) and a **15-pin** connector (PLC end).

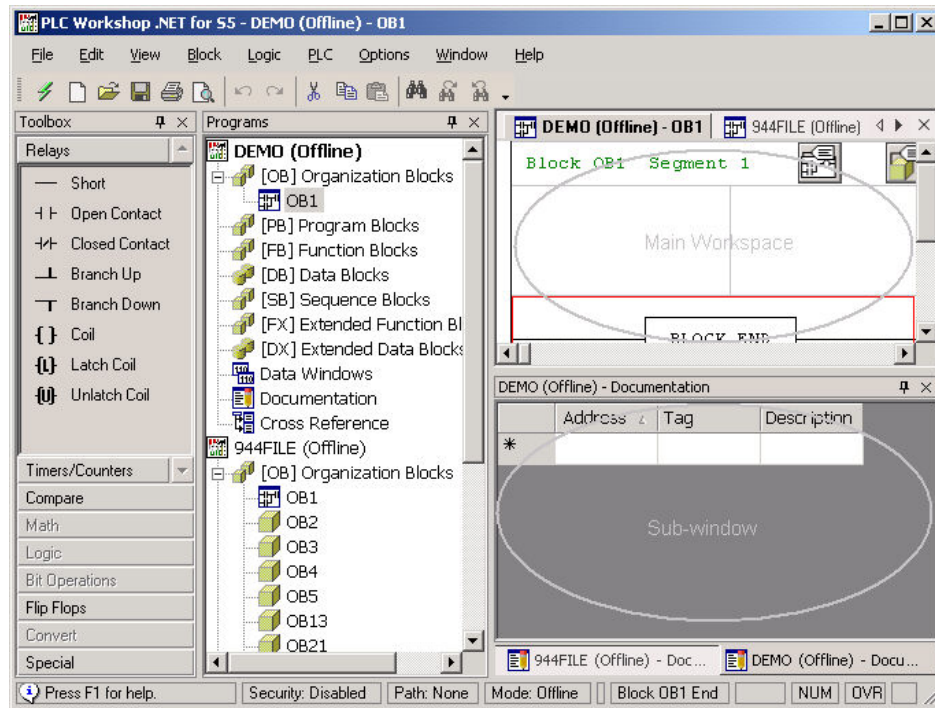
If your computer has a 9-pin COM port, and you have a 25-pin cable, you can use a **9 to 25-pin converter** to connect the communications cable to the processor. If your computer has a 25-pin COM port, this converter is not necessary.

3 - PLC WorkShop Basics

The Landscape: PLC WorkShop Window

WorkShop's editors are shown on the workspace - the main area of the WorkShop window.


The workspace can contain multiple tabs, each containing a logic block or data block editor.



Sub-Windows

The workspace can also contain sub-windows, each containing one or more tabs containing lists or editors. The sub-windows can be docked to an edge of the workspace, resized, or detached from the workspace. A sub-window can also be set to Auto-Hide. A tab in a sub-window can be moved to the main work area.

To resize a sub-window:

1. Move the mouse cursor to an edge of the sub-window. When the mouse cursor is in the right spot, it changes: .
2. Click and drag to the desired size.

To move a sub-window to another docking point or detach it, click and drag the sub-window's title bar.

To re-attach a detached sub-window, double click the sub-window's title bar.

To set a sub-window to auto-hide, right-click the sub-window's title bar and check the **Auto Hide** menu item.

To move a tab from a sub-window to the main workspace, right-click the sub-window's title bar and un-check the **Dockable** menu item. This menu item is not available when the sub-window is in auto-hide mode.

Window Description

The key features of the PLC WorkShop window are defined below. More detailed descriptions follow.

Window Feature	Function
Title Bar	Displays the name of the application. Buttons in the upper right corners change the window's size and position.
Menu Bar	Use to select PLC WorkShop functions.
Toolbars	Use to quickly access frequently used menu options.
Multiple Program Windows	Displays view and edit windows of multiple logic programs at the same time, limited only by the size of your computer's memory.
Status Bar	Displays information about the operation in progress.





Title Bar

The Title Bar spans the top of the PLC WorkShop Window.



Use the Title Bar for three purposes:

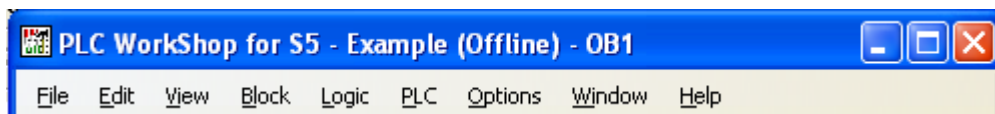
- To identify the application being used. In the example above, it's PLC WorkShop.
- To move the window. A window or dialog box can be moved by clicking on the title bar with the mouse pointer, holding down the left mouse button and dragging to the desired location.
- To change the size or position of the window. The following buttons appear on the right side of the title bar:

Button Title	Location	Function
Minimize 	Left Box	Click the dash button to reduce window to an icon.
Maximize / Restore Down  	Middle Box	Click the window button to enlarge the window when minimized, or shrink the window when maximized.
Close 	Right Box	Click to exit WorkShop.

Menu Bar

The menu bar, located just below the title bar, identifies the names of the available PLC WorkShop functions. To display the menu options for each function, click on the function name. The menu options displayed may change depending upon the operation in progress.

For example, the Menu Bar illustrated below appears when you open PLC WorkShop.



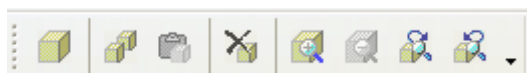
Toolbars

The toolbars display a row of buttons that represents frequently used options. Select each option by clicking on its corresponding button, saving you the steps of selecting several options from a series of menus. Notice that when you move your mouse over each button, its purpose appears in a tooltip next to the button.




PLC WorkShop contains five default toolbars, listed below, plus unlimited user-customizable toolbars. The toolbars can be accessed from the **View \ Toolbars** menu item. Selecting each toolbar menu item displays the toolbar and places a check mark in front of the menu item indicating it has been selected. Selecting the menu item again hides the toolbar.






Each toolbar can be docked to the top and bottom of the WorkShop window, as well as both sides. In addition, you may change the toolbars into floating windows by dragging them from their docked positions to anywhere on the screen, including outside the WorkShop window.

Block Toolbar



The Block Toolbar contains icons that pertain to block operations. Each icon and its function is listed below.





Icon	Function
 New Block	Add a new block to the current program.
 Copy Block	Copy the contents of a block to the clipboard.
 Paste Block	Paste a copied block to the selected location.











 Delete Block	Delete the selected block.
 Zoom Into Block	View the contents of block highlighted by the Zoom Cursor.
 Zoom Out of Block	Reverses a Zoom Into Block operation.
 Zoom Next	Moves the Zoom Cursor to the next zoomable location.
 Zoom Previous	Moves the Zoom Cursor to the previous zoomable location.

Main Toolbar









The Main Toolbar contains icons that pertain to the most basic PLC WorkShop application functions. Each icon and its function is listed below.

Icon	Function
 Fast PLC Connection	Quickly connect to and view logic on a PLC.
 New	Create a new logic program.
 Open	Open an existing logic program.
 Save	Save the current program.

 Print	Print information about the current program.
 Print Preview	View the printed output of the current program before sending to the printer.
 Undo	Reverse the most recent edit.
 Redo	Reverse the most recent Undo operation.
 Cut	Remove a selection and place it on the clipboard.
 Copy	Copy a selection and place it on the clipboard.
 Paste	Place the contents of the clipboard to the selected location.
 Find	Search for a segment, address, or tag.
 Find Next	Search further in the selection using the criteria of the most recent Find operation.
 Find Previous	Search earlier in the selection using the criteria of the most recent Find operation.

Logic Toolbar





The Logic Toolbar contains icons that pertain to basic logic programming operations. Each icon and its function is listed below.

Icon	Function
 Switch to Ladder	Switches the programming mode from Statement List to Ladder.
 Switch to Statement List	Switches the programming mode from Ladder to Statement List.
 New Row	Add a new row to the segment.
 New Segment	Add a new segment to the program.
 Cursor	Removes any attached instruction from the selection arrow.
 Validate and Enter	Validates edits to the program and commits valid edits to the program.

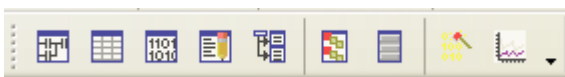
PLC Operations Toolbar






The PLC Operations Toolbar contains icons that directly affect the operation of a PLC when it is connected to PLC WorkShop. Each icon and its function is listed below.







Icon	Function
 Cold Start	Clears register data before starting the PLC.
 Warm Start / Start	The PLC resumes at the point of interruption while retaining register data.
 Stop	Halt the PLC.
 Compress	Eliminate gaps in memory allocation to free memory.

Editors Toolbar



The Editors Toolbar contains icons that launch all of the available editor utilities within PLC WorkShop. Each icon and its function is listed below.

Icon	Function
 Logic Block Editor	Displays all existing logic blocks.
 Data Block Editor	Displays all existing data blocks.
 Data Window	Displays a new Data Window.

 Documentation	Displays the Documentation Window.
 Cross Reference	Displays the Cross Reference Window.
 Programs	Displays/hides the Program Tree.
 Toolbox	Displays/hides the Toolbox.
 FTLogger	Launches the FTLogger data acquisition utility.
 FTTrender	Launches the FTTrender trend analysis utility.

Customizing Toolbars

PLC WorkShop's toolbars can be fully customized for quick access to the program functions that are most important to you.

Configuration options include:

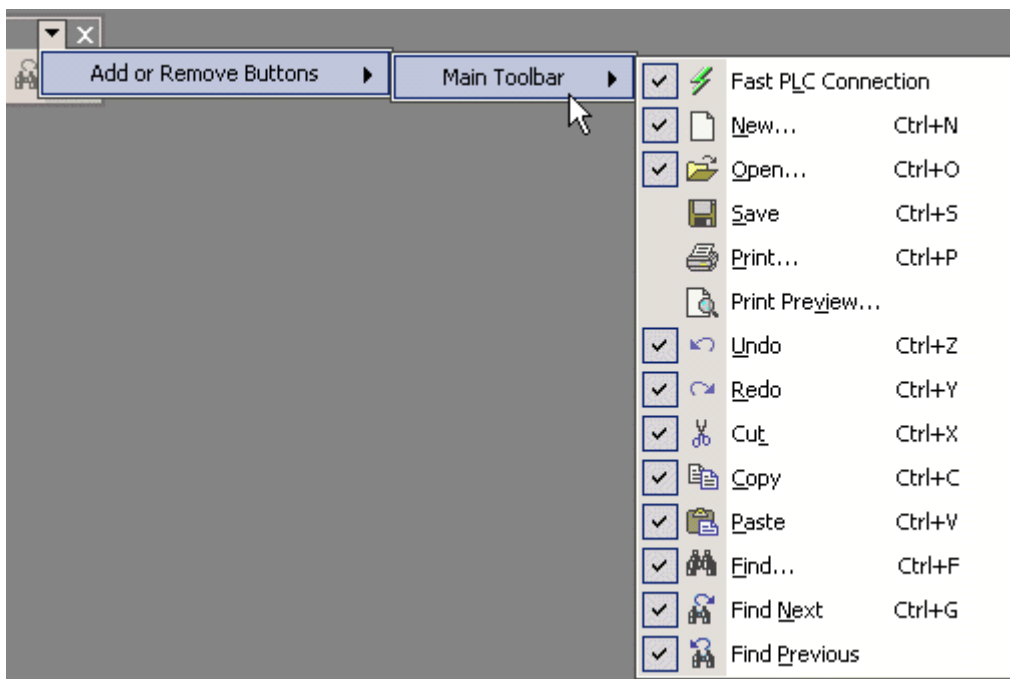
- Selecting which toolbars are visible
- Adding or removing buttons
- Moving toolbars to another part of the screen



Move a toolbar by clicking and dragging the **handle** at the left edge of the toolbar.

Show or hide a toolbar by selecting the toolbar from the **View \ Toolbars** submenu.

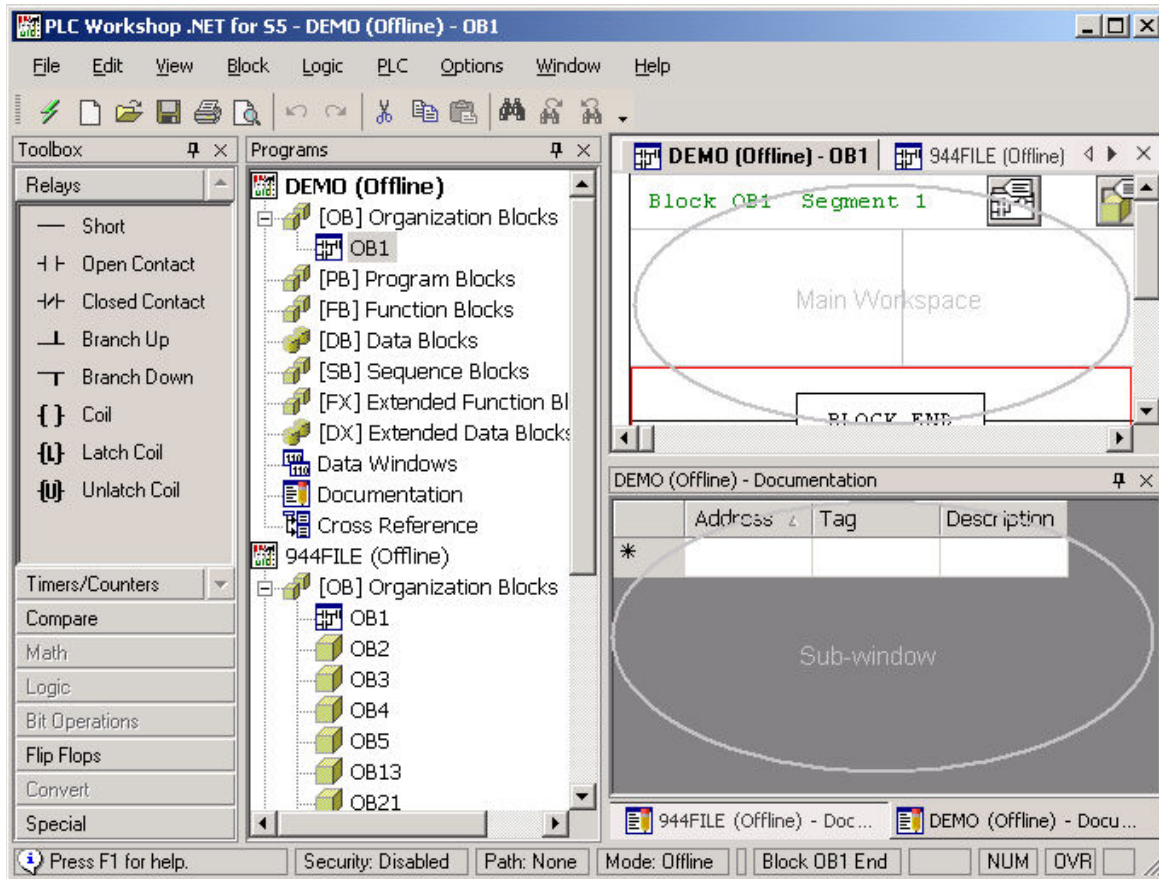
Show or hide a specific toolbar icon by selecting the item from the **menu** that appears when you click the triangle at the right edge of the toolbar, as shown below.



For further customization options, use the Customize dialog by selecting the **View \ Toolbars \ Customize** menu item.

Multiple Program Windows

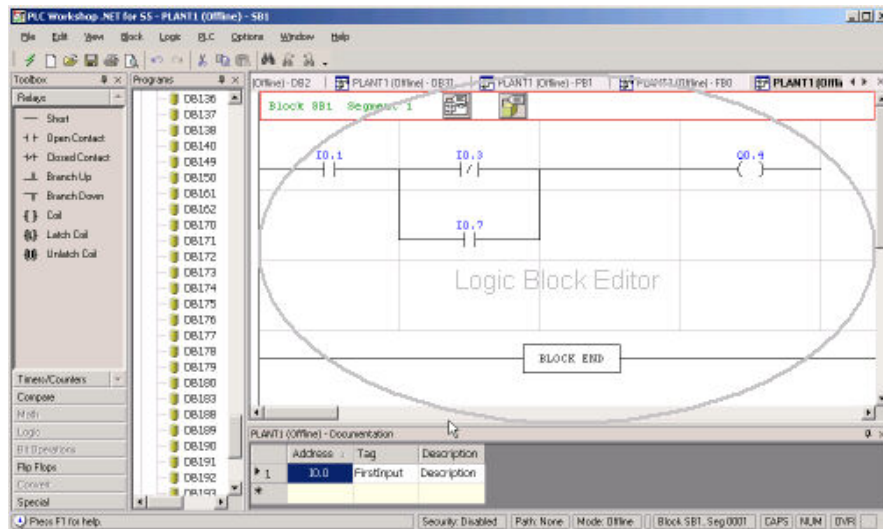
The WorkShop screen will usually look something like this:



Each of the components shown is optional. Some may be subdivided or moved.

Logic Block Editor

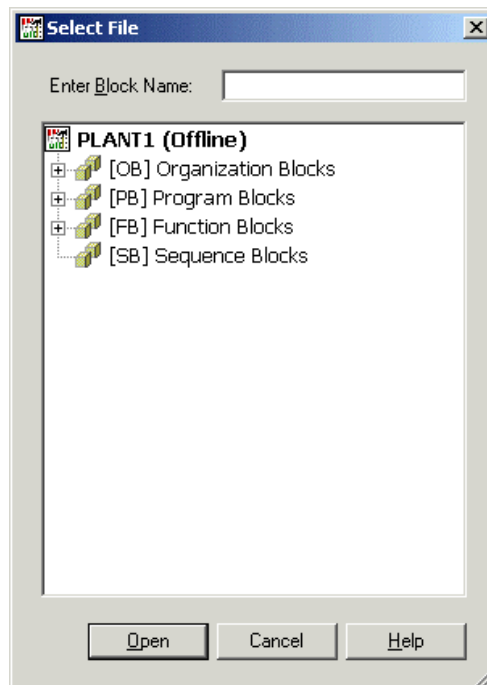
A logic block editor is displayed as a tab in the main workspace. Multiple block editors can be open at once. Logic may be edited in either Ladder, as shown below, or in Statement List.



The display options for the logic block editor are set in the **Logic** tab on the **Program Setup** dialog.

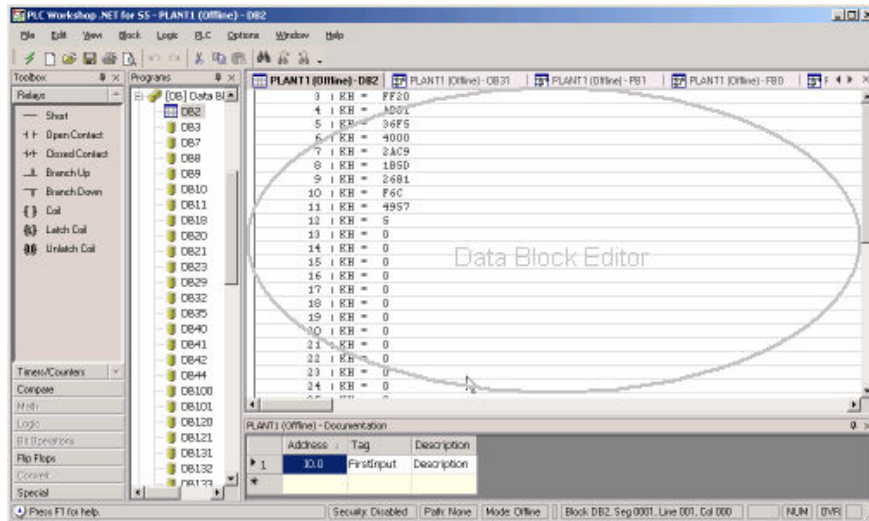
To open a block in a logic block editor, either:

- Double-click the logic block in the program tree, or
- Display the **Select File** dialog by selecting the **View \ Logic Block Editor** menu item or clicking the toolbar button, then either double-click the block or type the block name in the **Enter Block Name** field.



Data Block Editor

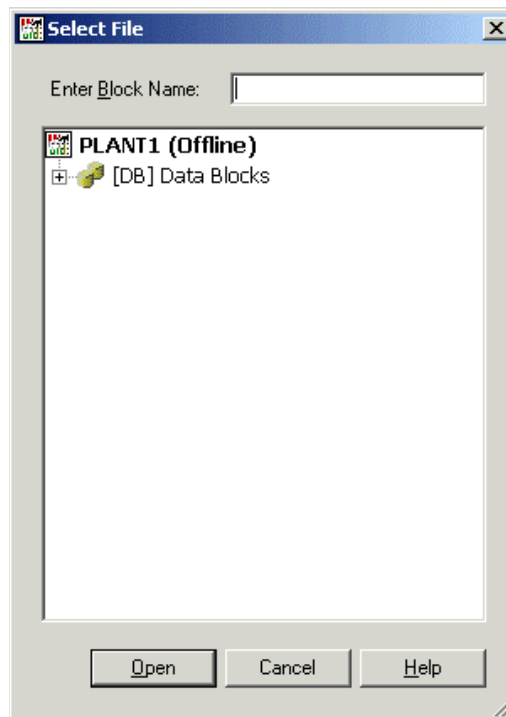
A data block editor is displayed as a tab in the main workspace. Multiple block editors can be open at once.



The display options for the data block editor are set in the **Data** tab on the **Program Setup** dialog

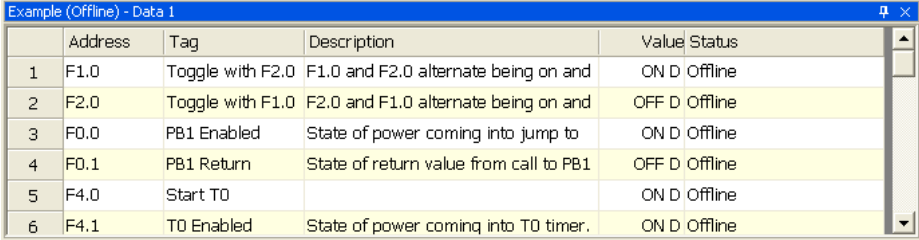
To open a block in a data block editor, either:

- Double-click the logic block in the program tree, or
- Display the **Select File** dialog by selecting the **View \ Data Block Editor** menu item, then either double-click the block or type the block name in the **Enter Block Name** field.



Data Window

The Data Window provides a way to view and edit the values in a set of PLC memory addresses.



	Address	Tag	Description	Value	Status
1	F1.0	Toggle with F2.0	F1.0 and F2.0 alternate being on and	ON	D Offline
2	F2.0	Toggle with F1.0	F2.0 and F1.0 alternate being on and	OFF	D Offline
3	F0.0	PB1 Enabled	State of power coming into jump to	ON	D Offline
4	F0.1	PB1 Return	State of return value from call to PB1	OFF	D Offline
5	F4.0	Start T0		ON	D Offline
6	F4.1	T0 Enabled	State of power coming into T0 timer.	ON	D Offline

To view a data window, either:

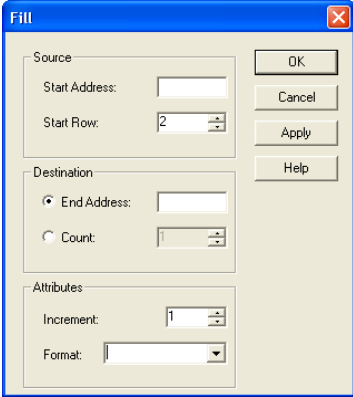
- Double-click the data window in the program tree, or
- Display the **Select File** dialog by selecting the **View \ Data Window** menu item or clicking the toolbar button, then either double-click the data window or type the name in the **Enter Block Name** field.

To add an address to the data window, either:

- Type the address in a cell in the **Address** column, or
- Open the drop-down list in a cell in the **Tag** column and select the tag for the address to be added.

To add a series of addresses to the data window:

1. Select the **Data \ Fill** menu item to bring up the **Data View Fill** dialog.



The Fill dialog box contains the following fields and controls:

- Source:**
 - Start Address: [Text Field]
 - Start Row: [Spin Box, value 2]
- Destination:**
 - ☒ End Address: [Text Field]
 - ☐ Count: [Spin Box, value 1]
- Attributes:**
 - Increment: [Spin Box, value 1]
 - Format: [Drop-down List]
- Buttons: OK, Cancel, Apply, Help

2. Enter the first address in the **Start Address** field.
3. Enter the line on which that address should appear in the **Start Row** field.
4. Select **End Address** to specify the end of the series, or select **Count** to specify the number of addresses in the series. Enter the appropriate information in the field next to the selected radio button.
5. Set the **Increment** between addresses in the series. The default (1) creates a series of consecutive addresses.
6. Select the display **Format** for the data from the drop-down list.

To edit the documentation for an address in the data window, use the **Modify Address Documentation** feature.

View Documentation

Address documentation is listed in a spreadsheet-style display.

Example (Offline) - Documentation

	Address	Tag	Description
1	CO	0 to 10, 10 to 0 Counter	CO counts from 0 to 10, then 10 to 0 continuously.
2	F0.0	PB1 Enabled	State of power coming into jump to PB1.
3	F0.1	PB1 Return	State of return value from call to PB1.
4	F1.0	Toggle with F2.0	F1.0 and F2.0 alternate being on and off.
5	F2.0	Toggle with F1.0	F2.0 and F1.0 alternate being on and off.
6	F4.0	Start T0	

To display the **Documentation List**, select the **View \ Documentation** menu item.

The display is not directly editable. Double-click on a line to edit the documentation.

Documentation Editor

Use the documentation editor to edit documentation about PLC memory addresses.

There are several ways to bring up the documentation editor:

- Select the **Edit \ Modify Address Documentation** menu item, or press **[Ctrl+L]**, while the cursor is on the address to be modified.
- Select the **Edit \ New Address Documentation** menu item.
- Double-click a line in the documentation display.

Edit Documentation

Address:

Prev Doc Prev Addr Next Addr Next Doc

Tag

Description: Toggles On and OFF with F2.0

Description Comment

Ladder Symbols

Add Symbol... Delete Symbol

OK Cancel Help

- **Address:** Enter the address to be documented. When this field does not contain a valid address, all the other fields are disabled.
- **Tag:** Enter the tag for the displayed address. Tags must be unique.
- **Description:** Enter the description of the address.
- **Description Comment:** Enter comments about the address.
- **Prev Doc, Next Doc:** Edit documentation for the previous or next documented address.
- **Prev Add, Next Add:** Edit documentation for the previous or next address, whether it is currently documented or not.

Assign Tag

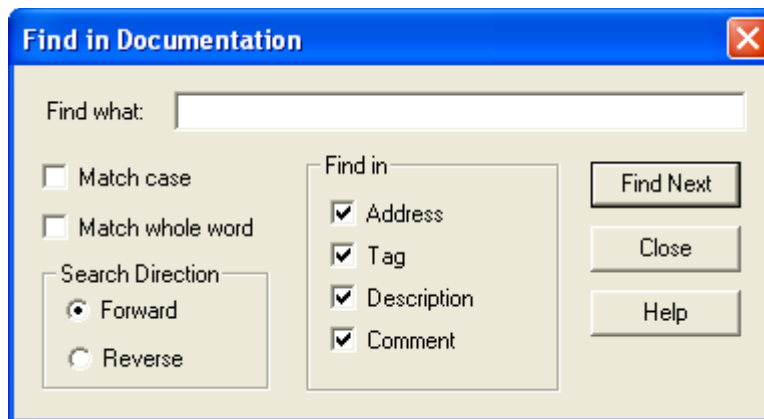
When the **Assign Tag** option is selected and you enter an address that does not already have a tag in ladder logic or STL, WorkShop displays the **Assign Tag** dialog. This is identical to the **Edit Documentation** dialog except that the address is a non-editable field containing the address to which the tag will be assigned, and the navigation buttons are disabled.

Assign Address

When the **Assign Address** option is selected and you enter a tag that is not already assigned to an address in ladder logic or STL, WorkShop displays the **Assign Address** dialog. This is identical to the **Edit Documentation** dialog except that the Tag field is already filled in and the navigation buttons are disabled.

Find in Documentation

Use the **Find in Documentation** dialog to locate text in the address documentation.

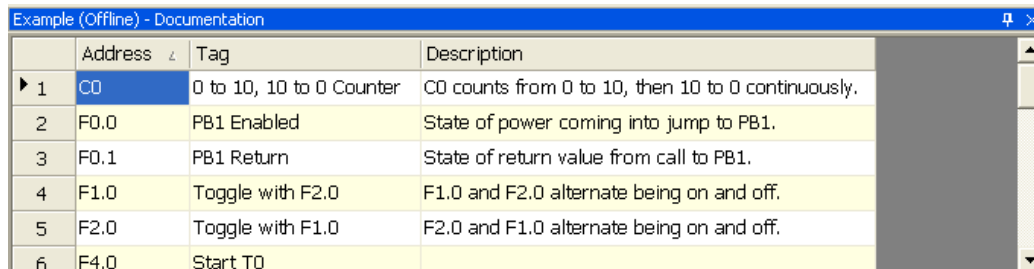


- **Find what** - Enter the text to be found.
- **Match case** - Check this box to search for the exact case. For example, if you search for 'Coil' and box is checked, WorkShop will only find 'Coil', not 'coil' or 'COIL'.
- **Match whole word** - Check this box to find the text only as a whole word. For example, if you search for 'Coil' and this box is checked, WorkShop will find 'Coil' but not 'Coils'.
- **Search Direction** - Select whether to search **Forward** towards the end of the program or **Reverse** towards the start of the program.
- **Find in** - Check to boxes for the areas in which to search. For example, if you search for 'Coil' and only the Tag box is checked, WorkShop will find only documentation where the tag contains 'Coil', not documentation where 'Coil' appears only in the description.

- **Find Next** - Click this button to find the next (or previous, if the **Search Direction** is **Reverse**) instance of the text. The **Find in Documentation** dialog does not close automatically when you click this button, so you can click it repeatedly to find more instances.

To access the **Find in Documentation** dialog:

1. Select a documentation window.



	Address	Tag	Description
1	CD	0 to 10, 10 to 0 Counter	CD counts from 0 to 10, then 10 to 0 continuously.
2	F0.0	PB1 Enabled	State of power coming into jump to PB1.
3	F0.1	PB1 Return	State of return value from call to PB1.
4	F1.0	Toggle with F2.0	F1.0 and F2.0 alternate being on and off.
5	F2.0	Toggle with F1.0	F2.0 and F1.0 alternate being on and off.
6	F4.0	Start T0	

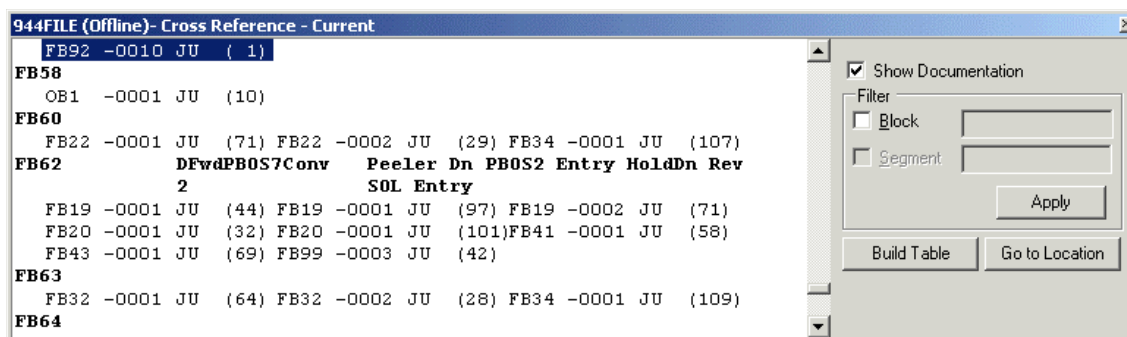
2. Select the **Edit \ Find** menu item, press [Ctrl+F], or click the binoculars icon in the toolbar.

View Cross Reference



The **Cross Reference** lists PLC addresses and the contexts (location and instruction) where they are used.

You can go to any of the locations where an address is in use, by selecting the segment reference in the Cross Reference display and clicking the **Go to Location** button.



944FILE (Offline) - Cross Reference - Current			
FB92 -0010 JU { 1 }			
FB58			
OB1 -0001 JU {10}			
FB60			
FB22 -0001 JU {71}	FB22 -0002 JU {29}	FB34 -0001 JU {107}	
FB62 DFwdPB0S7Conv Peeler Dn PB0S2 Entry HoldDn Rev SOL Entry			
FB19 -0001 JU {44}	FB19 -0001 JU {97}	FB19 -0002 JU {71}	
FB20 -0001 JU {32}	FB20 -0001 JU {101}	FB41 -0001 JU {58}	
FB43 -0001 JU {69}	FB99 -0003 JU {42}		
FB63			
FB32 -0001 JU {64}	FB32 -0002 JU {28}	FB34 -0001 JU {109}	
FB64			

To display the Cross Reference, select the **View \ Cross Reference** menu item, click the toolbar button, or double-click the cross reference icon in the **program tree** display.

You can go to any of the locations where an address is in use, by selecting the segment reference in the cross reference display and clicking the **Go to Location** button.

To rebuild the cross reference table, click **Build Table**.

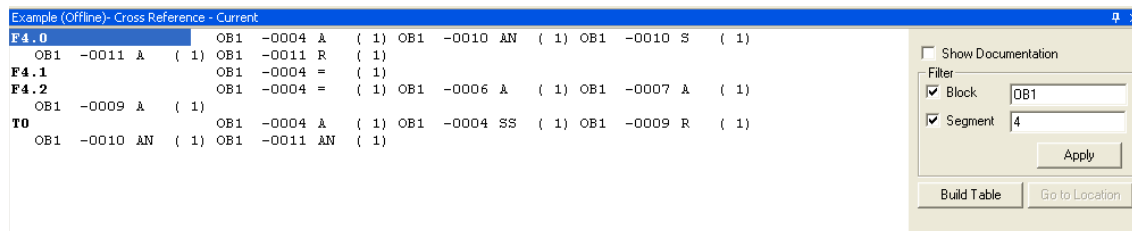
To include address documentation in the display, check the **Show Documentation** box.

To limit the cross reference to a particular block or segment, check the **Block** box and enter the block name, and the **Segment** box and number if applicable, in the **Filter** area, then click **Apply**.

Segment Cross Reference

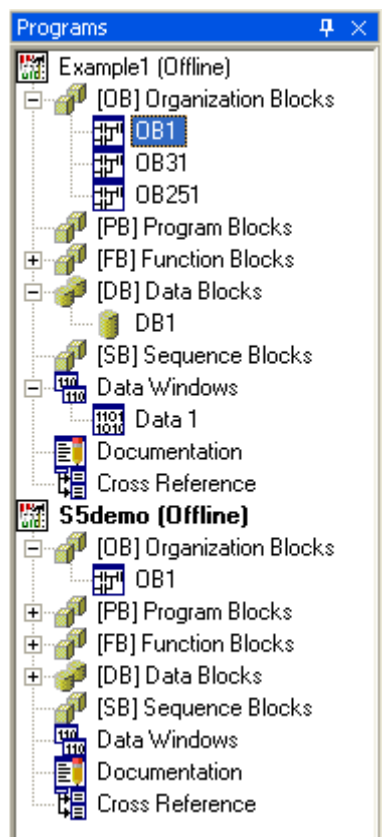
The **Segment Cross Reference** displays the cross reference information for the addresses in the current logic segment.

The segment cross reference is equivalent to the general cross reference with the filter set to the current block and segment.



To display the **Segment Cross Reference**, select the **View \ Segment Cross Reference** menu item.

Program Tree



The program tree provides an overview of the structure of the PLC program.

Double-clicking an item in the tree opens that item. If the item is a container (indicated by a +/- box) the container opens by expanding the tree. For other items, an editor or list opens. For blocks that can contain logic (Organization Blocks, Program Blocks, Function Blocks, and Sequence Blocks) a **Logic Block Editor** opens in the workspace. For Data Blocks, a **Data Block Editor** opens in a sub-window.

Status Bar

To toggle display of the status bar, select the **View \ Status Bar** menu item.

The status bar shows the status of several features of the system.




- **Security** - Displays the status of the security system, enabled or disabled.
- **Path** - Displays the communications path.
- **Online** - Displays the RUN/STOP status of the PLC.
- **Cursor location** - Displays the block, segment, line, and column at which the cursor is located.
- **CAPS** - If the Caps Lock is active, the word CAPS is shown.
- **NUM** - If the Num Lock is active, the word NUM is shown.
- **OVR** - If the Caps Lock is active, the word CAPS is shown.
- **Heartbeat** - When online, the heart symbol alternates between red and white to indicate that communication with the PLC is occurring.

Working with Logic Programs

Fast PLC Connection

The **Fast PLC Connection** operation allows you to go into online editing with a single click. Fast PLC Connection does not open a documentation file. No existing documentation will be available. However, you can enter new documentation or input documentation from an existing PLC program file.

To use the Fast PLC Connection:

1. Select the **File \ Fast PLC Connection** menu item or click the  toolbar button.
2. The system will attempt to connect to a PLC using the communication parameters set in **Fast PLC Setup**.


NOTE: The communication parameters for **Fast PLC Connect** are separate from those used by the **Open** operation. Changes to one will not affect the other.

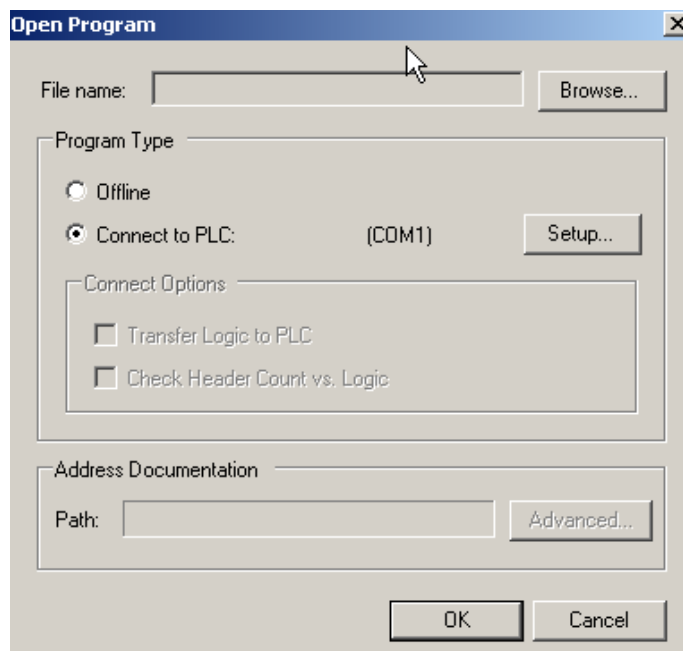
New Program

PLC programs can be created online or offline.

Creating a New Program Online

To start a new PLC program online:


1. Select the **File \ Open** menu item, click the  toolbar button, or press [Ctrl+O]. The **Open Program** dialog appears.

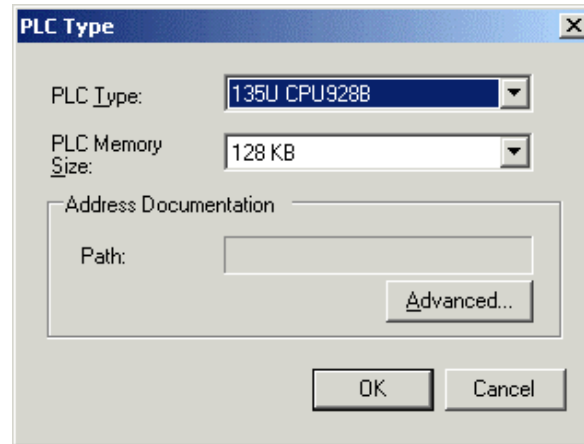


2. Select the **Connect to PLC** radio button.
3. Click the **Setup** button to configure communications between the PLC and PC.
4. Since this is a new program, there is no need to browse for the **File name**.
5. Click **OK**. PLC WorkShop connects to the PLC, displaying any logic already present.

Creating a New Program Offline

To create a new PLC program offline:


1. Select the **File \ New** menu item, click the  toolbar button, or press **[Ctrl+N]**. The **PLC Type** dialog appears.

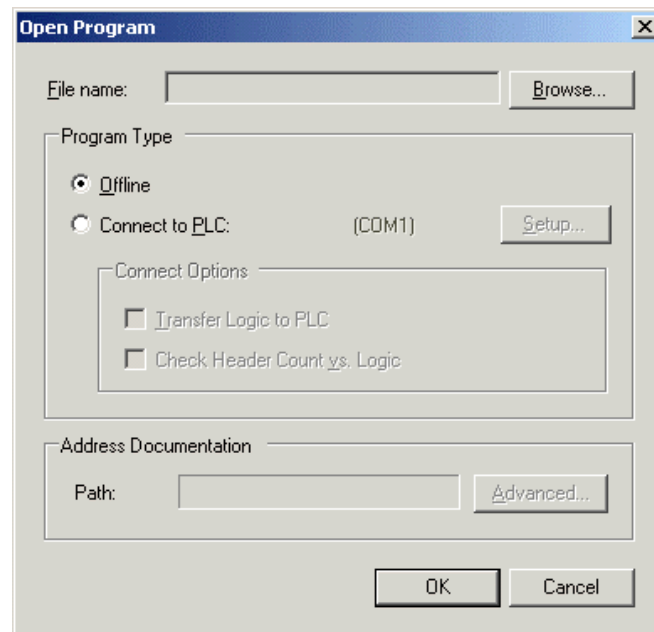


2. Select the **PLC Type** and **PLC Memory Size** corresponding to the PLC where the program will be used.
3. If the documentation is not to be shared with other applications or programs, click **OK**.
4. To share documentation with other applications or programs, click the **Advanced** button to bring up the **Shared Documentation Database** wizard.

Open Program

To open an existing program, either online or offline:

1. Select the **File \ Open** menu item, click the  toolbar button, or press **[Ctrl+O]**. The **Open Program** dialog appears.



2. Click the **Browse** button to select the PLC file to open. PLC WorkShop can open the following file types, but can only save PLC programs in .SF5 format.

▪ *.FS5	▪ WorkShop for Siemens S5 - Performance Series
▪ *.FTK	▪ 16 bit WorkShop for S5
▪ *.WGS	▪ GS Wings
▪ *.PGR	▪ FasTrak S5 for DOS
▪ *.S5D	▪ Step 5

3. Make the following choices and click **OK**.
- **Program Type:** Select **Offline** or **Connect to PLC**.
 - If you select **Offline**, the file selected above is required.
 - If you select **Connect to PLC**, PLC WorkShop will connect to a PLC using the communication option displayed. The documentation will be read from the file selected above, if any. Opening connected to the PLC without selecting a file is equivalent to using the Fast PLC Connection function, except that the Open communication settings are used rather than the Fast PLC Connection communication settings.
 - **Setup:** Click **Setup** to access the **Communications Setup** dialog. Note that the options set from here are separate from those used in the **Fast PLC Connection**.
 - **Connect Options - Transfer Logic to PLC:** Before opening the program online, WorkShop transfers the ladder logic and data to the PLC.
 - **Connect Options - Check Header Count vs Logic:** Before opening the program online, WorkShop counts the number of headers in the online program and compares that count to the number of headers in the offline program, in order to keep the network documentation on the correct networks.
 - **Address Documentation:** To share documentation with other applications or programs, click the **Advanced** button to bring up the **Shared Documentation Database** wizard.

Close Program

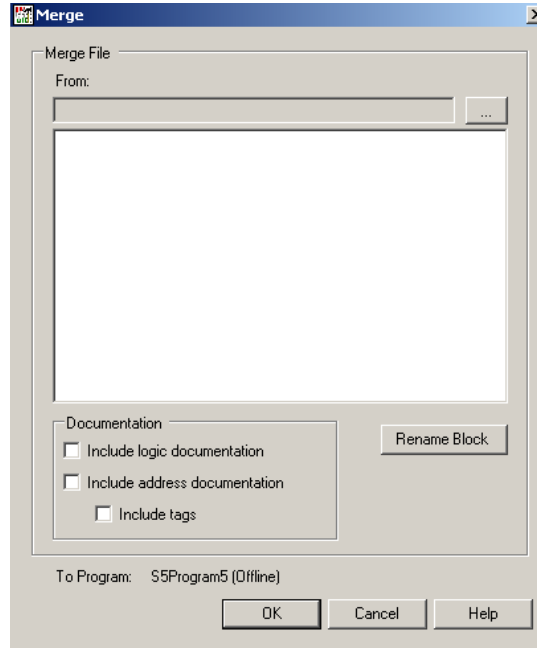
To close a PLC program, select the **File \ Close Program** menu item, and select the particular program to be closed.

- If there are changes that have not been entered, a warning dialog will appear, giving you the opportunity to cancel the close.
- If there are edits that have not been saved, a warning dialog will appear, giving you the options of closing and losing the changes, saving the changes, or canceling the close.

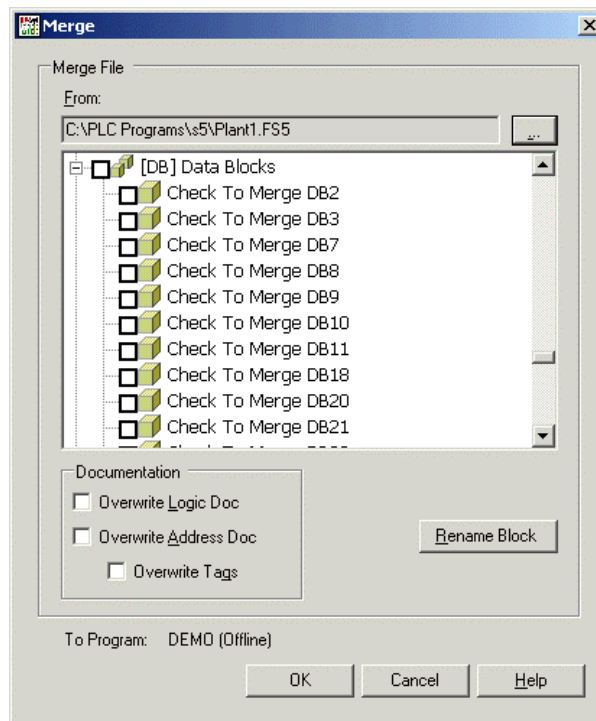
Merge

Use the **Merge** feature to bring blocks from one program into another.

1. With the program that you want the blocks added to (the target program) open and in the foreground, select the **File \ Merge** menu item. The **Merge** dialog appears.



2. Browse for the PLC program that contains the blocks you want. The blocks from that program will display.



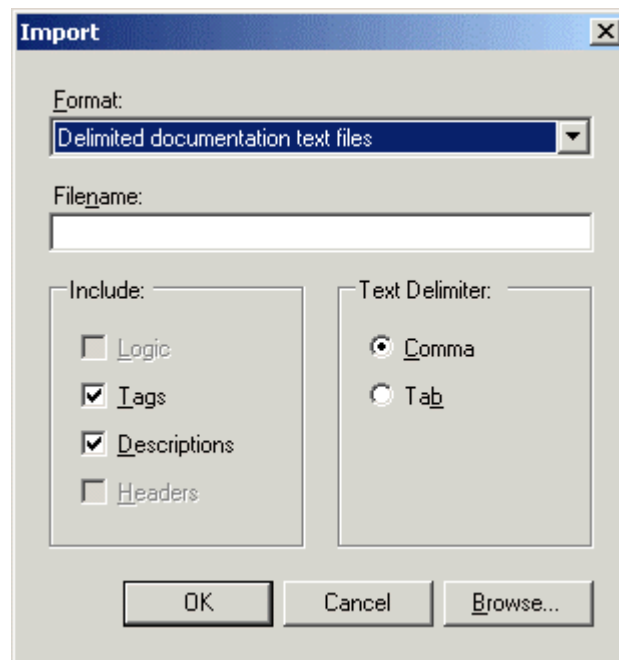
3. Check the box next to each desired block. If your target program already has a block by that name and that block should be kept, click **Rename Block** and enter a new block name.
4. Select **Documentation** options. These boxes control which documentation is kept when there is a conflict between the documentation in the blocks being merged and the target program. If a box is checked, documentation for that item will be imported with the blocks regardless of any existing documentation in the target program. If the box is not checked, any existing documentation in the target program will be preserved.
5. Click **OK**.

Import Documentation

The **Import Documentation** feature allows you to use documentation exported from other software or to edit documentation in either a text editor or a spreadsheet application such as Microsoft Excel.

To import documentation from a text file:

1. Select the **File \ Import** menu item. The **Import** dialog appears.



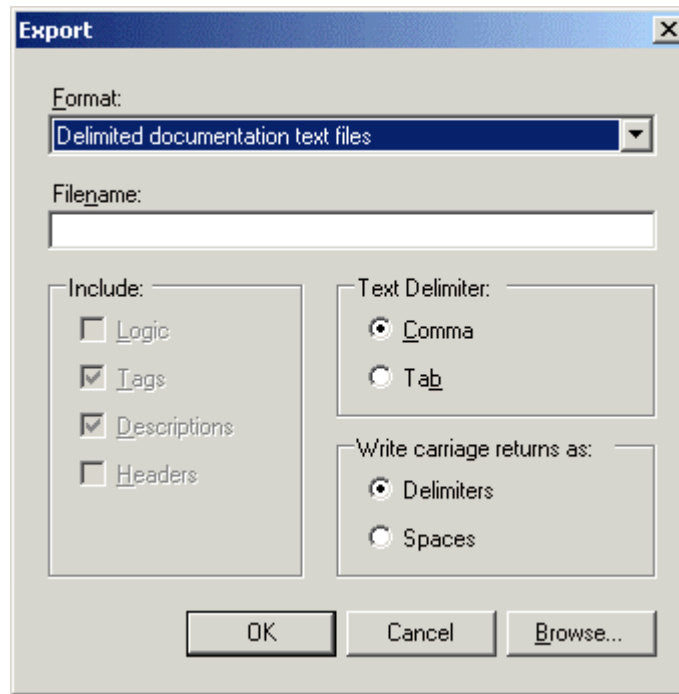
2. Browse for the file to import.
3. To skip fields, un-check their corresponding boxes in the **Include** area.
4. Select the delimiter used in the text file. By default, the text files that Microsoft Excel creates are tab delimited.
5. Click **OK**.

Export Documentation

The **Export Documentation** feature allows you to create a text file containing the PLC program documentation, either to be imported into another program, or to edit using a text editor or spreadsheet program such as Microsoft Excel.

To export the documentation to a text file:

1. With the PLC program from which the documentation will be exported open and in the foreground, select the **File \ Export** menu item. The **Export** dialog appears.



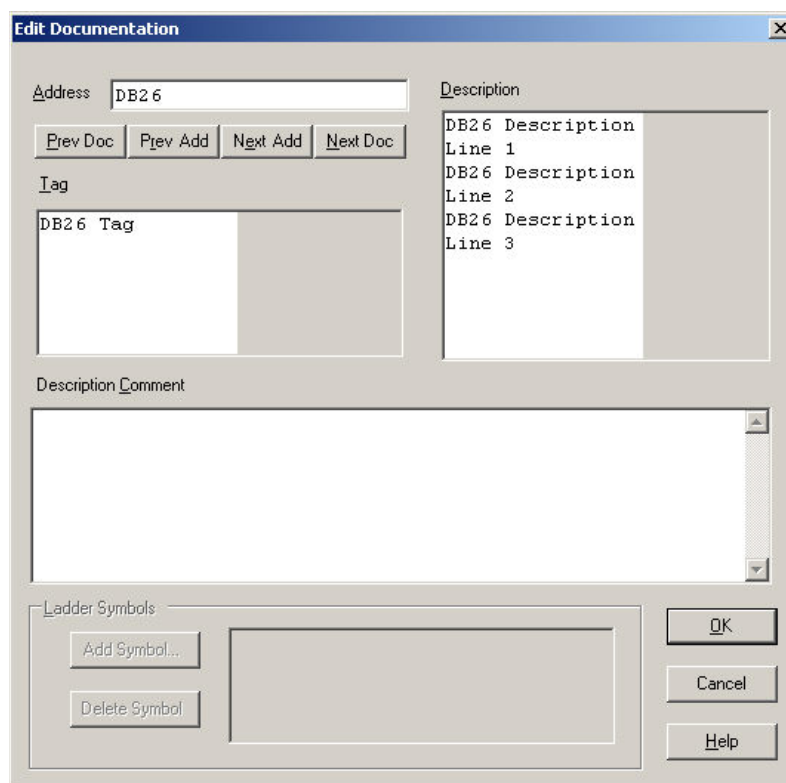
2. Select the format. There are two options:
 - **Delimited documentation text file:** Use this format to edit the documentation in a spreadsheet or text editor.
 - **STEP5 Logic and Documentation files:** Use this format to transfer the program to STEP5.
3. Set the **Text Delimiter** to determine how the fields will be separated in the text file. Microsoft Excel uses the tab delimiter by default, but can also use comma delimiter.
4. Each record in the documentation database is represented as a single line in the text file. Set the **Write carriage returns as:** to determine how to represent multi-line descriptions and description comments.
5. Browse to set the file name and location.
6. Click **OK**.

Text file format

The following is the text format that is used when documentation is exported to a text file, and expected when documentation is imported from a text file:

- Each record is stored in a line
- Fields are separated by commas
- Fields are:
 - Address
 - Tag
 - Description lines, each line is a comma-separated field

For example:



appears in the text file as

DB26,DB26 Tag,DB26 Description Line 1,DB26 Description Line 2,DB26 Description Line 3

Transfer to Online

The Transfer to Online feature is a convenient way to move from offline editing to online editing.

When you transfer to online, WorkShop writes the current PLC program to the PLC, and then opens it for online editing. The communication parameters are the ones set via the **Communications Setup** menu item, not the ones set via Fast PLC Setup.

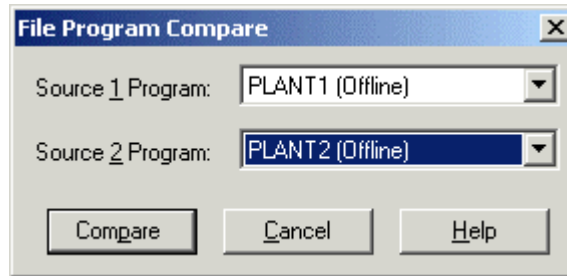
To Transfer to Online, select the **File \ Transfer -> Online** menu item or press **[Ctrl+T]**.

File Program Compare

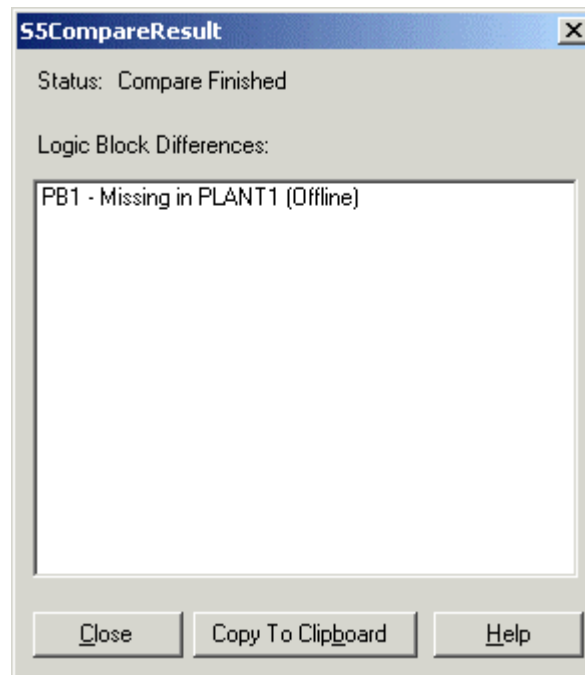
The File Program Compare provides a convenient way to compare two PLC programs.

To compare two PLC program files:

1. Open both files.
2. Select the **File \ File Program Compare** menu item



3. Select the files to compare. The drop-down lists show files currently open. Click **Compare**.



4. The window shows differences between the programs. You can copy the contents to the clipboard to be pasted into another application such as a text editor by clicking the **Copy to Clipboard** button.

Recent Files

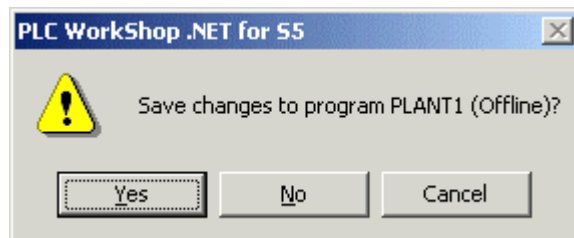
To re-open a recently used PLC program file, select the file name from the **File \ Recent Files** submenu.

The number of files in the recent files list is set in the **Application Setup** dialog.

Exit PLC WorkShop

To exit from PLC WorkShop, select the **File \ Exit** menu item or press **[Alt+F4]**.

A prompt will appear for each PLC program with unsaved edits.

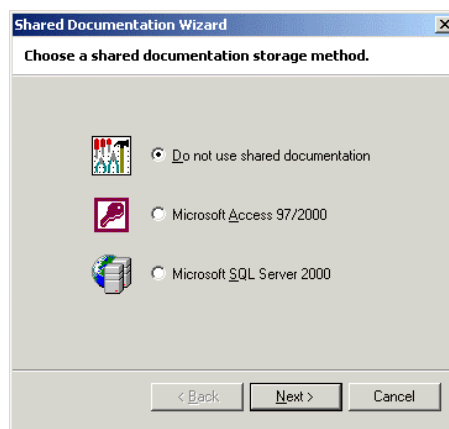


Shared Documentation Database

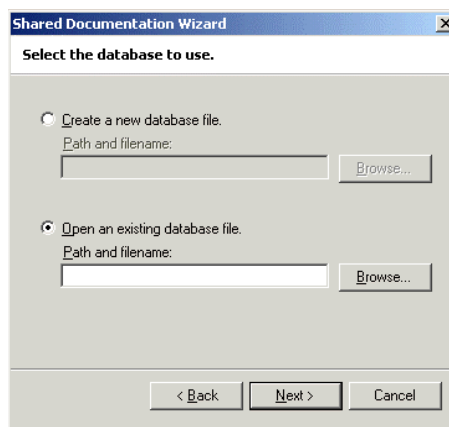
Address documentation can be shared between applications by using an external database.

To share the address documentation with other applications:

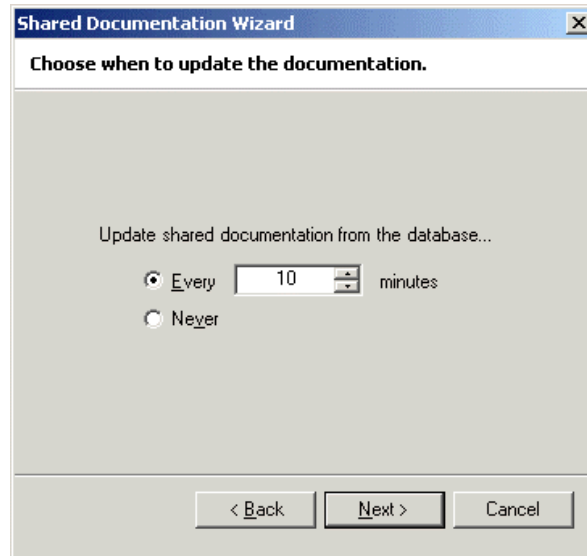
1. From either the **New Program** dialog or the **Open Program** dialog, click the **Advanced** button in the Address Documentation area to bring up the Shared Documentation Wizard.



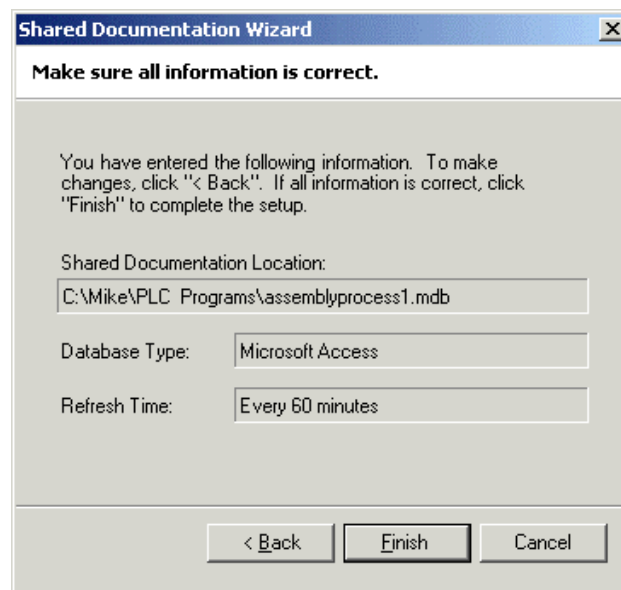
2. Select the type of database and click **Next**.



3. If there is already a shared documentation database, select the **Open an existing database file** radio button and browse for the database. To create a new shared database, select the **Create a new database file** radio button and browse to set the path and file name, and a new database will be created in the file format selected in the previous step. Click **Next**.




4. In this step, you determine how often the database will be checked for changes that have been made in other applications. If the database is shared on a network and others may be changing it while you are using WorkShop, you may wish to select a short interval. If you are sure no other users will update the documentation while you are using WorkShop, you may prefer a long interval. Set the interval in minutes, or select **Never**. Click **Next**.



5. Confirm that all the information is correct. Click **Finish**.

Save Program

Saving a current program under the same name:

1. Select the **File \ Save** menu item, click the  toolbar button, or press **[Ctrl+S]**.
 - If the program has a name it will be saved under that name, overwriting any previous version of the program. The old version will be saved as a backup under the name `x_BAK001.FS5`, where `x` is the name of the program. The old `x_BAK001.FS5` will be renamed to `x_BAK002.FS5`, and so on, up to the number of backups specified in **Application Setup**.
 - If the program file does not have a name (it is new or was opened online without opening an offline file) a standard **Save As** dialog will appear for you to select the file name and location.

Saving a current program under a new name:

1. Select the **File \ Save As** menu item. A standard **Save As** dialog will appear for you to select the file name and location.

NOTE: PLC WorkShop can open several file types, but can only save PLC programs in .FS5 format.

Printing Logic Programs

PLC WorkShop provides you with a number of print features that allow customization of your printouts. These include:

Specific Print Selections

- **Logic**
- **Documentation**
- **Cross Reference**
- **Tree Diagram**
- **Summary Page**

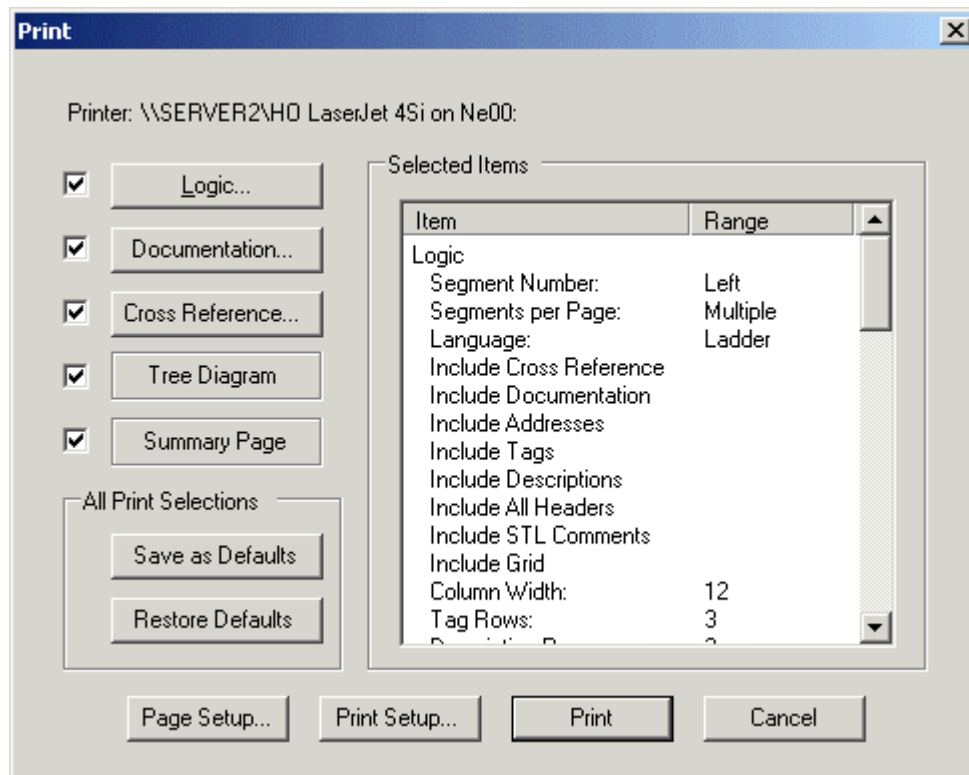
Customizable Options

- **Output to Text File**
- **Documentation Font**
- **Edit Title Page**

Print

To print information about your PLC program:

Select **File \ Print** from the menu, click the toolbar button, or press **[Ctrl+P]**.



For each category of reports to be printed, check the box. To configure a report, click that report's button.

To configure the page layout, click the **Page Setup** button.

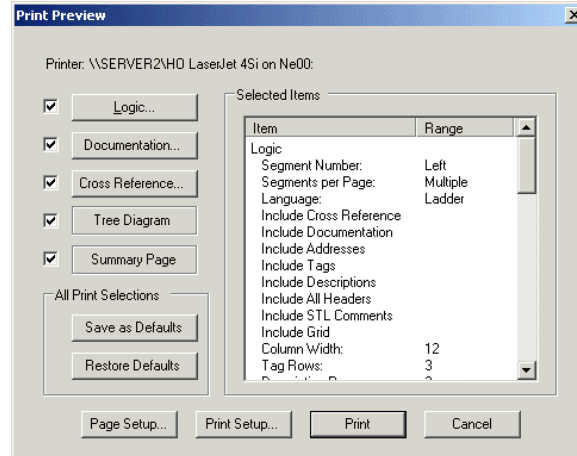
To access the printer options, click **Print Setup**. The dialog presented depends on your printer drivers.

To save the current settings, click the **Save as Defaults** button. To restore the saved settings, click the **Restore Defaults** button.

Print Preview

To see what reports of information about your PLC program will look like:

Select **File \ Print Preview** from the menu or click the toolbar button. The Print Preview button does not appear on the default configuration of the toolbar, but can be added.



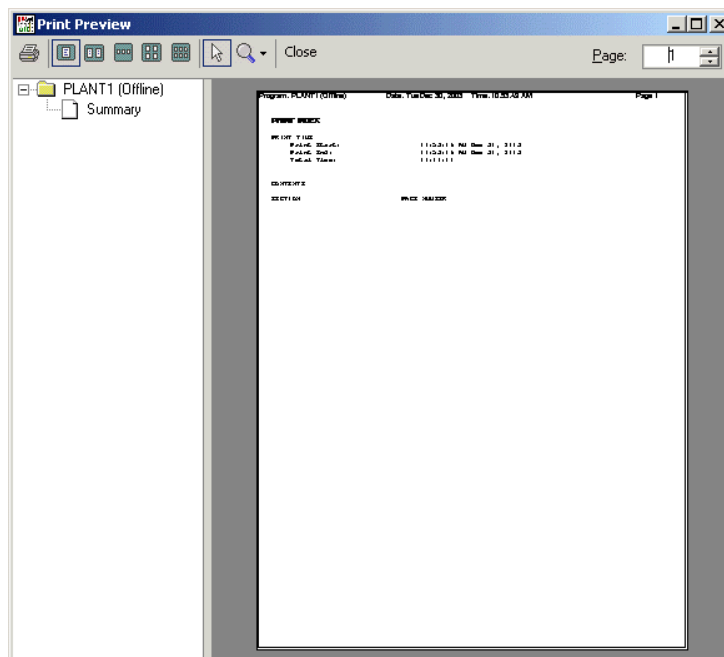
For each category of reports to be printed, check the box. To configure a report, click that report's button.

To configure the page layout, click the **Page Setup** button.

To access the printer options, click **Print Setup**. The dialog presented depends on your printer drivers.

To save the current settings, click the **Save as Defaults** button. To restore the saved settings, click the **Restore Defaults** button.

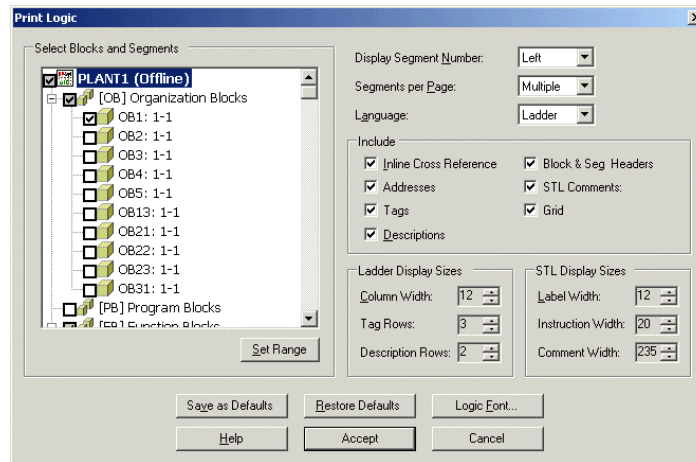
When you click **Print**, WorkShop displays a graphic representation of the report.



Print Logic

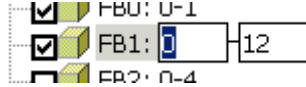
To print a report of the logic of the PLC program:

1. Bring up the **Print** dialog. The documentation report can also be previewed or printed to a text file.
2. Check the **Logic** box.
3. To set the configuration options, click the **Logic** button.



Select Blocks and Segments: Check the boxes for the blocks and segments to include in the report. To select a range of segments within a block:

1. Check the block and click the **Set Range** button.



2. Enter the range in the pair of text boxes that appears.

Display Segment Number: Select the position of the segment number on the report. Choices are Left, Right, or Disabled.

Segments per page: Select Single or Multiple.

Language: Select Ladder or STL.

Include: Check the boxes for the items to include in the logic report. The Inline Cross Reference, while convenient, can add a significant number of pages to the report, since the cross reference is repeated for each occurrence of the address. For a shorter report, consider printing the cross reference report separately.

Ladder Display Sizes, STL Display Sizes: Use these settings to control the size of rungs/STL lines in the report. These settings are currently not changeable.

Defaults: To save the current settings, click the **Save as Defaults** button. To restore the saved settings, click the **Restore Defaults** button.

Doc Font: To select the font, style, and size of text to appear in the report, click the **Doc Font** button.

4. When the options are set, click the **Accept** button.
5. Click **Print**.

Print Documentation

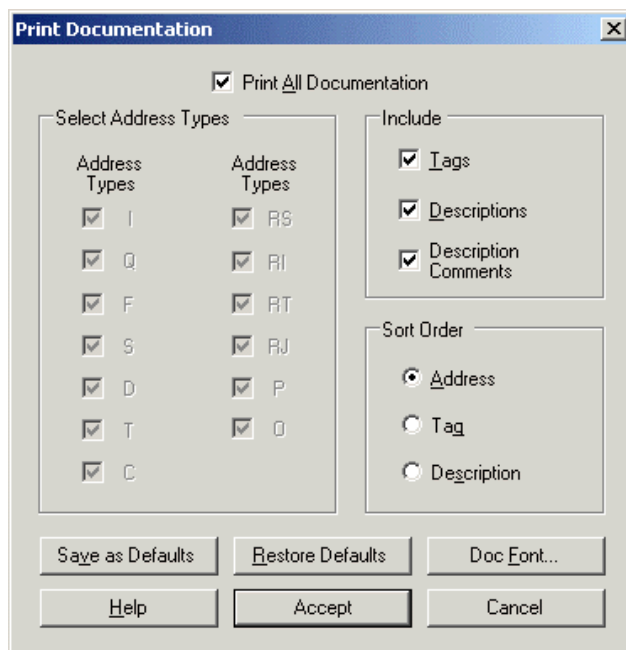
Documentation may also appear in other reports. These settings do not affect how documentation appears anywhere other than in this report.

This report shows the contents of the documentation database, and does not refer to the PLC program. As a result, documentation may be reported that refers to addresses that do not exist or that are not used.

To print a report of the contents of the documentation database:

1. Bring up the **Print** dialog. The documentation report can also be previewed or printed to a text file.
2. Check the **Documentation** box.

To set the configuration options, click the **Documentation** button.



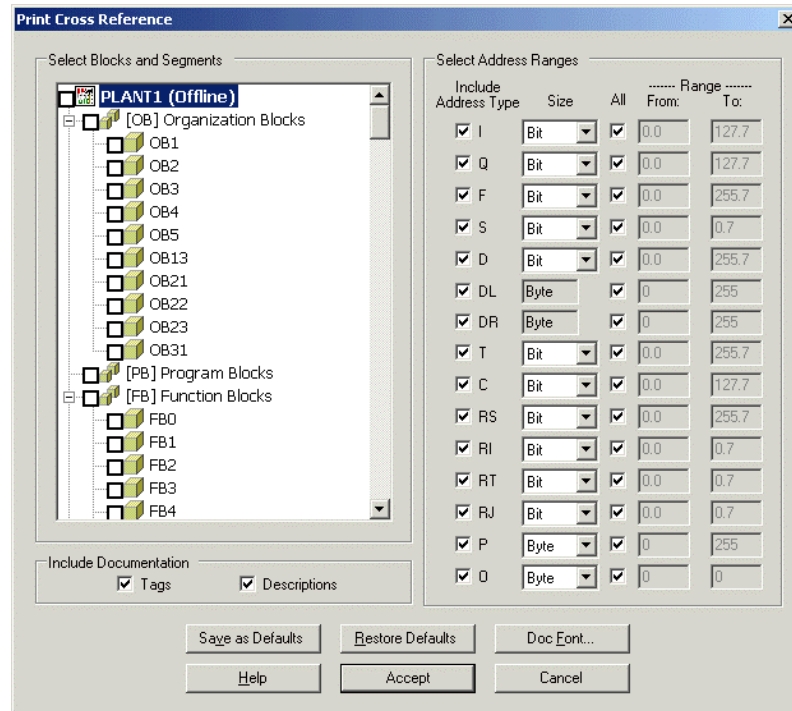
1. **Print All Documentation:** check this box to include the documentation for all addresses.
2. **Select Address Types:** Check the boxes for the address types to appear in the report.
3. **Include:** Check the boxes for the documentation elements (Tags, Descriptions, and Description Comments) to include in the report.
4. **Sort Order:** Select the order (Address, Tag, or Description) in which the addresses will appear in the report.
5. **Defaults:** To save the current settings, click the **Save as Defaults** button. To restore the saved settings, click the **Restore Defaults** button.
6. **Doc Font:** To select the font, style, and size of text to appear in the report, click the **Doc Font** button.
7. When the options are set, click the **Accept** button.
8. Click **Print**.

Print Cross Reference

Cross reference information may also appear on the logic report. The information here refers to the separate cross reference report only.

To print a cross reference report, showing where, and in what way, each address is used:

1. Bring up the **Print** dialog. The cross reference report can also be previewed or printed to a text file.
2. Check the **Cross Reference** box.
3. To set the configuration options, click the **Cross Reference** button.



Select Blocks and Segments: check the boxes for the parts of the program to be included in the cross reference report. Uses of an address outside the selected blocks and segments will not appear in the report. If no boxes are checked, the entire program will be included.

Select Address Ranges: Check the boxes for the address types to appear in the report. For address types that can be interpreted as either bits or words, select the **Size**. To include all the addresses of a type, leave the **All** box checked. To include only a selected range, clear the **All** box and enter the **From** and **To** addresses.

Defaults: To save the current settings, click the **Save as Defaults** button. To restore the saved settings, click the **Restore Defaults** button.

Doc Font: To select the font, style, and size of text to appear in the report, click the **Doc Font** button.

Include Documentation: To include address documentation in the report, check the **Tags** and/or **Descriptions** buttons.

4. When the options are set, click the **Accept** button.
5. Click **Print**.

Print Tree Diagram

To print the tree diagram for a PLC program:

1. Bring up the **Print** dialog. The Tree Diagram can also be previewed or printed to a text file.
2. Check the **Tree Diagram** box. There are no configuration options.
3. Click **Print**.

Print Summary Page

The summary page lists the reports printed in the batch, and records the time and date of the printing.

To include the summary page in a batch of reports:

1. Bring up the **Print** dialog. The Tree Diagram can also be previewed or printed to a text file.
2. Check the **Summary Page** box. There are no configuration options.
3. Click **Print**.

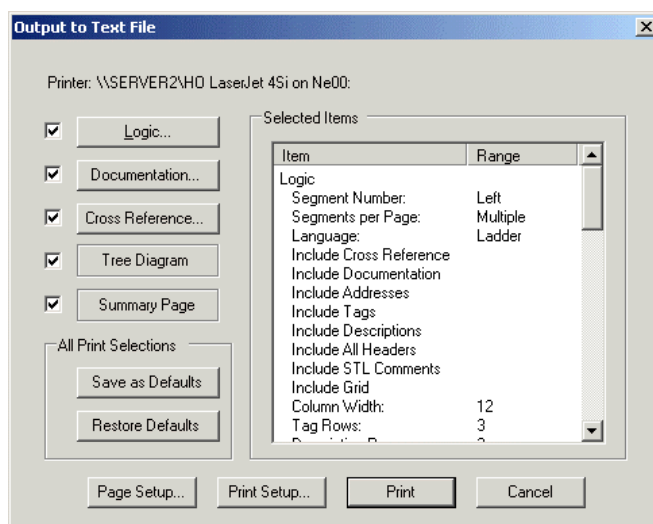
Output to Text File

The **Output to Text File** feature generates a text version of the same type of reports that the Print feature generates.

The resulting files can be sent to a printer in text mode (many printers are much faster in text mode, some older printers only operate in text mode) or edited with a text editor. The text file can provide a convenient way to send an excerpt of your ladder logic to a colleague.

To print information about your PLC program to a text file:

Select the **File \ Output to Text File** menu item. The Output to Text File feature is almost identical to the Print feature, except for the Print Configuration options.



For each category of reports to be printed, check the box. To configure a report, click that report's button.

To configure the page layout, click the **Page Setup** button.

To access the printer options, click **Print Setup**. The dialog presented depends on your printer drivers.

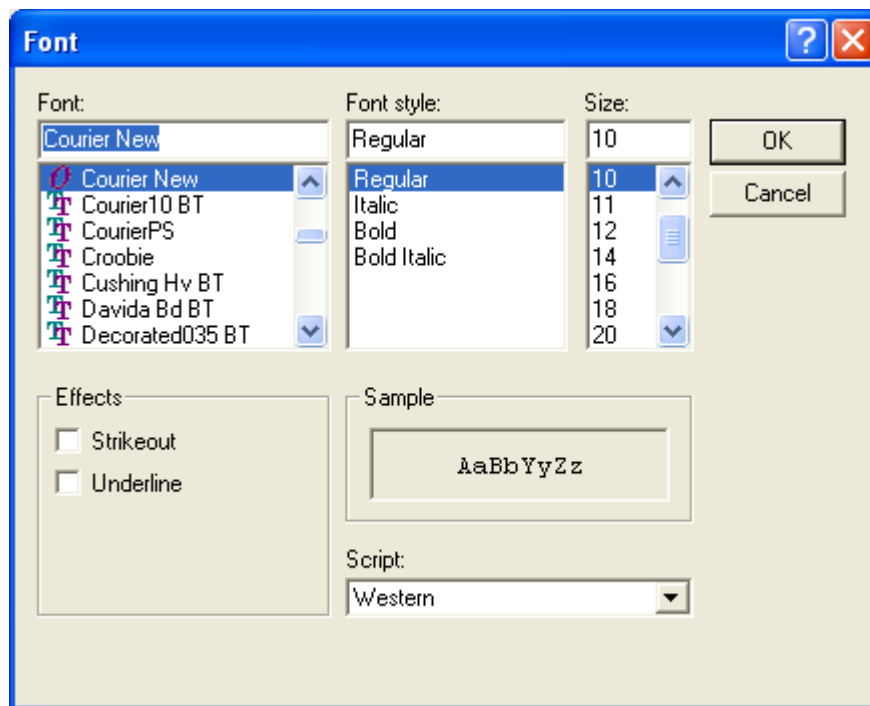
To save the current settings, click the **Save as Defaults** button. To restore the saved settings, click the **Restore Defaults** button.

Configuring Documentation Font

Font, font style, and font size for documentation (tags, descriptions, and comments) can be customized.

To change the documentation font:

1. Access the appropriate Print dialog by selecting either **Print** or **Print Preview** from the **File** menu or by pressing [Ctrl+P].
2. Click the **Logic**, **Documentation**, or **Cross Reference** button to access the applicable dialog.
3. Click the **Font** button. The **Font** dialog appears.



4. Configure font options.

NOTE: The print selection options are stored when saving a program.

Editing Logic Programs

PLC WorkShop uses a number of timesaving editing features to help you complete your programming tasks.

Cut & Copy

To cut, select the **Edit \ Cut** menu item, click the toolbar button, or press **[Ctrl+X]**.

To copy, select the **Edit \ Copy** menu item, click the toolbar button, or press **[Ctrl+C]**.

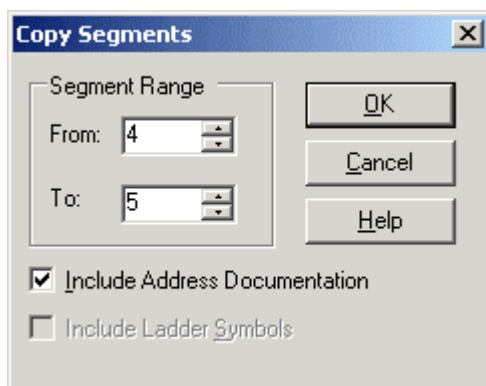
To paste, select the **Edit \ Paste** menu item, click the toolbar button, or press **[Ctrl+V]**.

You can cut, copy and paste either complete segments, or partial segments.

If a selection within a segment is active when you cut or copy, the selected logic is cut or copied to the buffer. This is a partial segment selection, even if the selection happens to include all the logic in the segment. In the case of a cut, the segment is placed in edit mode and turns yellow.

Paste with Rewire is not available for partial segment selections. Select complete segments by dragging the mouse in the space to the left of the logic, or by dragging the mouse from one segment to another.

If no logic is selected, or if complete segments are selected, a dialog appears.



Set the **Segment Range** to be cut or copied.

Check the **Include Address Documentation** box to copy documentation along with the logic.

Paste, Paste Special, Paste with Rewire

To Paste, select the **Edit \ Paste** menu item, click the toolbar button, or press **[Ctrl+V]**.

To Paste Special, select the **Edit \ Paste Special** menu item.

To Paste with Rewire, select the **Edit \ Paste with Rewire** menu item.

Paste

When you paste a partial segment, the logic in the clipboard replaces the logic under the insertion point, and to the right.

When you paste complete segments, the segments on the clipboard are inserted above the segment where the insertion point is located.

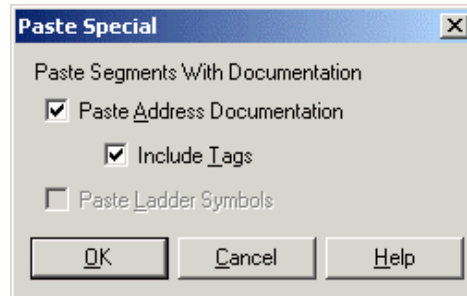
Paste Special

When you paste special, you have the option of pasting the documentation along with the logic.

The Paste Special option is not available when the address documentation is not included with the logic on the clipboard. See **Cut & Copy** for details.

To Paste Special:

Select the **Edit \ Paste Special** menu item.



Check the boxes for the documentation to paste with the logic. A tag that already exists in the target program (the program where the logic is being pasted) will not be included even if the box is checked.

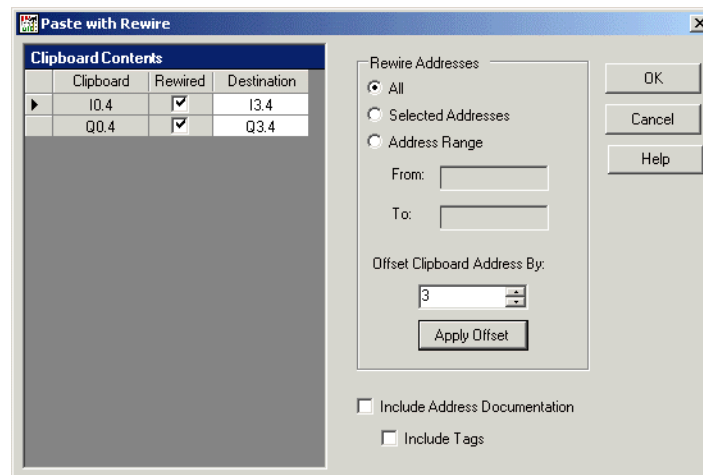
Paste with Rewire

The Paste with Rewire feature allows you to replace addresses in the logic on the clipboard.

Paste with Rewire is only available when complete segments are on the clipboard. Partial segment selections cannot be rewired, even if the selection happens to include all the logic from the segment. See **Cut & Copy** for details.

To Paste with Rewire:

Select the **Edit \ Paste with Rewire** menu item.



- Clipboard Contents
 - Clipboard: This column shows the addresses as they appear in the logic on the clipboard.
 - Rewired: This column indicates whether the address will be replaced.
 - Destination: This column contains the replacement address.
- Rewire Addresses:

- Select the addresses to be rewired.
- To change all the selected addresses by the same offset, enter the offset in the **Offset Clipboard Addresses By** field and click **Apply Offset**.
- Include Address Documentation / Include Tags: Check the desired boxes to copy the address documentation to the new addresses.

Modify Address Documentation

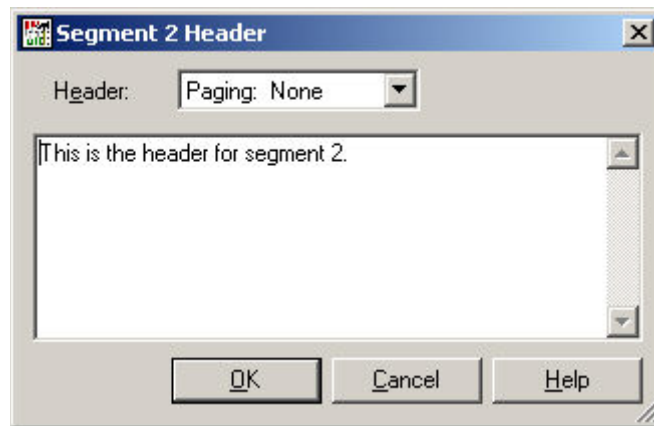
To modify the documentation for the current address, select the **Edit \ Modify Address Documentation** menu item or press [Ctrl+L]. WorkShop displays the **Edit Documentation** dialog with the current address loaded.

New Address Documentation

To create new documentation, select the **Edit \ New Address Documentation** menu item. WorkShop displays the **Edit Documentation** dialog.

Header Input Dialog

Use the Header Input Dialog to document segments and blocks.



- **Paging** - This feature is not currently available.
- **Header** - Enter up to 16k of text.

To access the Header Input Dialog:

Either

Click the segment header or block header icon,



Or, if there is already header text present, double-click on the text.

Clear

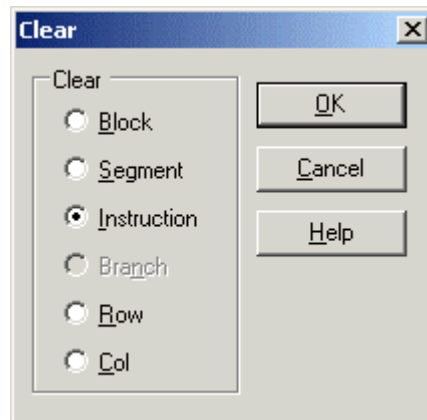
Clearing removes content without moving the surrounding content, leaving a blank area. Deleting removes both the content and the space it occupied, and moves other content.

To clear logic or data, select the **Edit \ Clear** menu item or press the **Del** key. Pressing the **Del** key clears the default item: an instruction in ladder logic, a line in STL or data.

Selecting the **Edit \ Clear** menu item displays a dialog appropriate to the context.

Clearing Ladder Logic

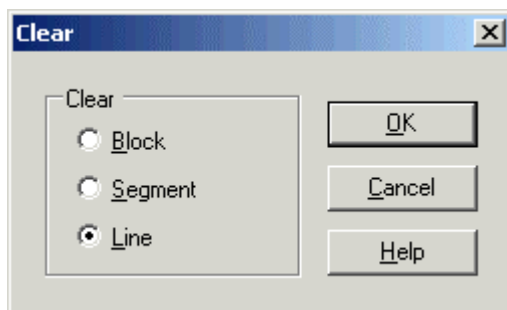
When clearing ladder logic, the following dialog appears:



- **Block** - Clears the entire containing block. WorkShop displays a warning before deleting the block. The result is an empty block.
- **Segment** - Clears the entire segment/network. The result is a blank segment in edit mode.
- **Instruction** - Clears the instruction at the cursor location. If the cursor is on a branch, the instruction to the left is cleared. The segment is placed in edit mode.
- **Branch** - Clears the branch at the cursor location. This selection is available only when the cursor is on a vertical branch. The segment is placed in edit mode.
- **Row** - Clears all the instructions and branches at the same height as the cursor. A branch is considered to be on the row at the top of the branch. The segment is placed in edit mode.
- **Col** - Clears all the instructions and branches in the segment that are in the same column as the cursor. A branch is considered to be on the column to the left of the branch. The segment is placed in edit mode.

Clearing STL

When clearing STL, whether in a block being viewed as STL or in a block being viewed as ladder, the following dialog appears.



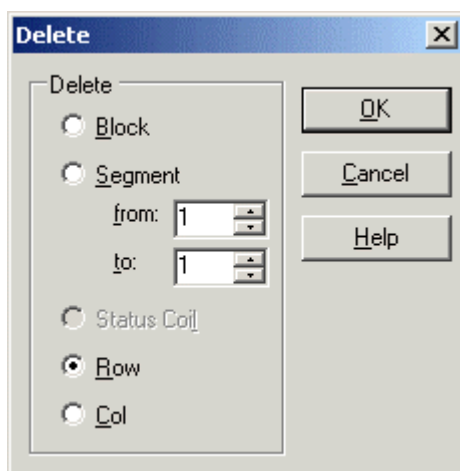
- **Block** - Clears the entire containing block. WorkShop displays a warning before deleting the block. The result is an empty block.
- **Segment** - Clears the entire segment. The result is a blank segment in edit mode.
- **Line** - Clears the line at the cursor location.

Delete

Deleting removes both the content and the space it occupied, and moves other content.

To delete logic or data, select the **Edit \ Delete** menu item, click the toolbar button (the delete button does not appear on the default toolbars, but it can be added) or press **[Shift+Del]**.

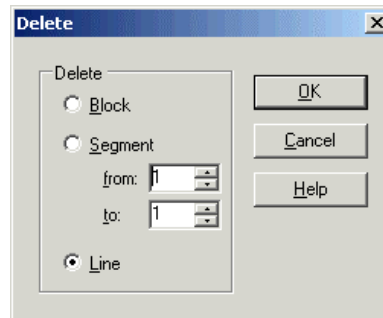
Depending on the context, a dialog may appear for you to select what is to be deleted.



Delete STL

Deleting removes both the content and the space it occupied, and moves other content.

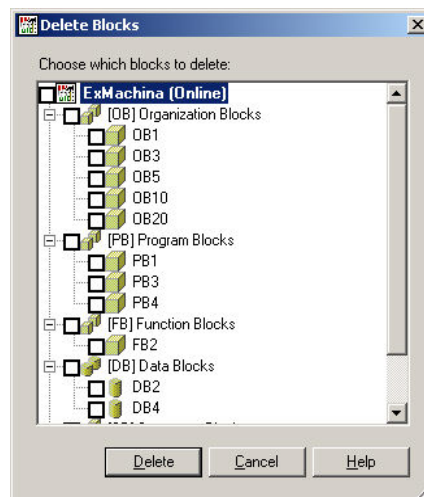
To delete STL code, select the **Edit \ Delete** menu item, click the toolbar button (the delete button does not appear on the default toolbars, but it can be added) or press **[Shift+Del]**. Depending on the context, a dialog may appear for you to select what is to be deleted.



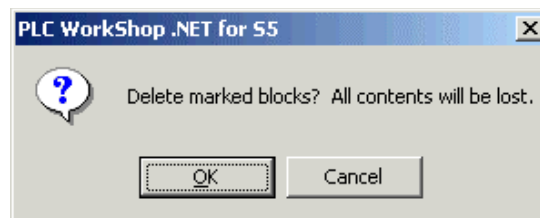
Delete Blocks

To delete blocks:

1. Select the **Block \ Delete Blocks** menu item or click the toolbar icon.



2. Select the blocks to delete by checking the boxes.
3. Click the **Delete** button.



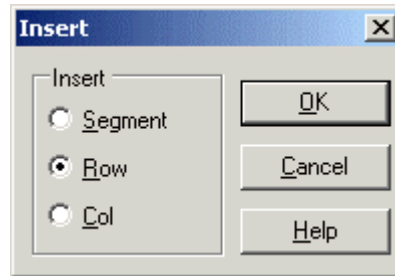
4. Click the **OK** button if you are certain about the deletion.

Insert

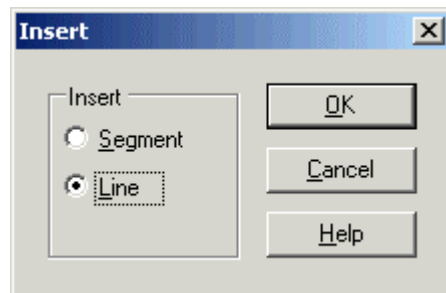
Inserting moves logic or data to make space for new logic or data. The new space is above or to the left of the insertion point.

To insert logic or data, select the **File \ Insert** menu item or press the [F3] key. Depending on the context, a dialog may appear for you to select what is to be inserted.

Insert Ladder

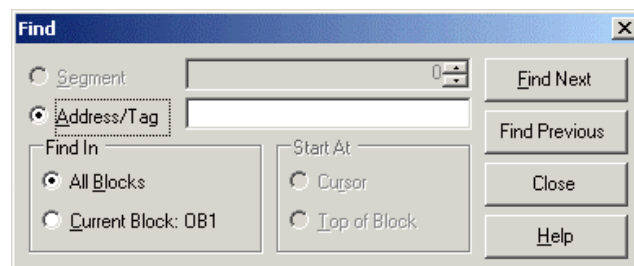


Insert STL



Find

To find an address or tag, or to go to a particular segment, select the **Edit \ Find** menu item or press [Ctrl+F]. WorkShop displays the **Find** dialog.



To find an address or tag:

1. Select the **Address/Tag** radio button.
2. Enter the address or tag in the text field.
3. Select the appropriate option button to search all the blocks or only the current block.
4. If you are searching only the current block, select whether the search will start at the top of the block or at the cursor.
5. Click **Find Next** and/or **Find Previous** until you locate the desired instance.
6. Click **Close**.

To go to a segment in the current block:

1. Select the **Current Block** radio button.
2. Select the **Segment** radio button.
3. Enter the segment number in the text field.
4. Click **Find Next**.

Find Next/Previous

To repeat the last search, select the **Edit \ Find Next** (or [Ctrl+G]) or **Edit \ Find Previous** menu item depending on the desired search direction.

Select All

To select the entire contents of a block, select the **Edit \ Select All** menu item or press [Ctrl+A].

Undo Redo

To undo an edit, select the **Edit \ Undo** menu item, click the toolbar button, or press [Ctrl+Z].

Repeating the Undo command reverses more edits.

To reverse an Undo command, select the **Edit \ Redo** menu item, click the toolbar button, or press [Ctrl+Y].

4 - PLC WorkShop Setup

This section covers the most common setup features within PLC WorkShop. PLC WorkShop has been designed to be completely customizable to fit any work environment or programming scenario. Familiarity with the features below greatly increases the flexibility and value inherent in PLC WorkShop.

Program Setup	Customize the way PLC WorkShop handles a PLC program
Application Setup	Customize several features of PLC WorkShop that apply regardless of the PLC program
Communications Setup	Tell PLC WorkShop how the computer is connected to the PLC
Printer Setup	Select and configure the printer
Page Setup	Configure the layout of each page of a report
Fast PLC Setup	Set up communication parameters for the Fast PLC Connection function

Program Setup

The **Program Setup** dialog allows you to configure many features of the WorkShop display.

The dialog is divided into tabs:

- **Logic** - Configuration options for the display of logic and data blocks.
- **Data** - Configuration options for the **Data Window**. These options do not affect the display of data within logic or data blocks.
- **Documentation** - Configuration options for the **Documentation Window**.
- **Update Times** - Configure how often data is updated for the Data Window and for **Logic Status**.
- **Colors** - Configure the colors for many parts of the display.

The **Save Defaults** button allows you to save your usual configuration. Then, if you change some options for a special situation, you can use the **Use Defaults** button to restore the defaults you saved. The defaults apply to the entire dialog, not just the tab being displayed.

To access the **Program Setup** dialog:

Select the **Options \ Program Setup** menu item.

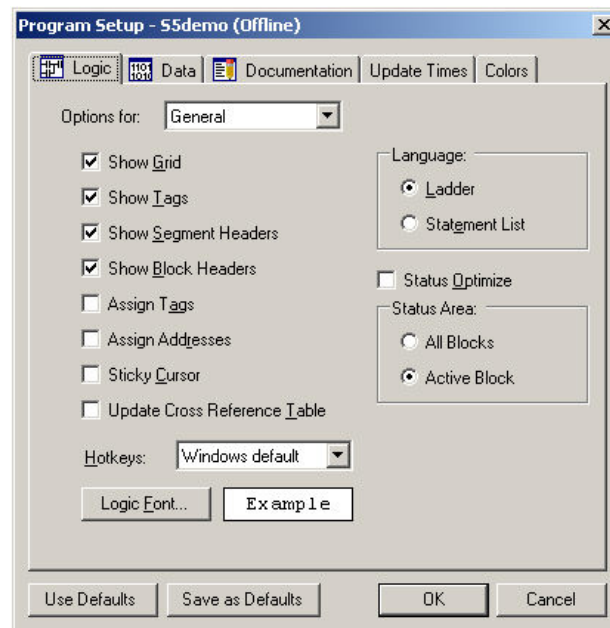
Logic

This tab provides configuration options for the logic and data block editors.

There are three sets of options, selected by the **Options for:** drop-down list:



- **General** - configure the logic and data block editors in general
- **Ladder** - configure the ladder options
- **Statement List** - configure the STL options

General Options




- **Show Grid** - See illustration below.
- **Show Tags** - See illustration below.
- **Show Segment Headers** - See illustration below.
- **Show Block Headers** - See illustration below.
- **Assign Tags** - When this box is checked, if the user enters an address in ladder logic, and that address does not already have a tag, the **Assign Tag** dialog is displayed for the user to enter a tag and any other address documentation.
- **Assign Addresses** - When this box is checked, if the user enters a tag in ladder logic, and that tag does not already assigned to an address, the **Assign Address** dialog is displayed for the user to enter the address.
- **Sticky Cursor** - When this box is not checked, the instruction-dropping cursors that are activated by clicking instructions in the **Toolbox** drop an instruction once and then the cursor reverts to a normal selection cursor. When this box is checked, the instruction-dropping cursors are "sticky" - they continue dropping the instruction until another cursor is selected.
- **Update Cross Reference Table** - If this box is checked, when logic is entered the cross reference table is immediately updated.
- **Language Ladder, Statement List** - To display logic as ladder when possible (not all logic can be displayed as ladder) select the **Ladder** radio button. To display logic as STL, select the **Statement List** radio button.
- **Status Optimize** - Check this box to optimize the **Logic Status** display.
- **Status Area: All Blocks, Active Block** - To monitor the logic status for the entire program, select the **All Blocks** radio button. To monitor the logic status for only the active block, select the **Active Block** radio button.
- **Logic Font** - Select the font used in the logic and data block display.

THIS IS AN EXAMPLE OF A BLOCK HEADER. IT IS SPECIFIC TO EACH BLOCK AND CAN BE UP TO 16K CHARACTERS. THE SAME HEADER IS SEEN BOTH IN THE LADDER MODE AND THE STATEMENT LIST MODE.

Block OB1 Segment 1



This is the header for segment one of OB1. It can be up 16k characters. This Segment header window can be turned on or off in the Program Setup accessed through Utilities. A header can be attached to each segment. The header will be displayed for every segment.

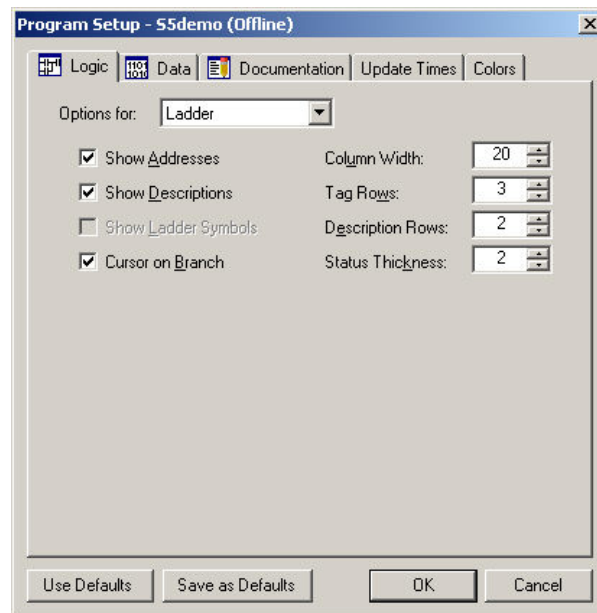
This is a Symbol. F28.0	This is a Description. Symbols can be up to 30 char F28.1	Grid	
Column width			

Block OB1 Segment 2


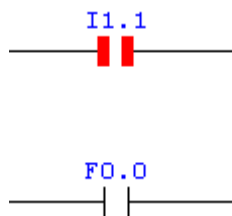
This is the header for segment 2.

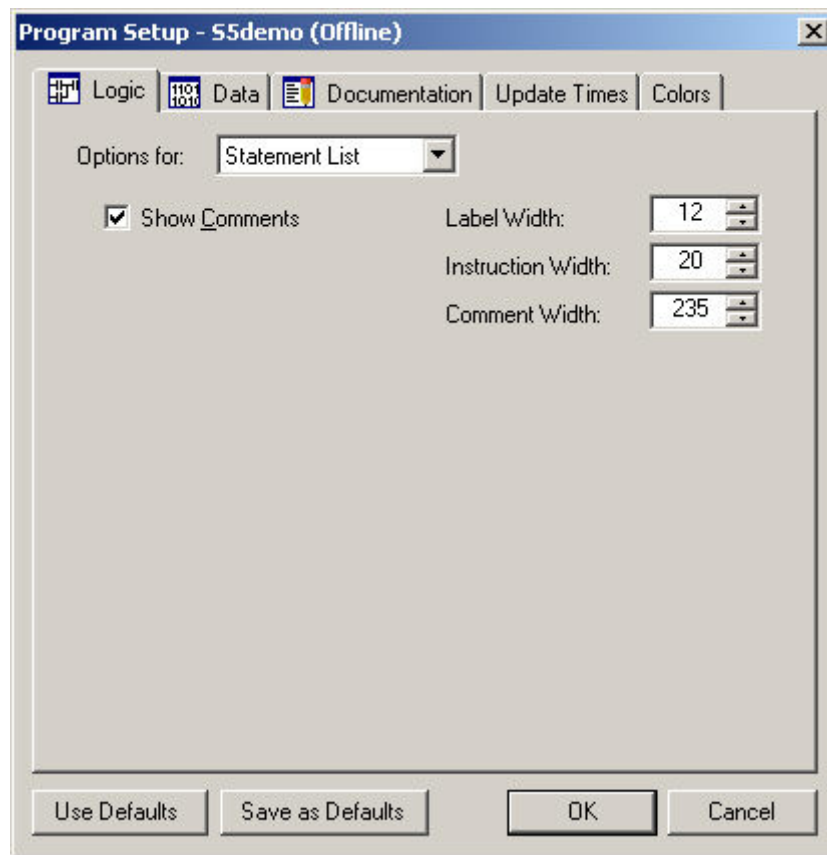
	TIMER	WORD
--	-------	------

Ladder options

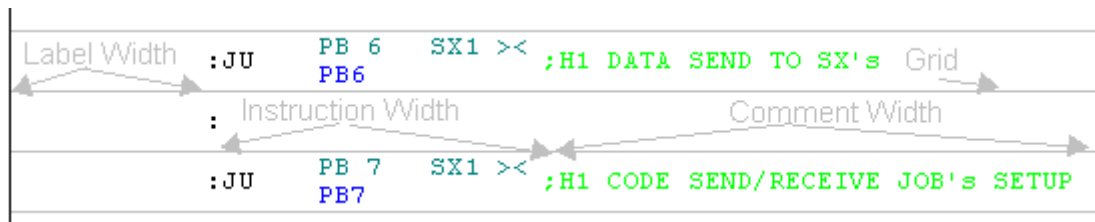


- **Show Addresses** - See illustration on the previous page.
- **Show Descriptions** - See illustration on the previous page.
- **Show Ladder Symbols** - Show alternate ladder symbols from the **Symbol Library**. This feature is not currently available.
- **Cursor on Branch** - Branches in ladder logic are shown on the border between cells. When this box is checked, the cursor can be located on a branch. When it is not, the cursor can only be located inside a cell.
- **Column Width** - Set the width, in character, of columns in the ladder display. Narrower columns allow more logic to be displayed without horizontal scrolling, but may result in tags and descriptions not being displayed completely.
- **Tag Rows** - Set the number of rows to be reserved for tags. If there are not enough rows to display a tag, part of the tag will be displayed. The space is reserved in every place where there could be a tag, whether there is a tag or not.
- **Description Rows** - Set the number of rows to be reserved for descriptions. If there are not enough rows to display a description, part of the description will be displayed. The space is reserved in every place where there could be a description, whether there is a description or not.
- **Status Thickness** - Specify the width of the highlight for logic status, in pixels. In the illustration below, the width is 5. If the width is 1, the highlighted logic is the same width as the normal logic, but colored red.



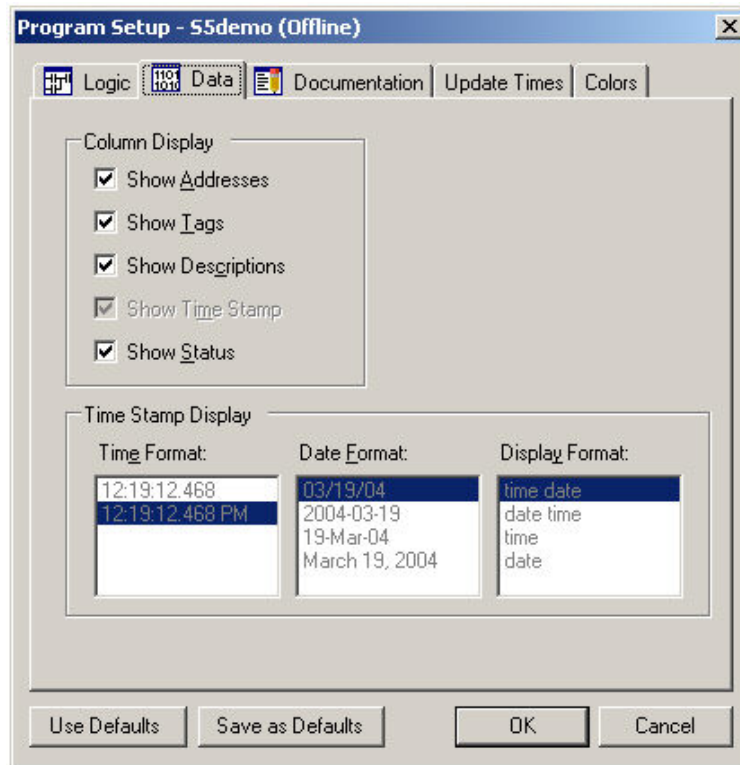
Statement List

- **Show Comments** - Check this box to show address comments on the STL.
- **Label Width** - See illustration below. Enter the width in characters.
- **Instruction Width** - See illustration below. Enter the width in characters.
- **Comment Width** - See illustration below. Enter the width in characters.



Data

This tab provides configuration options for the **Data Window**. The options here do not affect the display of data in the logic and data block displays.

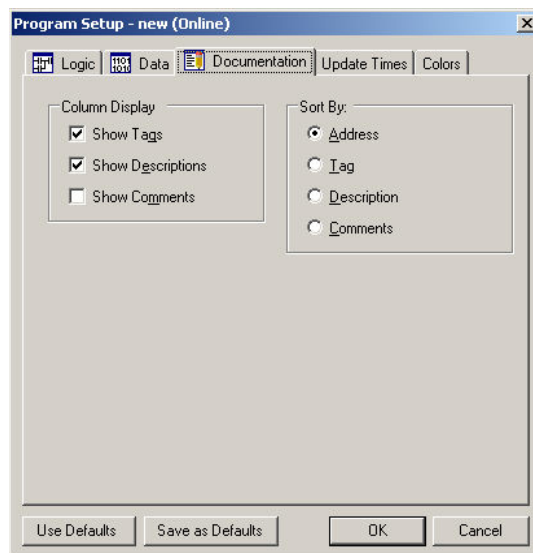


- **Show Address** - Check this box to display the address column.
- **Show Tags** - Check this box to display the tag column.
- **Show Time Stamp** - Display the time stamp, indicating when the data shown was read. This option is not currently available - the time stamp is mandatory.
- **Show Status** - Check this box to display the status column, indicating whether the data has been successfully read.
- **Time Format** - Select the time format for the **Timestamp** column.
- **Date Format** - Select the date format for the **Timestamp** column.
- **Display Format** - Select the combination of time and date information to include in the **Timestamp** column.

new (Online) - Data 1						
	Address	Tag	Description	Value	Timestamp	Status
1	F10.1			ON D	11:19:48.277 AM	Success
2	DB2:DW2	Example Ta	Example Description	4F42 H	11:19:48.277 AM	Success
3	T2	Example Tag		000 OFF	11:19:48.277 AM	Success
4	F0.0			OFF D	11:19:48.277 AM	Success
5						
6						

Documentation

This tab provides configuration options for the **Documentation Window**. The options here do not affect the display of documentation in the logic and data block displays.



Column Display

These check boxed control which columns will be displayed

- **Show Tags**
- **Show Descriptions**
- **Show Comments**

Sort By

These radio buttons control how the documentation list is sorted. In each case, the sort is in ascending order. It is possible, but likely to be confusing, to sort by a field that is not displayed.

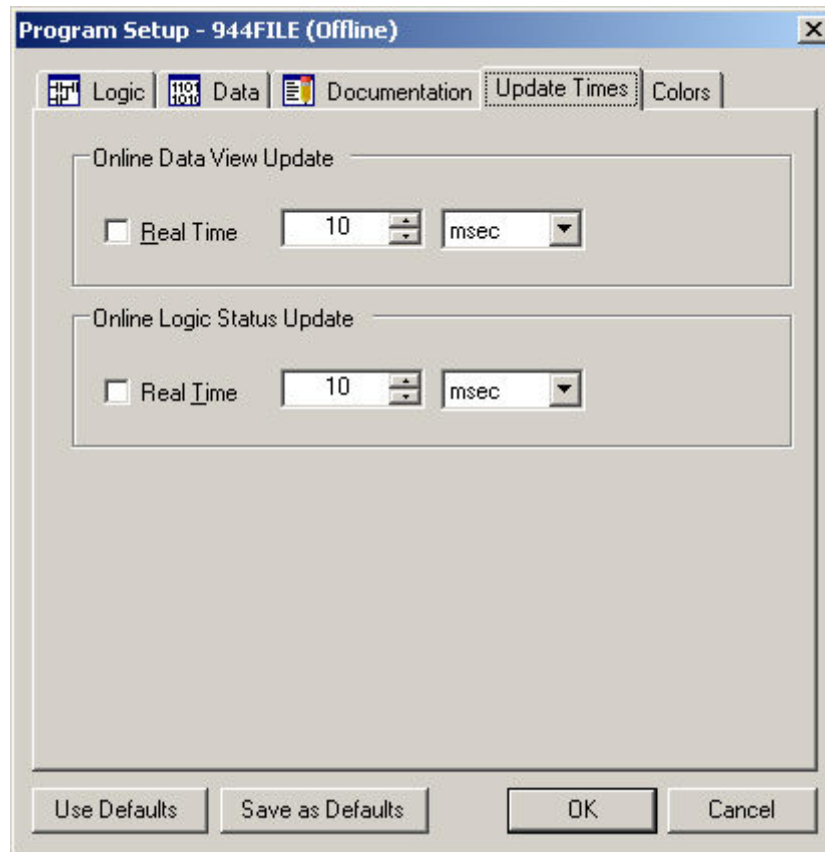
You can also control the sort order by clicking on the column headers. Clicking on the column headers allows you to sort in ascending or descending order.

- **Address** - Select this radio button to sort by address. This sort is logical, not alphabetic. In other words, DB1 is followed by DB2, not DB10.
- **Tag** - Select this radio button to sort alphabetically by tag. This is an alphabetic sort, so X1 is followed by X10, not X2.
- **Description** - Select this radio button to sort alphabetically by description.
- **Comments** - Select this radio button to sort alphabetically by description comment.

944FILE (Offline) - Documentation				
	Address	Tag	Description	Comment
8	DB8	FwdMtrstrCon	TensionSt Up PBOS2 Shear Up SOL Shear Up	
9	DB9	FwdPBOS1PO	PBOS2 Shear Cut PBOS2 ScrCh	
10	DB10	FwdPBOS2POE	Front Jog PBOS4 System Air	
11	DB11	FwdPBOS6	Pressure Pr/s	
12	DB12	FwdPBOS7	Overarm	
13	DB13	FwdPBOS7Con	Up	
14	DB14	FwdPBOS7Line	PBOS2 Recoil Overarm Up PBOS3 Exit Coil Ca	

Update Times

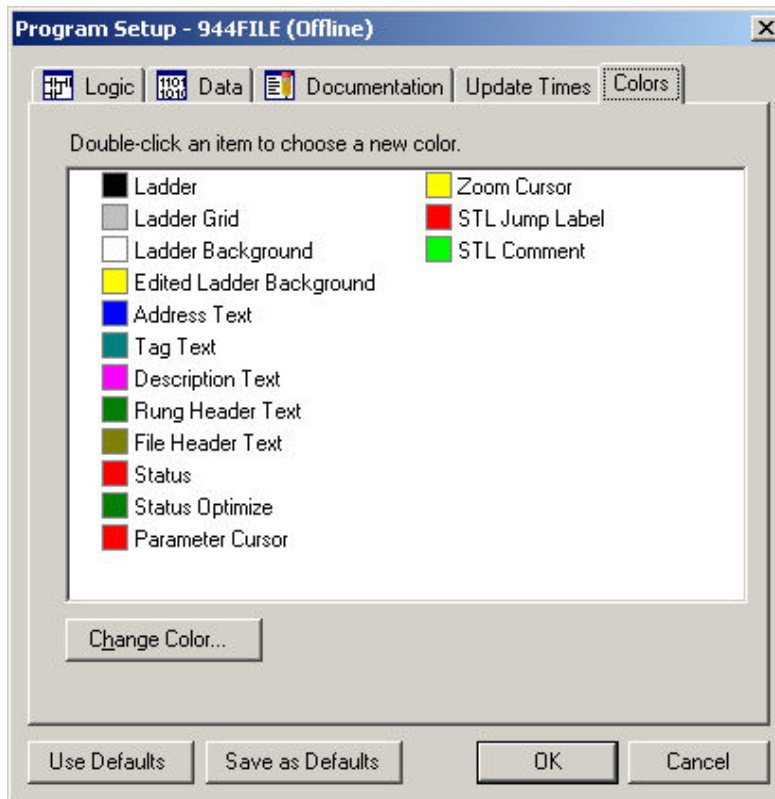
This tab controls how often data will be read for display purposes.



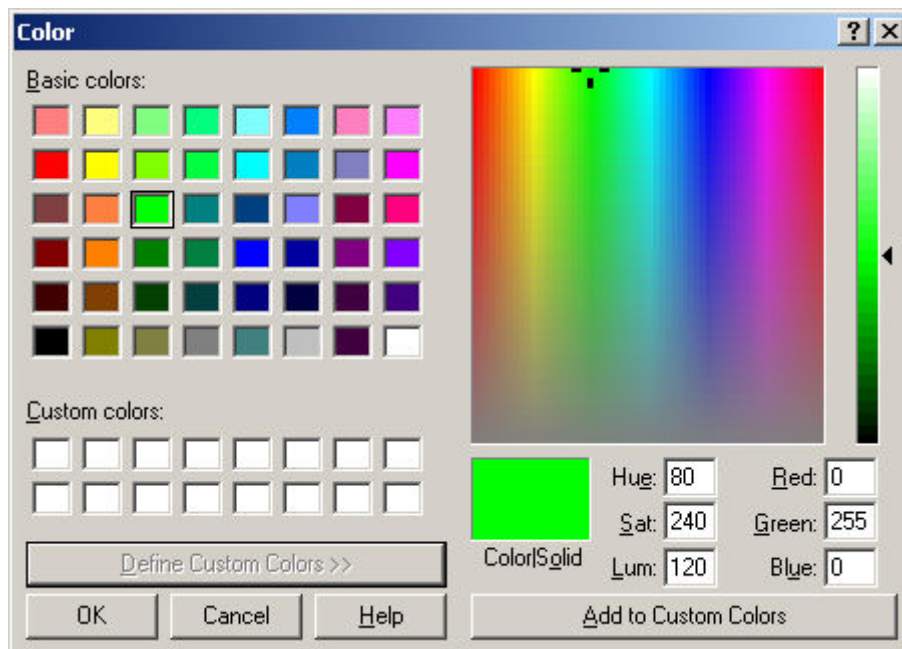
Real Time means that the data will be read as fast as possible. The number and unit fields set the highest update speed - actual update speeds may be lower due to system limitations.

Colors

This tab controls the colors of various display items.

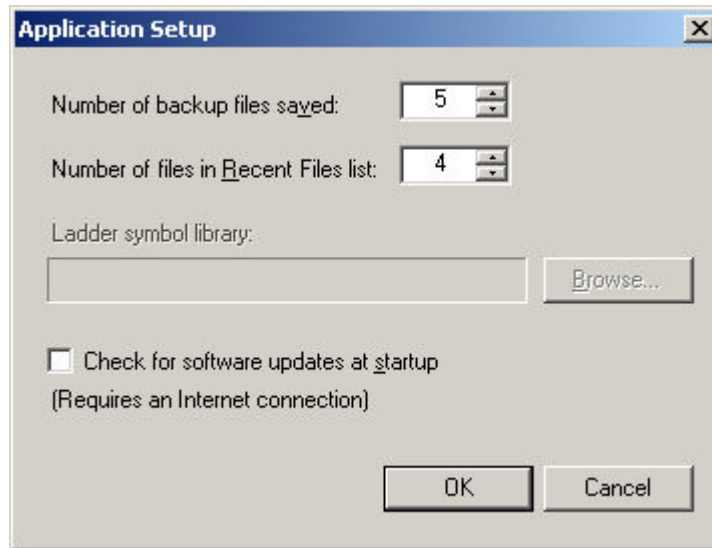


To change the color of an item, either double-click the color box for that item, or select the item and click the **Change Color** button. Either way, WorkShop displays a standard color selection dialog.



Application Setup

Use the **Application Setup** dialog to set several WorkShop options.



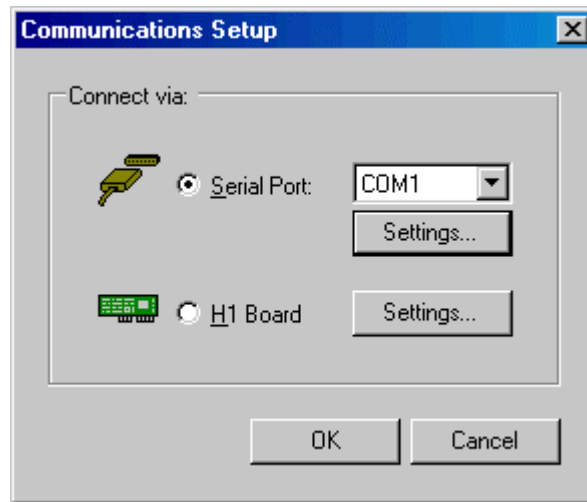
- **Number of backup files to be saved** - When you save the program you are working on, WorkShop creates a backup of the previous version under the name x_BAK001.FSS, where x is the name of the program. The old x_BAK001.FSS will be renamed to x_BAK002.FSS, and so on, up to the number of backups specified here.
- **Number of files in Recent Files list** - Set the number of files to appear in the **Recent Files** list.
- **Ladder symbol library** - Use the **Browse** button to select a file containing alternative symbols to be used in displaying ladder logic. Use the **Application Setup** dialog to turn this feature on or off. This feature is not yet available.
- **Check for software updates at startup** - If this box is checked and there is an active Internet connection when you start WorkShop, WorkShop will check the FasTrak web site (www.fast-soft.com) for new versions of WorkShop, and inform you if any are available.

To access the **Application Setup** dialog:

Select the **Options \ Application Setup** menu item.

Communications Setup

Use the **Communications Setup** or **Fast PLC Connection Setup** dialog to set the parameters for communication between the computer and the PLC. The **Communications Setup** dialog controls the settings used when you connect to the PLC using the **Open** operation, the **Fast PLC Connection Setup** dialog controls the settings used when you connect using the **Fast PLC Connection** operation. The controls on each are identical.



- **Serial Port** - Select this radio button to communicate via your computer's serial port. Use the drop-down list to select which serial port to use.
- **Settings** - Click the **Settings** button directly below the serial port drop-down list to access the **Serial Port Settings** dialog.
- **H1 Board** - Select this radio button to communicate via an H1 communications board.
- **Settings** - Click the **Settings** button to access the **H1 Board Settings** dialog.

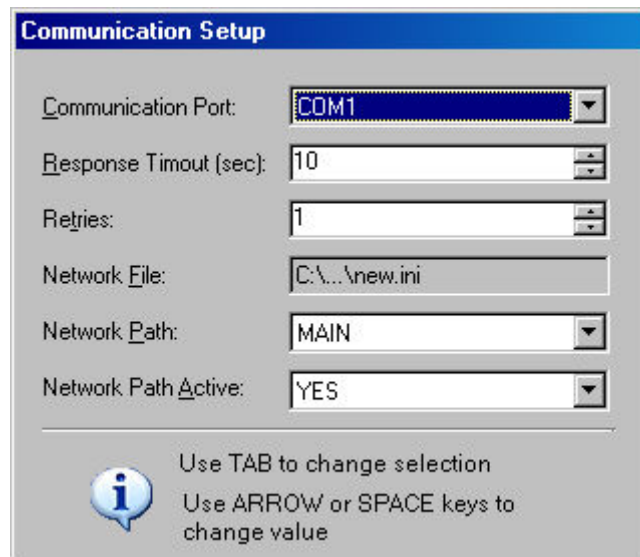
To access the **Communications Setup** dialog:

There are two ways to access the Communications Setup dialog. Both control the settings used when you connect to the PLC using the **Open** operation.

1. Select the **File \ Communications Setup** menu item.
2. From the **Open Program** dialog, select the **Connect to PLC** radio button and click the **Setup** button.

To Configure Communications in SoftKey mode:

1. Press the **[F8]** key.



The image shows a 'Communication Setup' dialog box with the following fields and values:

Field	Value
Communication Port:	COM1
Response Timeout (sec):	10
Retries:	1
Network File:	C:\...\new.ini
Network Path:	MAIN
Network Path Active:	YES

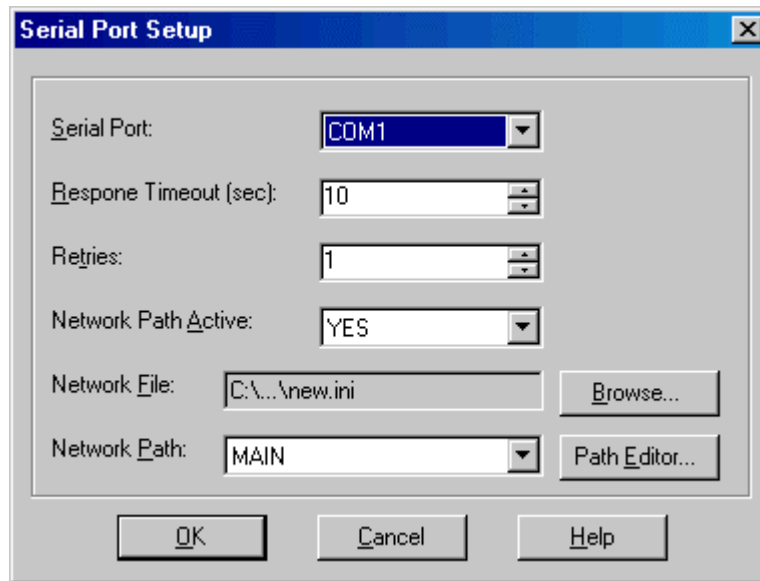
Below the fields, there is an information icon and the following text:

Use TAB to change selection
Use ARROW or SPACE keys to change value

- **Communications Port** - Select the port from the drop-down list. The options are **COM1** through **COM4** and **H1 Board**.
- **Response Timeout (sec)** - Enter the number of seconds that WorkShop is to wait for a response from the PLC.
- **Retries** - Select the number of times to try again when there has been no response within the number of seconds specified in the **Response Timeout**.
- **Network File** - The network file contains network path configurations. Press **[F2]** to select the network file. To create a new network file, use the Path Editor.
- **Network Path** - Select the network path from the drop-down list. To create or edit a path, access the **Path Editor** by pressing **[F3]**. The Path Editor is part of a stand-alone application called **FTH1Config for S5**.
- **Network Path Active** - For a direct serial connection, select **NO**. To use an H1 path, select **YES** and select the network file and path as described below.

Serial Port Setup

Use the **Serial Port Settings** dialog to configure the serial port used to communicate between the computer and the PLC.



- **Serial Port** - Use the drop-down list to select which serial port to use.
- **Response Timeout (sec)** - Enter the number of seconds that WorkShop is to wait for a response from the PLC.
- **Retries** - Select the number of times to try again when there has been no response within the number of seconds specified in the **Response Timeout**.
- **Network Path Active** - For a direct serial connection, select **NO**. To use an H1 path, select **YES** and select the network file and path as described below.
- **Network File** - The network file contains network path configurations. Use the **Browse** button to select the network file. To create a new network file, use the Path Editor.
- **Network Path** - Select the network path from the drop-down list. To create or edit a path, access the **Path Editor** by clicking the **Path Editor** button. The Path Editor is part of a stand-alone application called **FTH1Config for S5**.

H1 Board

PLC WorkShop supports CP1413 and CP1613 H1 communications modules.

Software Requirements for H1 boards

- PLC WorkShop for Siemens S5 -Performance Series, **version 5.04** or higher
- **Simatic Net CD 5/2000** or greater. Note that drivers for the CP1413 are not available for some Windows versions.
- If the 6GK1143 (CP1430TF) modules are not already configured, you may need **SINEC NCM COMs** to set the MAC addresses.

Installation

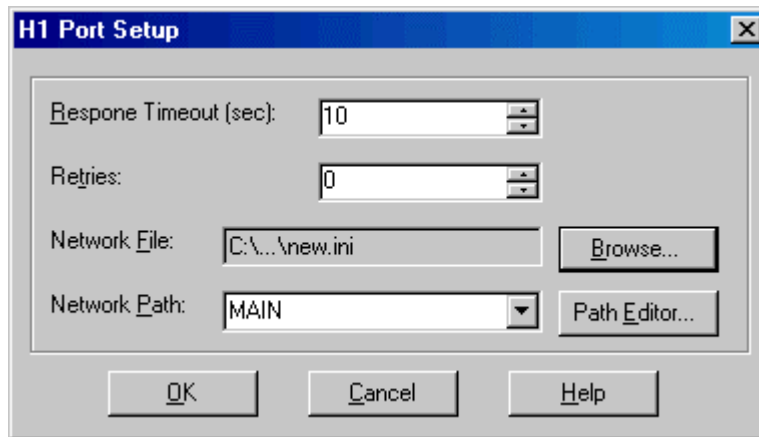
1. Install the **S7-1413/1613 for Windows** libraries that include the **S7_SR.DLL**, from the Simatic Net CD.
2. Install the **CP1413** or **CP1613** following the manufacturers recommendations.
3. If necessary, use the **SINEC NCM COMs** software to set the MAC address on the 6GK1143.
4. Synchronize the PLC and the CP1430 as described in the manufacturer's manual.
5. Install PLC WorkShop for Siemens S5 -Performance Series, **version 5.04** or higher.

Configuration

Use the **FTH1Config for S5** program to configure H1 communication paths. **FTH1Config for S5** can be accessed via the **Path Editor** buttons on the **Serial Port Setup** and **H1 Port Setup** dialogs, or as separate program. See ***FTH1Config for S5*** for details.

H1 Port Setup

Use the **H1 Port Setup** dialog to configure the serial port used to communicate between the computer and the PLC.



- **Response Timeout (sec)** - Enter the number of seconds that WorkShop is to wait for a response from the PLC.
- **Retries** - Select the number of times to try again when there has been no response within the number of seconds specified in the **Response Timeout**.
- **Network File** - The network file contains network path configurations. Use the **Browse** button to select the network file. To create a new network file, use the Path Editor.
- **Network Path** - Select the network path from the drop-down list. To create or edit a path, access the **Path Editor** by clicking the **Path Editor** button. The Path Editor is part of a stand-alone application called **FTH1Config for S5**.

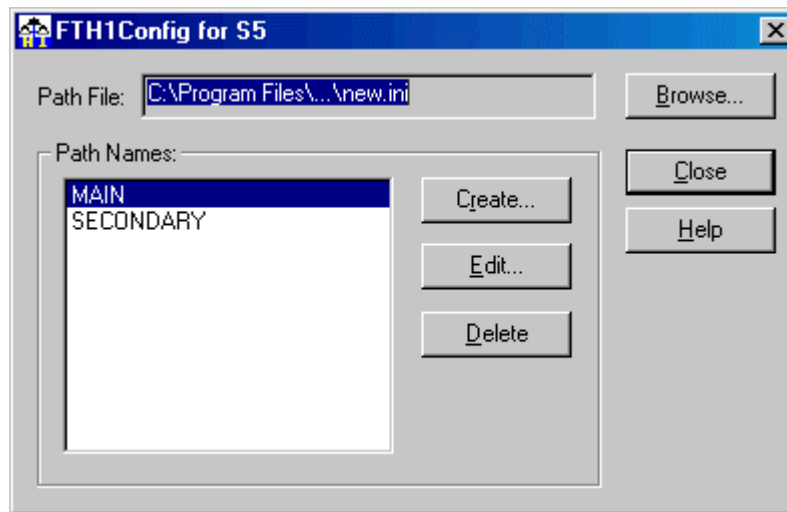
FTH1Config for S5

FTH1Config is a stand-alone program for configuring H1 communications paths.

FTH1Config can be opened from the Windows **Start** menu (**Start \ Program Files \ FasTrak SoftWorks \ FTH1Config** by default) or by clicking the **Path Editor** button on the **Serial Port Setup** dialog or the **H1 Port Setup** dialog.

Main Dialog

When you open FTH1Config, the main dialog appears:

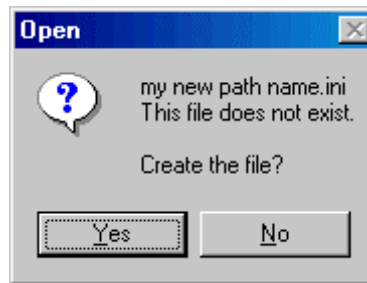


- **Path File** - The file containing the path information. Use the **Browse** button to select or create a path file.
This file is in the same format as that used by Siemens Step5 software, so path information from Step5 projects can be used.
If FTH1Config was opened by clicking a **Path Editor** button, the path file is set to that of the dialog where the button was located. However, selecting another file here does not change the file in that dialog.
- **Path Names** - The list shows path names from the path file selected above. If FTH1Config was opened by clicking a **Path Editor** button, the path is set to that of the dialog where the button was located. Selecting another path in this list does not change the path selection in that dialog.
- **Create** - Click this button to create a new path. The **Path Editor** described below opens, with the **Path Name** field empty.
- **Edit** - Click this button to create a new path. The **Path Editor** described below opens, with the **Path Name** field in a non-editable state.
- **Delete** - Click this button to delete the highlighted path.

To create a new path file:

1. Click the **Browse** button.
2. Select the location for the file.
3. Type the new file name.

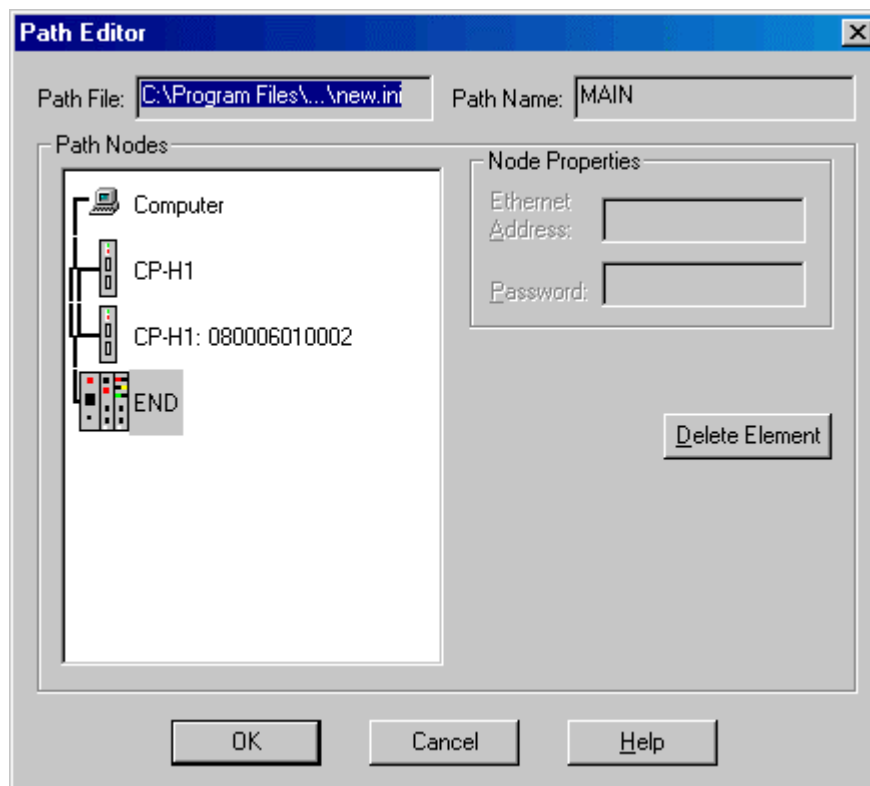
- Click the **OK** button. A dialog appears:



- Click the **Yes** button to create the new path file.

Path Editor

Click the **Create** button or the **Edit** button on the FTH1Config main dialog to open the Path Editor.



- **Path File** - The file containing the path information that is being edited. This field is display-only.
- **Path Name** - The name of the path being edited. If editing an existing path, this field is display-only.
- **Path Nodes** - A graphic display of the devices used in the path. One node may be highlighted. The highlighted node is described in the **Node Properties** fields, but the position of the highlight has no effect on the insertion or deletion of nodes: those operations always apply to the end of the path.

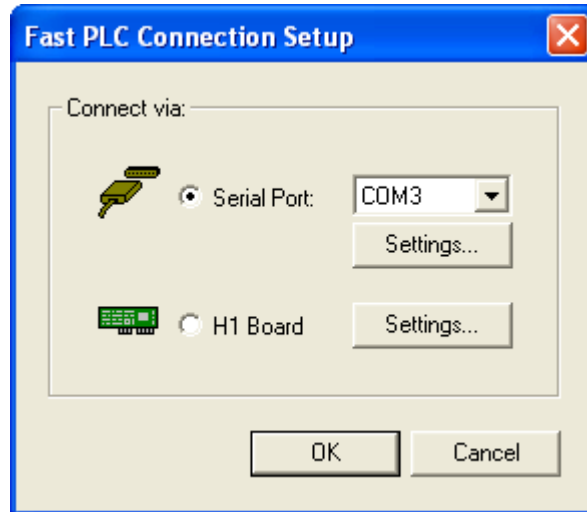
- **Node Properties** - When there are configurable properties for the highlighted node, edit them in these fields.
- **Ethernet Address** - The Ethernet address for a CP1430. This field is available only when the current node is a CP1430 not directly connected to the serial port of the PC.
- **Password** - The password for a CP1430. This field is available only when the current node is a CP1430 not directly connected to the serial port of the PC.
- **Address** - The COR/MUX address. If the current node is not a COR/MUX, this field is not available.
- **Delete Element** - Click this button to delete the element at the end of the path - the last element shown in the **Path Nodes** display.
- **Node append buttons** - Click one of these buttons to add a node to the end of the path. The buttons displayed vary depending on the current nodes - nodes that cannot be added to the current path are not shown.
- **Computer - AS511** - Click this node button for paths where a serial port on the computer is used. No node properties are configurable.
- **H1-CP** - Click this node button for paths where a CP1413 and CP1613 H1 communications module is used. No node properties are configurable.
- **COR/MUX** - Click this node button to represent a COR/MUX device in the path. Enter the COR/MUX **Address** in the **Node Properties**.
- **CP-H1** - Click this node button to represent a CP1430 in the path. If this CP1430 is not connected directly to the PC serial port, set the **Ethernet Address** and the **Password** (if any) in the **Node Properties**. If this CP1430 is directly connected to the PC serial port, the Node Properties will not be available.
- **END** - Click this node button to represent the end of the path. No node properties are configurable.

Fast PLC Setup

The **Fast PLC Setup** dialog allows the computer/PLC connection to be configured for use with the **Fast PLC Connection** function.

To set up the Fast PLC Connection:

1. Select the **File \ Fast PLC Setup** menu item. The **Fast PLC Connection Setup** dialog appears.



2. Select the radio button for the PLC communication method to be used.
3. Configure the details for that communication method by clicking the appropriate button.

The connection options for **Fast PLC Connection** are stored in the system registry. If **Fast PLC Connection** is attempted, and the Fast PLC setup has not been configured, the **Fast PLC Connection Setup** window will automatically display before continuing.

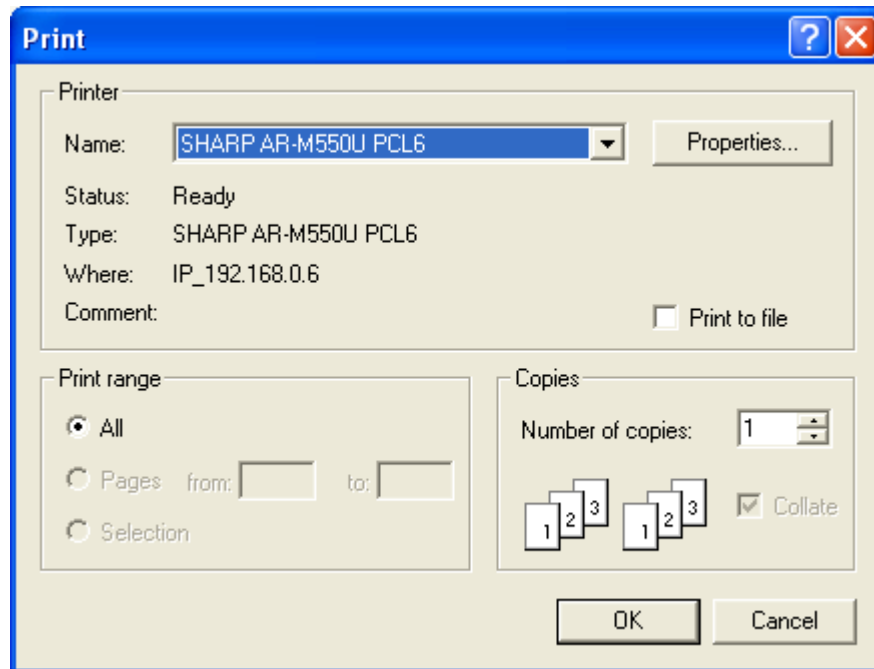
NOTE: The settings for the **Open** function are configured using the **Communications Setup** dialog. Changing the settings for **Fast PLC Connection** has no effect on the **Open** settings. Files cannot be loaded with **Fast PLC Connection**. To load a file online, use the **Open Program** dialog, which is accessed through the **File** menu.

Printer Setup

Use **Print Setup** to select a printer and determine where and how your printouts appear.

To access the Print Setup:

1. Start or open a logic program.
2. Select **Print Setup** from the **File** menu. The **Print Setup** dialog box appears.

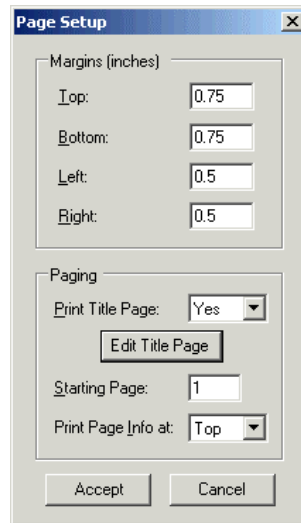


3. Choose a printer or device from the drop down box.
4. Additional setup options may be available depending on the printer you selected. If a **Properties** button is available, click it and another dialog box appears. Make your selections and select the **OK** button to return to the **Print Setup** dialog box.
5. Other options in the **Print Setup** dialog box include **Orientation** and **Paper Source**. Click the desired settings.
6. Click **OK** in the **Print Setup** dialog box to save your settings and return to the active logic window.

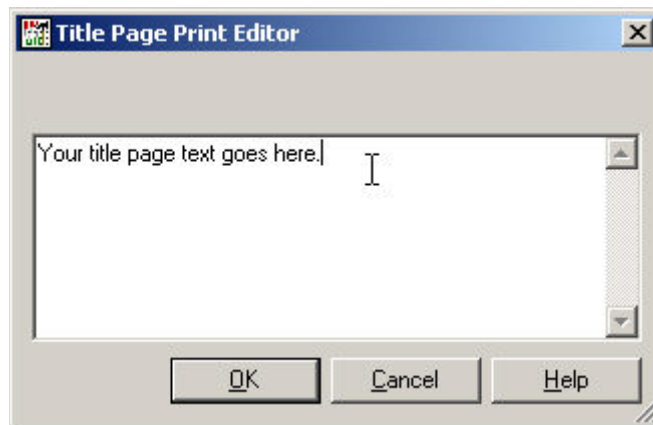
NOTE: The print setup options can also be accessed from the **Print** box that appears after selecting **Print** from the **File** menu.

Page Setup

Use the **Page Setup** dialog to set up margins, title page, and page numbering.



- **Margins** - Set the margins around the main part of page. The page info is printed outside the margins.
- **Print Title Page** - The title page is an optional first page containing any text you specify.
- **Edit Title Page** - Click the **Edit Title Page** button to enter the text to appear on the title page.



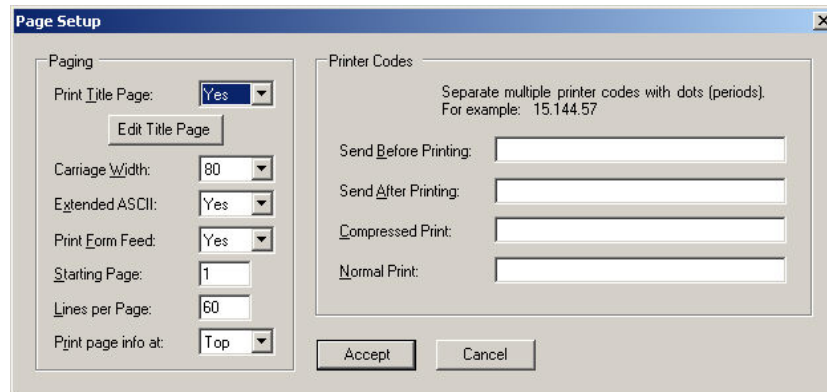
- **Starting Page** - Enter the page number of the first page of the report.
- **Print Page Info at** - Select where the page information line (program name, date and time, page number) will appear on each page.

To access the **Page Setup** dialog:

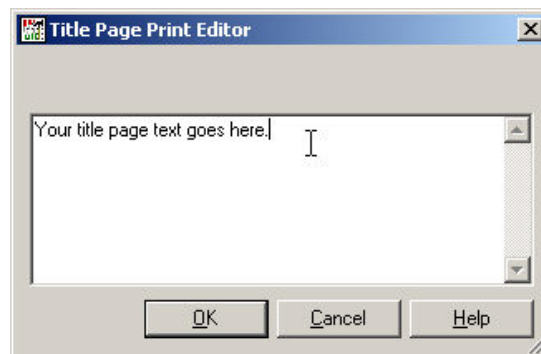
1. Bring up one of the print dialogs, by selecting one of the following menu options:
File \ Print
File \ Print Preview
2. Click the **Page Setup** button.

Print Page Setup for Output to Text File

Use this **Page Setup** dialog to set up margins, title page, page numbering, and printer codes.



- **Margins** - Set the margins around the main part of page. The page info is printed outside the margins.
- **Print Title Page** - The title page is an optional first page containing any text you specify.
- **Edit Title Page** - Click the **Edit Title Page** button to enter the text to appear on the title page.



- **Starting Page** - Enter the page number of the first page of the report.
- **Lines per Page** - Enter the number of lines of text that will fit on a page when sent to the printer, including **Page Info** line. This varies with printer and font, but most often 60 is appropriate. If the value is too low, there will be blank space at the end of each page. If it is too high, the last part of each page will be forced onto the next page, most of which will be blank.
- **Print Page Info at** - Select where the page information line (program name, date and time, page number) will appear on each page.
- **Printer Codes** - Enter the appropriate codes for your printer. These vary by printer model.

To access this **Page Setup** dialog:

1. Bring up the output to text dialog, by selecting the **File \ Output to text file** menu item.
2. Click the **Page Setup** button.

5 - FasTrak Authentication and NT Security

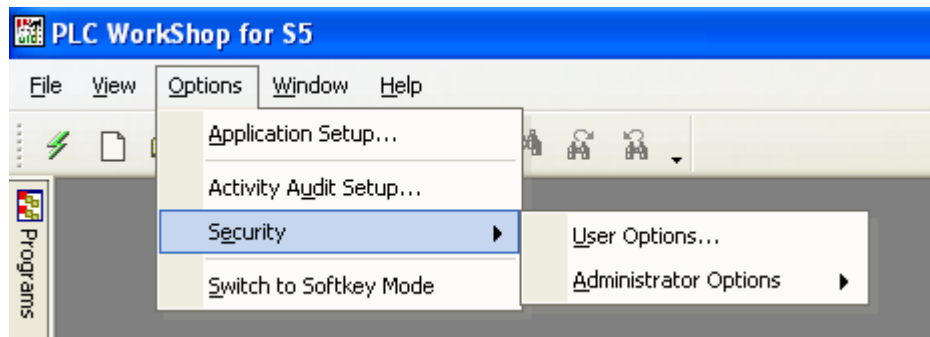
Overview

The WorkShop Password Security feature allows one or more security administrators to maintain a list of users and their access privileges. Access privileges restrict which functions of the application (such as online and offline editing, I/O forcing, loading, saving changes to disk etc.) individual users can perform.

Choosing a Security Type

PLC WorkShop Siemens S5 - Performance Series offers two unique security systems for use. If the computer on which PLC WorkShop is installed is running under MS-Windows NT, 2000, or XP, PLC WorkShop determines if the user currently logged in to the operating system is an administrator (or belongs to the Administrator group).

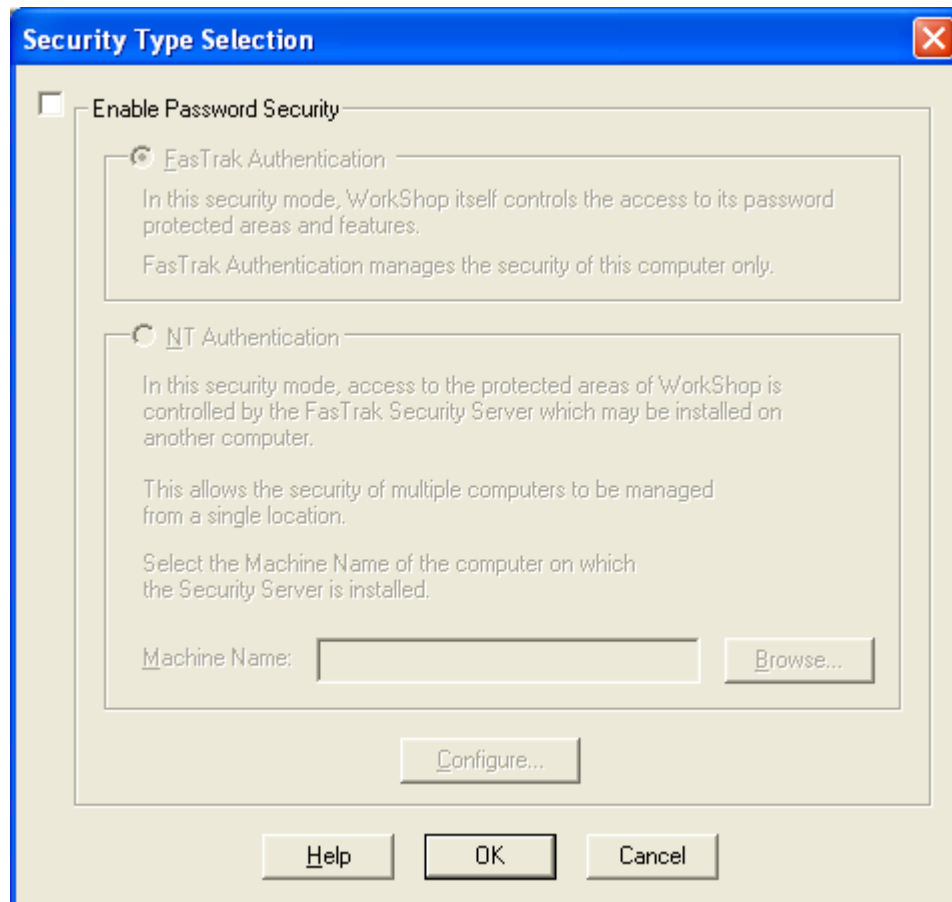
To activate the security feature of PLC WorkShop, select the **Options \ Security \ Administrator Options** menu item as illustrated below.



If PLC WorkShop is running under MS-Windows 95, 98, or ME, the **Password Required** dialog appears as illustrated below. This dialog appears after having chosen a security type for the first time and allows the user to become the first security administrator.



If the users already on file belong to the Administrator's group, then the fields above are filled in and the dialog is used to verify the user's password. Clicking **OK** launches the **Security Type Selection** dialog, seen below.



Clicking on **Enable Password Security** activates security, and the user is free to choose from either FasTrak Authentication or NT Authentication.

- **FasTrak Authentication:** The application itself regulates user access to password-protected areas. Management takes place on the local computer only.
- **NT Authentication:** When enabled, PLC WorkShop requests permission to access password-protected areas from the FasTrak Security Server. This server is a separate application, which can be installed on the local computer or on any other computer running under MS-Windows, NT, 2000, or XP. This server is capable of managing multiple computers from a single, central location.

FasTrak Authentication Security

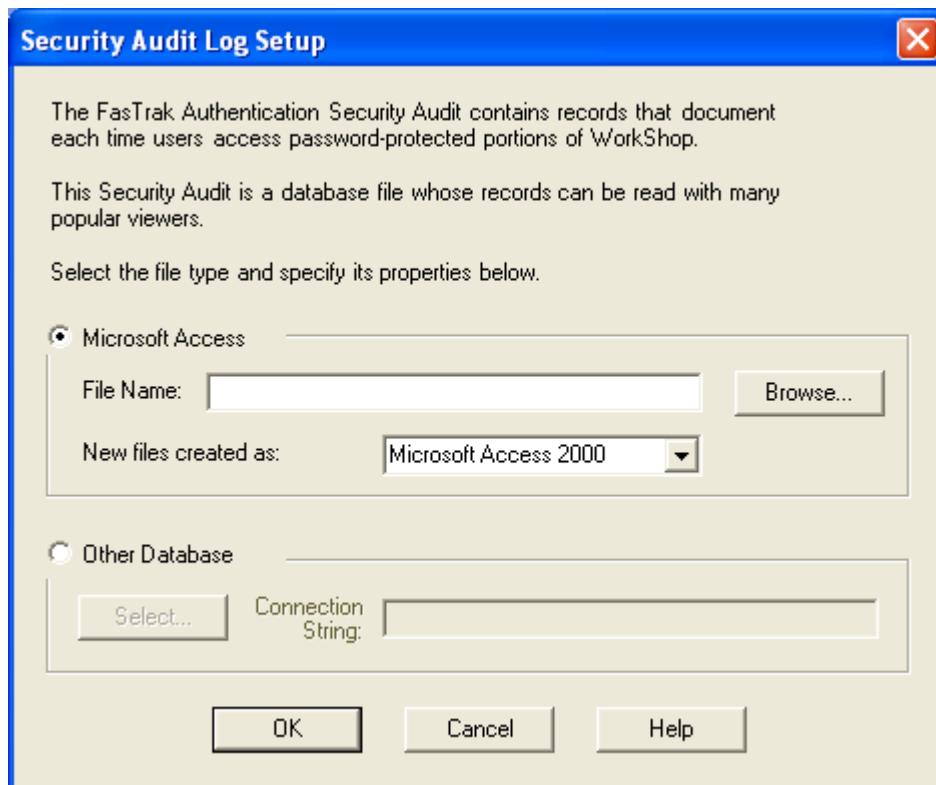
The **Authentication Security Dialog** is accessible from the **Security Type Selection** screen.

In addition to controlling user access, this security mode can also record each attempt made by a user to perform the tasks displayed above. To enable this feature, click on the **Enable Security Audit** check box.

NOTE: If the **Enable Security Audit** check box is checked but the security log has not been set up, when this dialog is exited, PLC WorkShop will warn the user that no log file had been configured, and the check box selection will not be retained.

FasTrak Authentication Log Setup

The following dialog is launched from the **FasTrak Authentication Security Configuration** dialog by clicking **Audit Setup**.



The dialog box is titled "Security Audit Log Setup" with a blue header bar and a red close button in the top right corner. The main area has a light beige background. It contains the following text and controls:

The FasTrak Authentication Security Audit contains records that document each time users access password-protected portions of WorkShop.

This Security Audit is a database file whose records can be read with many popular viewers.

Select the file type and specify its properties below.

☒ **Microsoft Access**

File Name:

New files created as:

☐ **Other Database**

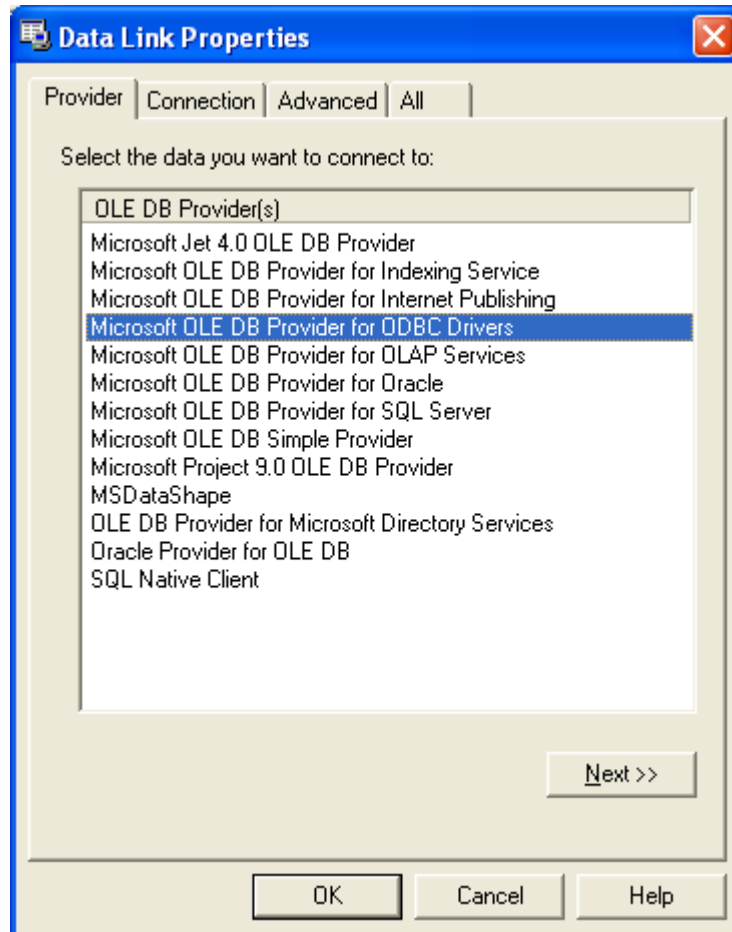
Connection String:

At the bottom are three buttons: , , and .

- To write the local security log to a Microsoft Access database file, select the **Microsoft Access** radio button. Enter the name of the Access file or browse to select a file and select a file format from the combo box.
- To write the local security log to an SQL database file, select the **Other Database** radio button. Enter the file **Connection String** in the edit box.

Data Link Properties Dialog

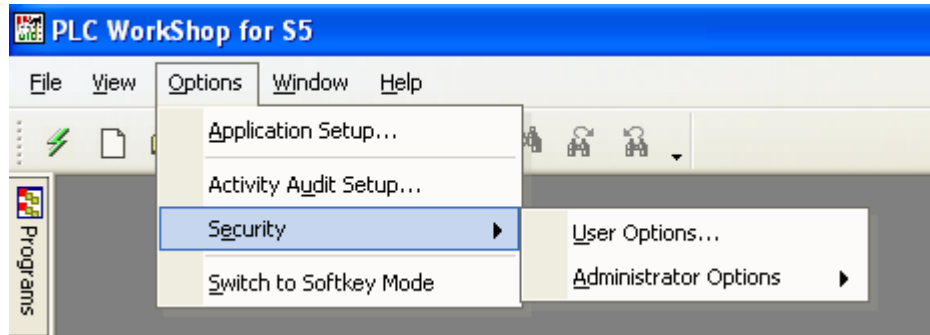
If choosing a database other than Microsoft Access, and the user does not provide a Connection String, click the **Select** button, and the **Data Link Properties** dialog opens. This dialog is the first in a series of tabbed dialogs that help users create the necessary string of the local security log file.



Security Setup

Password security in WorkShop is disabled by default. Without password security enabled, any user may access any portion of the programming package.

Before the password security feature can be used, a security administrator must be established by selecting the **Options \ Security** menu item.



- The **User Options** menu item allows users to change their own passwords or allow other users to enter their password without having to exit and restart WorkShop.
- The **Administrator Options** menu item allows the security administrator to add, edit, and delete users and specify their access privileges to specific features in WorkShop.

Administrator Options

By default, there is no security administrator, and the password security feature is not enabled. Therefore, the **User Options** menu item is disabled until a security administrator is established. Select the **Options \ Security Setup \ Administrator Options** menu item to establish a security administrator. The **Password Required** dialog appears.

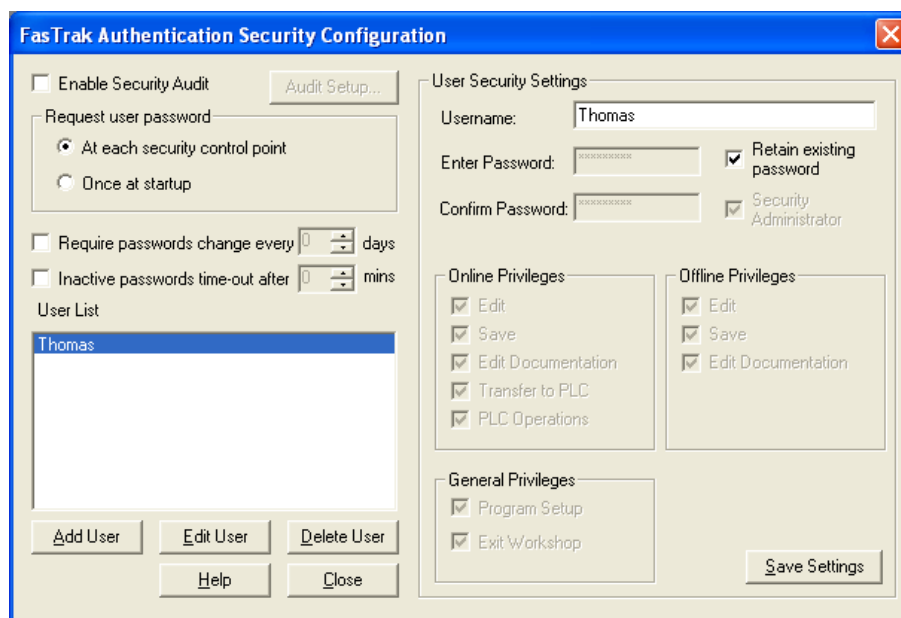
A dialog box titled 'Administrator Password Required' with a red 'X' icon in the top right corner. The text inside says 'Please enter your security administrator name and password.' There are three input fields: 'Name:', 'Password:', and 'Verify Password:'. At the bottom are 'OK' and 'Cancel' buttons.

1. **Name:** The security administrator is required to enter a name, which can be up to twenty characters long.
2. **Password:** The security administrator is required to enter a password, which can be up to fourteen characters long. Both alphanumeric characters as well as other keyboard-entered characters such as !, @, #, \$, and % are valid.

3. **Verify password:** The first time a security administrator is established, the password must be entered twice. This original security administrator can add other security administrators through the **FasTrak Authentication Security Configuration** dialog discussed below. If a security administrator has already been established, the password does not need to be entered a second time for verification. When a security administrator exists, the **Verify** password field is disabled.
4. Click **OK**. If the two passwords match, the **FasTrak Authentication Security Configuration** dialog appears.

Security Administration Dialog

Security administrators control the password security feature of WorkShop through the **FasTrak Authentication Security Configuration** dialog below.

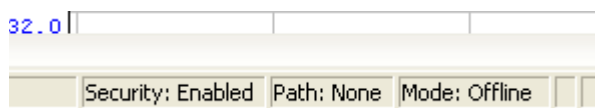


The security feature can be enabled and disabled and the places at which user passwords are requested can be specified through this dialog. The list of users and their rights to access specific features within WorkShop can be managed within this dialog.

Enable Password Security

The password security feature is disabled in WorkShop by default. The security administrator can turn this feature on by checking **Enable password security**. When this box is checked, users are requested to enter their passwords either once each time WorkShop is started or each time they attempt to enter a password-protected section of the application.

The current security mode is indicated in the status bar at the bottom of the WorkShop window as seen in the example below. **Security: Enabled** appears when security is enabled. **Security: Disabled** appears when security is disabled.



Inactive Passwords Timeout

Once users enter their passwords, they can operate PLC WorkShop indefinitely (within their access privileges). However, if PLC WorkShop runs unattended for a designated number of minutes without user interaction, the password under which the application is running can be timed-out.

Click **Inactive passwords time-out after N mins** to activate this feature. Enter the number of minutes PLC WorkShop may remain inactive before the current password times-out. The default number of minutes is 30 but the valid range is 1 to 999.

Request User Password

Once password security is enabled, PLC WorkShop requests users to enter their passwords at various times to operate the software.

Passwords can be requested each time users attempt to enter a password-protected portion of the application. Alternately, passwords may be requested only once when WorkShop is first started.

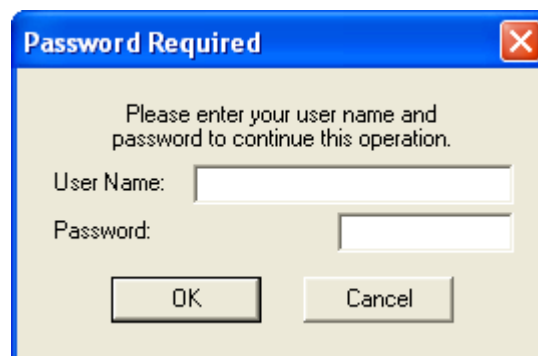
At Each Control Point

Password control points are designated as "privileges" within the **User Security Settings** group box illustrated in the following pages. Specifying that passwords be requested at these control points requires users to enter their name and password every time they attempt to use these features.

The advantage of this selection is that multiple users can operate WorkShop without having to exit and restart the application under another user name and password. Once a user has completed a password-protected operation and exits that function, other users can access password-protected operations by entering their own user names and passwords.

The disadvantage of this selection is that it requires users - even the same user - to re-enter user names and passwords each time they attempt to access one of the password-controlled features.

For example, saving a program to disk is one of these control points. Assume a user edits a ladder program. The user then selects **Save** from the **File** menu to write the changes to disk. The **Password Required** dialog box, pictured here, appears requesting the user name and password to access the save feature.



Upon entering a valid user name and password (and the security administrator has given this user privileges to this feature), the user is granted access to the save feature. After saving, the user immediately returns to the program, makes another change, then selects **Save** from the **File** menu again. Even though the user was just granted access to the **Save** feature, the **Password Required** dialog reappears requesting the user name and password.

Once At Startup

Alternately, user name and password can be requested once when WorkShop is started – or after selecting Switch user in the User Security Setup dialog, illustrated later in this document. Upon entering a valid user name and password, the new user can access each password-controlled feature (to which the security administrator has granted privileges) without having to re-enter the user name and password.

The advantage of this selection is that users enter their names and passwords once at startup and are not required to re-enter them each time they choose a password-controlled feature.

The disadvantage of this selection is that one user can start WorkShop with a correct name and password but another operator can continue to use the application with all the original user's access privileges.

Adding Users

Click the **Add User** button to add a new user to the list. The dialog controls for a new user are set as illustrated below.

User names can be up to twenty characters long. Passwords can be up to fourteen characters long. Valid characters for both fields are alphanumerics and the other keyboard-entered characters (! @ # \$ %, etc.).

Enter the user name then enter and re-enter the password.

All privileges are initially checked for new users. Check/uncheck the privileges appropriate for the user.

Security administrators can create other security administrators. Check the **Security Administrator** box to grant the new user all administrator rights and privileges.

Click **Save Settings**. The list of existing users is checked to assure the new user name is not a duplicate. If the new user name is unique, the two password entries are compared. Finally, the new user name is added to the **User List** box.

Editing Users

There are two ways to select an existing user to edit. Either double click a user name from the **User List** box or highlight a user name in the **User List** box and click the **Edit User** button.

By default, **Retain existing password** is checked and the password edit boxes are disabled. This allows the security administrator to modify privileges without needing to re-enter the user identity information (the user name and password).

To change the user name, type an alternate entry in the **User Name** edit box.

To change an existing user password, uncheck **Retain existing password** to enable the password edit boxes. Enter and verify a new password. Both password entries must match in order to save the new password.

Security administrator rights may be granted to or revoked from the user by checking or unchecking **Security Administrator**.

Deleting Users

To remove a user, highlight a name in the **User List** box and click the **Delete User** button. A verification message appears which asks to confirm the deletion. Click **OK** and the user is removed.

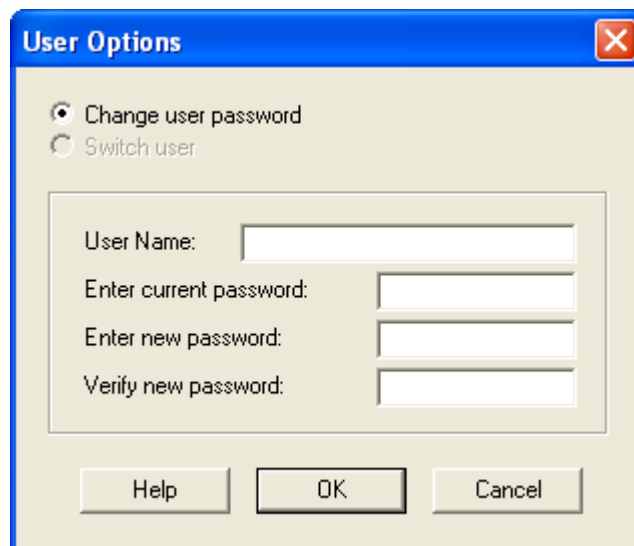
User Security Setup Dialog

Once the security administrator adds users, their initial passwords and access privileges, the **User Options** item of the **Security Options** menu (as illustrated earlier) is enabled. Users can select this menu item to change their passwords through the **User Security Options** dialog below.

If the security administrator elects to request user passwords once at startup, the **Switch User** radio button is enabled. Otherwise, if passwords are requested at password control points, this radio button is disabled.

Changing the User's Password

Users may change their own passwords. Security administrators may also change their passwords. Click the **Change user password** radio button and the dialog controls are set as illustrated below.

The image shows a Windows-style dialog box titled "User Options" with a blue title bar and a red close button in the top right corner. Inside the dialog, there are two radio buttons: "Change user password" (which is selected) and "Switch user". Below these buttons is a group box containing four text input fields: "User Name:", "Enter current password:", "Enter new password:", and "Verify new password:". At the bottom of the dialog, there are three buttons: "Help", "OK", and "Cancel".

Enter the user name and current password. Then enter and verify the user's new password and click **OK**.

If the entered user name is in the list of users previously added by the security administrator, the **Enter current password** is compared to the password already associated with that user.

If the **Enter current password** matches the existing password for that user, the Enter new password and Verify new password are compared with each other. If the two new passwords match, then the new password replaces the current.

Switching the User

If user passwords, specified by the security administrator, are requested only once when WorkShop is started, the password entered at startup (and the access privileges associated with it) is in effect until WorkShop is exited. Another password is not requested until WorkShop is restarted.

However, the **Switch user** name and option allows another user to enter another password without requiring the application be exited and restarted.

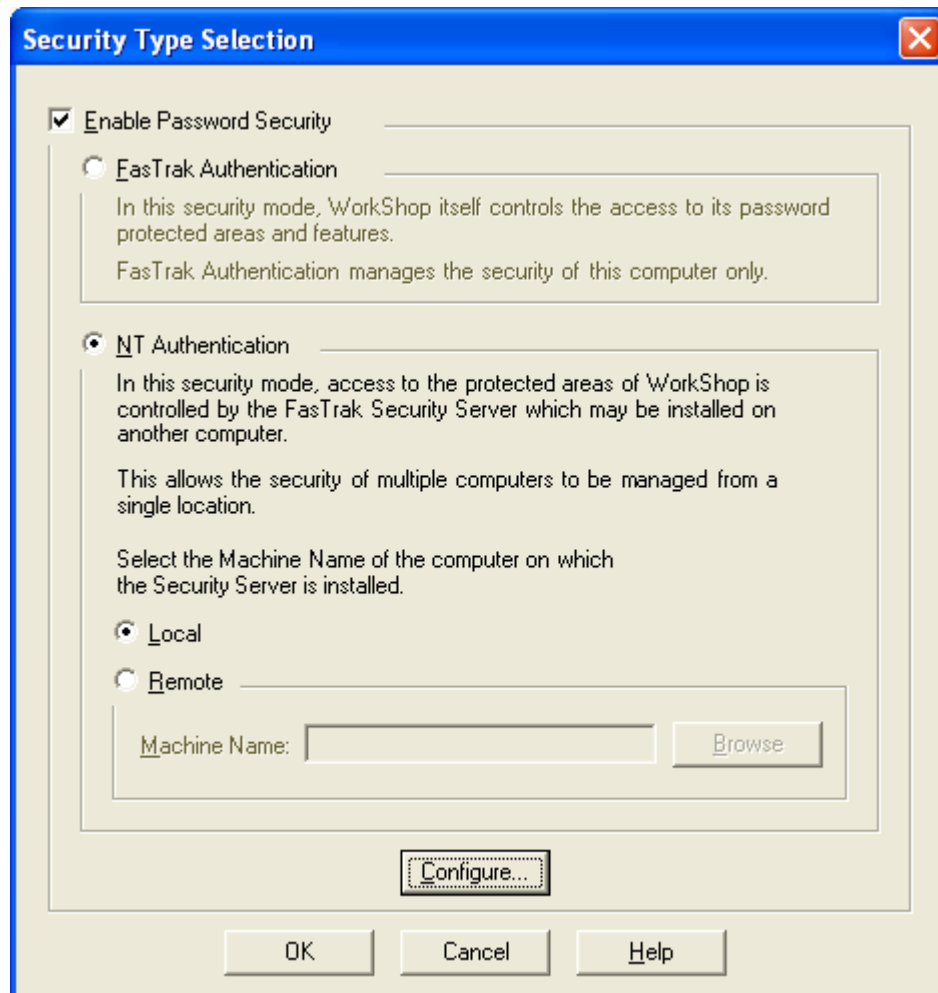
Enter the user name and password of the user who will assume operational control of WorkShop. If a valid user name and its matching password are entered, the security access privileges are reset to those of the new user.



NT Authentication Security

The other security type offered in the **Security Type Selection** dialog is **NT Authentication**. NT Authentication Security requests permission to access password-protected portions of PLC WorkShop from the FasTrak Security Server. This server is a separate application that can be installed and run on another computer in the network. Select the **Machine Name** of the computer on which the Security Server is installed.

Click the **Enable Password Security** check box and click the **NT Authentication** radio button as illustrated below.



Click the **Configure** button to run the **NT Authentication Security Configurator**. This configurator is a separate application that runs under Windows NT/2000/XP only. That is, the configurator can be installed and run on the security server computer or a security client computer as long as it is running under the Windows NT/2000/XP operating systems.

NOTE: If the **Configure** button for NT Authentication is clicked on a computer running Windows 95/98/ME, PLC WorkShop reminds that the NT Authentication Security Configurator can be run under Windows NT/2000/XP only.

Installing the Security Server

If the FasTrak client applications are installed on a machine other than the one FTSecSvr is running on (remote security), users may want to install FTSecCfg on the client machine(s) as well as the server machine so that the server can be configured locally or from the client machine.

FasTrak security must be installed on a machine running Windows NT (3.1 or later), 2000 or XP. Two applications get installed to a user-selected directory on the local machine. These files are **FTSecCfg.exe** and **FTSecSvr.exe**. If running Windows XP, FTSecSvr.exe can only be installed on the Professional version and not on the Home version. Regardless of the operating system being used, the server (FTSecSvr.exe) must still be installed locally on the client machine as well as on the remote machine. This is true even if the client machine is a non-NT type machine. By default, all "checkable" items are installed including FTSecSvr.exe (under NT Security\Server) and FTSecCfg.exe (under NT Security\Configurator). If installing to Win9x or Me, NT Security\Configurator is not listed and therefore FTSecCfg.exe does not get installed.

Installing and Running the Server on a Local Machine

If the user wishes to install the Security Server locally, this may be achieved by installing from off of CD or from a self-extracting executable file available from FasTrak's Website (<http://www.fast-soft.com>).

A CD installation requires only that all items for security be checked during the **InstallShield** process. If a client software application has been previously installed, and it supports NT Security, then re-inserting the installation CD or running the self-extracting executable and un-checking the client during the InstallShield process is all that is required.

Installing and Running the Server on a Remote Machine

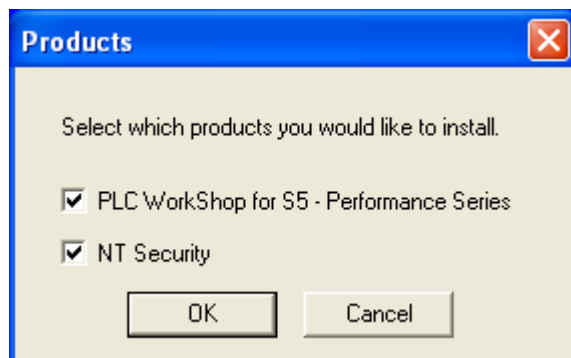
Installation begins with the installation of the client (i.e. PLC WorkShop) to a local, or client, machine. In this case, installing the Security Configurator is an option.

After this installation is complete, the user must install to the machine that will act as the remote server. Installation is identical to the above with the exception that the client need not be installed and therefore may be unchecked from InstallShield. It is recommended that both the Security Server (FTSecSrv) and Configurator (FTSecCfg) be installed.

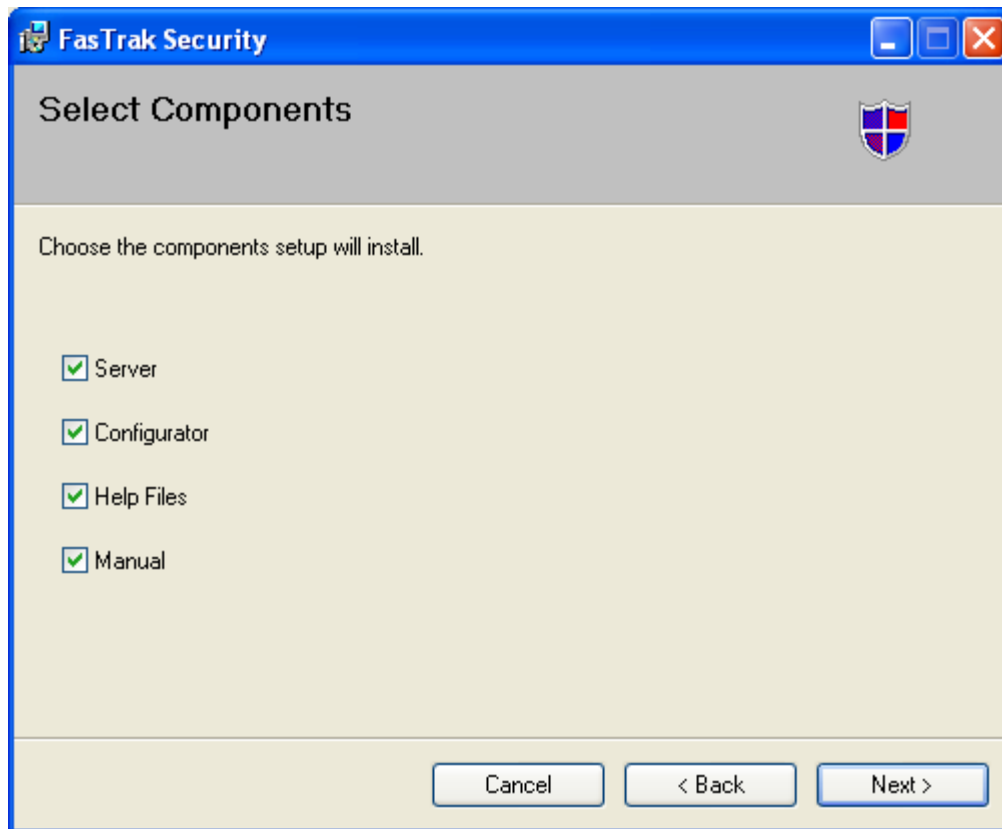
If a client software application is already installed to the machine that the user wishes to run as the remote security server, installation of security is identical to installing to a local machine, in the above section.

Installation Dialogs

The following two dialogs are examples of what a user should expect to see during installation. Below is the dialog whereby the user selects to install the client application, NT security, or both.



To select security components, select the **NT Security** check box and follow the instructions in the installation wizard for **FasTrak Security**. The **Select Components** dialog appears.



Workgroups and Domains

Workgroups

NT security works slightly different in workgroups than in domains. This difference becomes a factor when using the security server remotely. When a computer is part of a workgroup and a user enters their user name and password to log onto the operating system, the user name they logged in as, the rights they have, and groups they belong to are known only to the local computer.

When a local computer (running a client application such as PLC WorkShop) connects to a remote computer running the security server, it tries to log on to the remote computer with the same user name and password. If the exact user name and password cannot be found on the remote computer, the client (local computer) gets logged onto the remote computer as "Guest". For this reason, a guest user normally has minimal rights. This account is disabled by default. If a guest account is enabled, anyone can log on to the computer because a password is not required for this account. In general, when using workgroups, all users that need to get security clearance from FasTrak's security server must exist on the server machine. The rights a user has on the local machine may differ from the rights they have on a remote machine. Similarly, the groups a user belongs to on the local machine may differ from the groups they belong to on a remote machine.

Domains

When a computer is part of a Domain and a user logs onto any computer that is a member of the domain, the user name and password they supply is stored on the domain controller vs. the local machine. There is no "re-logging" when connecting to a remote machine on a domain. The rights a user has and the groups they belong to are the same amongst all the machines on the domain. This eliminates the need to declare users twice: once on the local machine and once on the remote machine. When setting up a server on a domain, it's important to choose the domain controller machine because this machine holds all the domain users and groups.

Adding Users and Groups to the Operating System

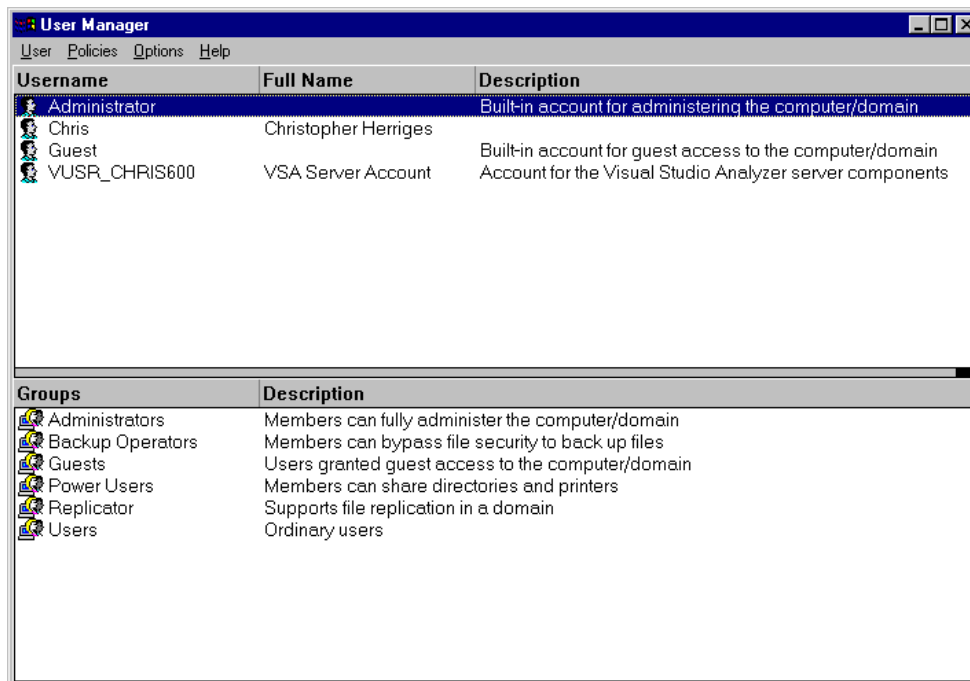
Configuring users and groups differs depending on the operating system being used. Because NT Security is based on Users and Groups, the following steps must be taken.

Adding Users for Windows 95, 98, and ME

In Windows 9x and Me, users may log on to the system to get their unique user profile, but they do not have any rights since the OS is unprotected and they do not belong to any groups. A user can be created simply by entering a unique user name and password when logging on to the OS. A user may skip the login procedure altogether, in which case they become the **Guest** user.

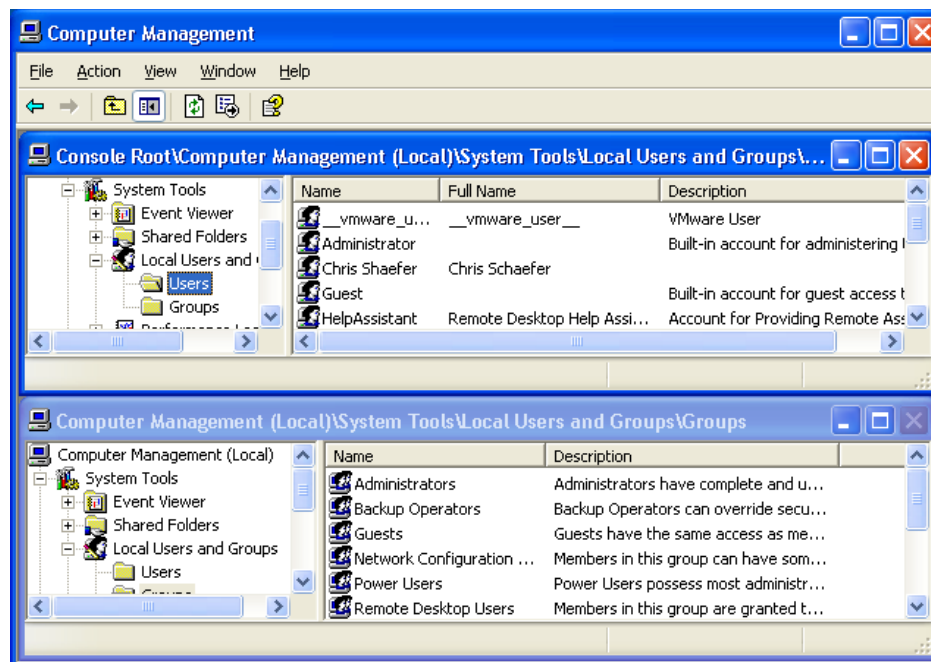
Adding Users for Windows NT

In Windows NT, users and groups can be created by entering **Administrative Tools** from **Control Panel** and selecting **User Manager**. This is shown in the figure below.



Adding Users for Windows 2000 and XP

In Windows 2000 and XP, users and groups can be created by entering **Administrative Tools** from **Control Panel** and selecting **Computer Management**. Within the Computer Management application, users and groups can be created by right clicking on the corresponding folders under the **Local Users and Groups** tree item as illustrated in the following figure.



Adding Users and Groups on a Domain Controller

If on a domain controller, select the **Administrative Tools \ Active Directory Users and Computers** menu item. From the tree control, right-click on the **Users** folder to add users and/or groups.

Configuring User Rights and Audit Policy

Correctly configuring specific user rights and audit policy on the server machine is essential for proper security and for the server to operate correctly. The following user rights need to be configured:

- **Access this computer from the network** - Enter all users/groups that will need to access this computer from the network. These users will represent the server's clients that need to request security clearance.
- **Deny access to this computer from the network** - Make sure that any user/groups that are listed in the above right are not listed here.
- **Generate security audits** - A user with administrative rights should be added here. This should be the same user that the server is launched under. See **DCOM** in the **Centralized Security Server - Server Configuration** portion of this manual. This right should be configured even if security audits are not used. This Administrator will be referenced later in this manual, in the section dealing with **DCOM**.
- **Manage auditing and security log** - A user with administrative rights should be added here. This should be the same user that the server is launched under. See **DCOM** in the **Centralized Security Server - Server Configuration** portion of this manual. This right should be configured even if the logs are not used. **Note:** this is the same Administrator as mentioned in the above point.

Configuration location differs depending on the operating system your on. In Windows NT enter the **User Manager** and choose **User Rights** from the **Policies** menu. If interested in generating security audits, select the **Audit** option from the **Policies** drop-down menu in the **User Manager**. From this dialog, check the **Success** and **Failure** buttons next to "File and Object Access".

In Windows 2000 and XP, users rights can be modified under **Administrative Tools** under **Local Security Policy**. While on a domain controller, users rights may be modified under **Administrative Tools**, which is under **Domain Controller Security Policy**. From either application, right click on the **User Rights Assignment** to list all user rights.

To enable security audits, click on **Audit Policy** from within **Local Security Policy** under **Local Policies**. Double-click on the **Audit Object Access** policy and check both **Success** and **Failure** boxes. The computer's operating system must have the latest service pack installed as this fixes auditing problems with earlier releases.

The following table may assist a user in determining what rights must be given to a user on the machines involved in FasTrak's NT Authentication Security.

Remote Server Machine	Local Server Machine	Client Machine
Access this computer from the network	Generate Security Audits	N/A
Generate Security Audits	Manage auditing and security log	
Manage auditing and security log		

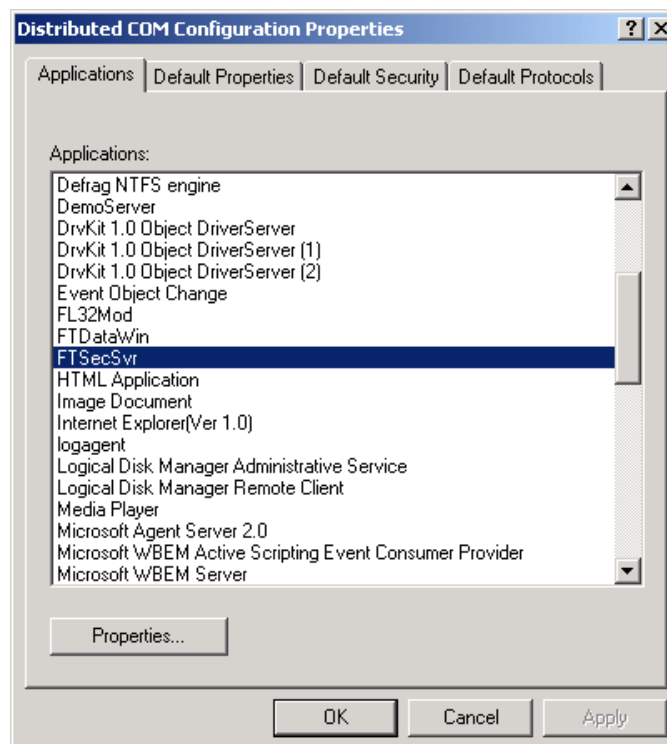
NOTE: It is mandatory that you reboot the machine for the new user rights to take effect.

Configuring DCOM for NT Authentication Security

The machine that the user wishes to run FTSecSvr (FasTrak Security Server) on must be configured for proper server/client communication. Below are the needed steps for configuring the server.

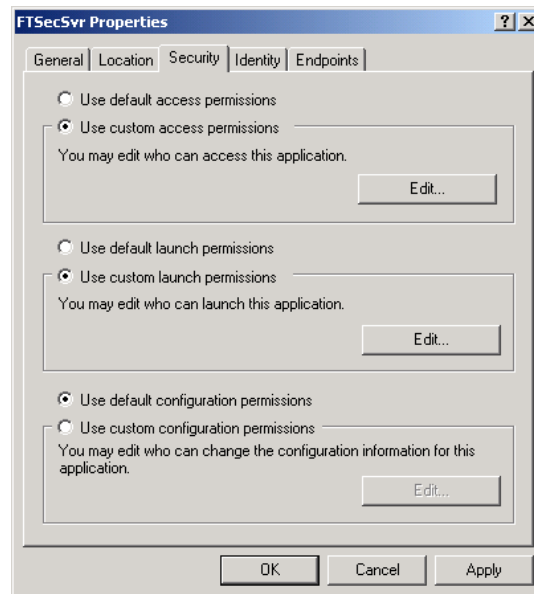
Configuring DCOM on Windows 9x, 2000, and NT

DCOM enables FasTrak clients, such as PLC WorkShop, to communicate with remote security servers. The dialog window, shown below, is launched by running **dcomcnfg.exe** from a DOS prompt or by clicking on the Windows **Start** button followed by clicking **Run**. Changes made in DCOM are applied immediately and there is no need to reboot the PC.

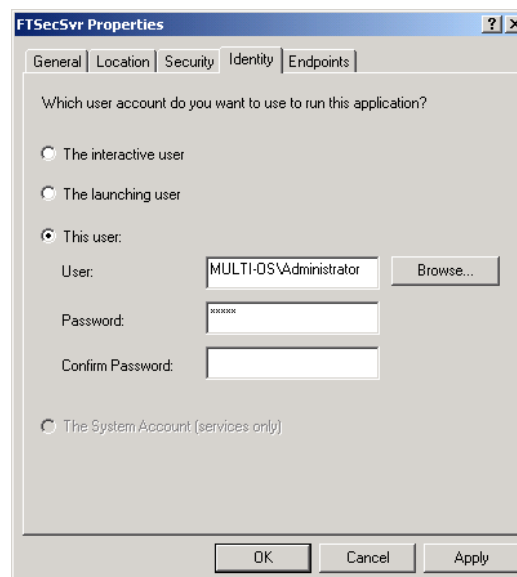


Instructions for Configuration

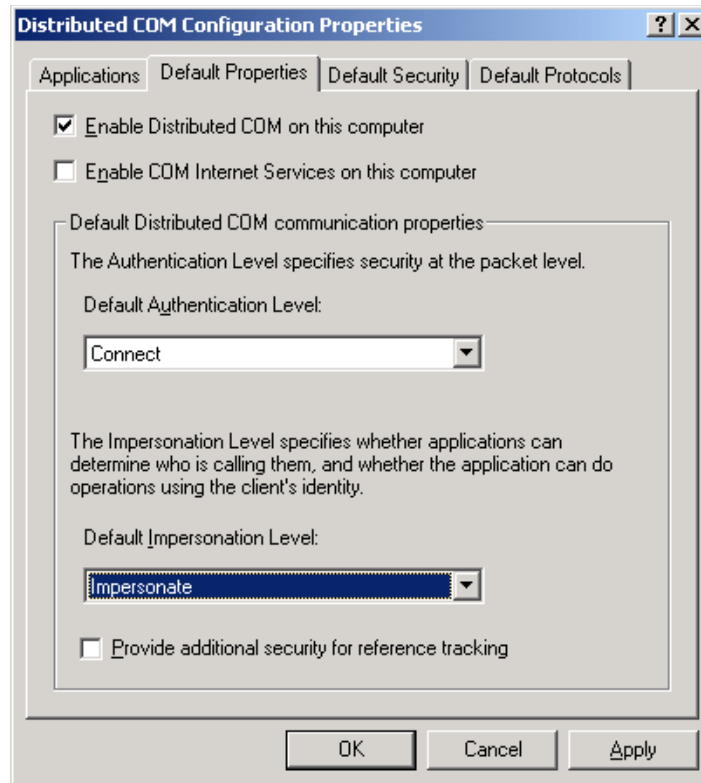
1. In the **Applications** list box, scroll down and select **FTSecSvr**. If this item is missing, it was not properly installed; refer to earlier sections in this manual.
2. Select the **Properties** button.
3. The **Properties** dialog window opens. Click the **Security** tab.



4. Under **Security**, choose the **Administrator** (from section *Configuring User Rights and Audit Policy*) who will have access permission. The following affects both the areas of Access and Launch. For Custom security for Launch and Access Permissions, follow these steps.
 - While in the **Properties** dialog, with the **Security** tab being active, click on **Edit**.
 - Click **Add** and choose the **Administrator**.
5. Choose the **Identity** tab and click the "this user" radio button.



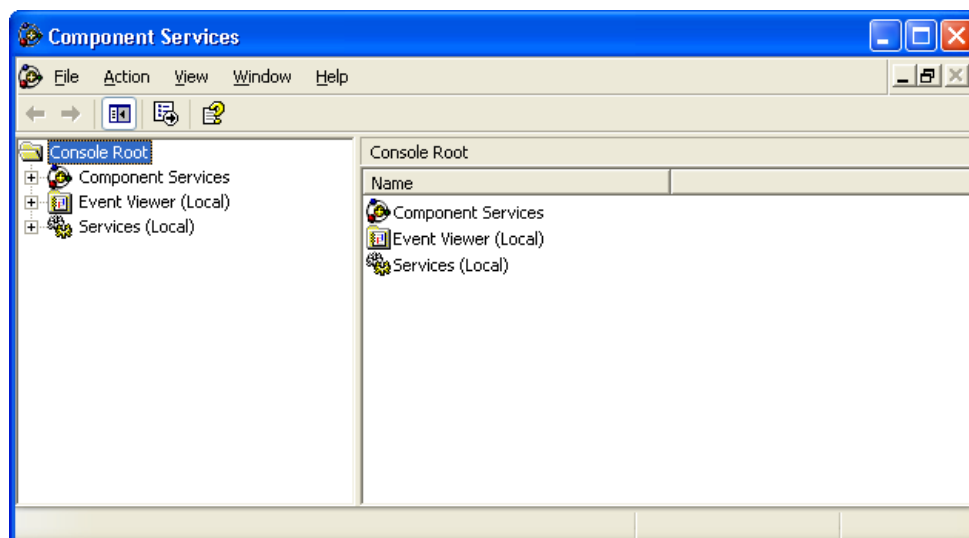
6. Browse and select the Administrator. Click **OK** to return to the main dialog.
7. Finally, click the **Default Properties** tab and choose "connect" for **Default Authentication** and "impersonate" for **Default Impersonation**.



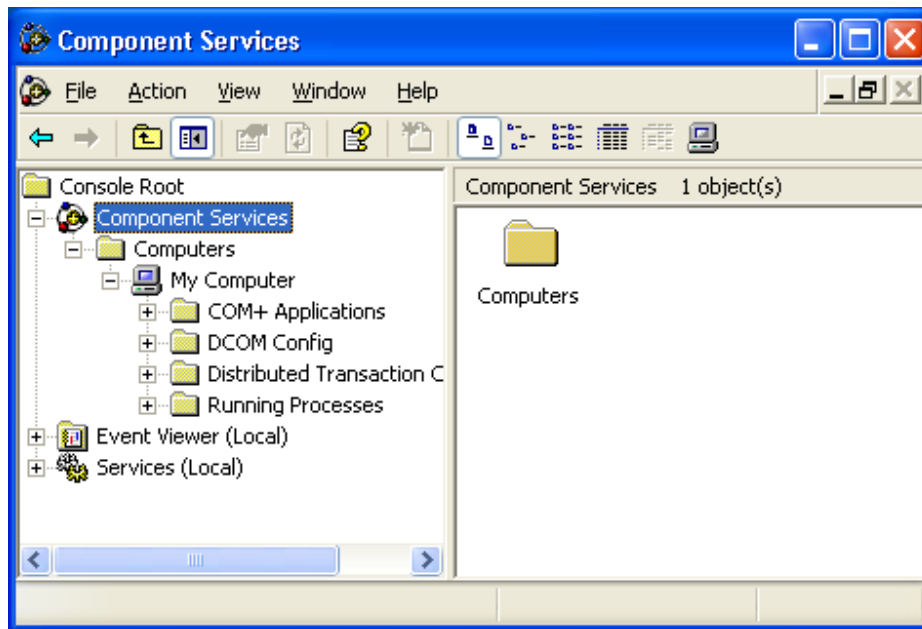
8. If the server is on a remote machine, then for the client, step 7 from above needs only be repeated.

Configuring DCOM for Windows XP

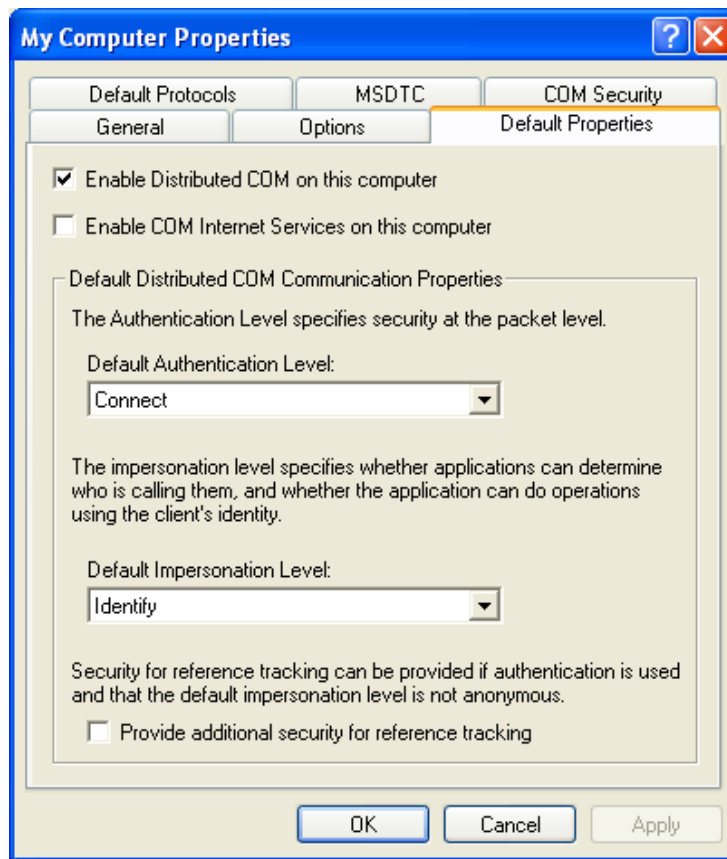
Configuring DCOM under Windows XP begins with launching the application, dcomcnfg.exe, from a DOS prompt or the Run dialog, just as in the previous instructions. The following dialog launches.



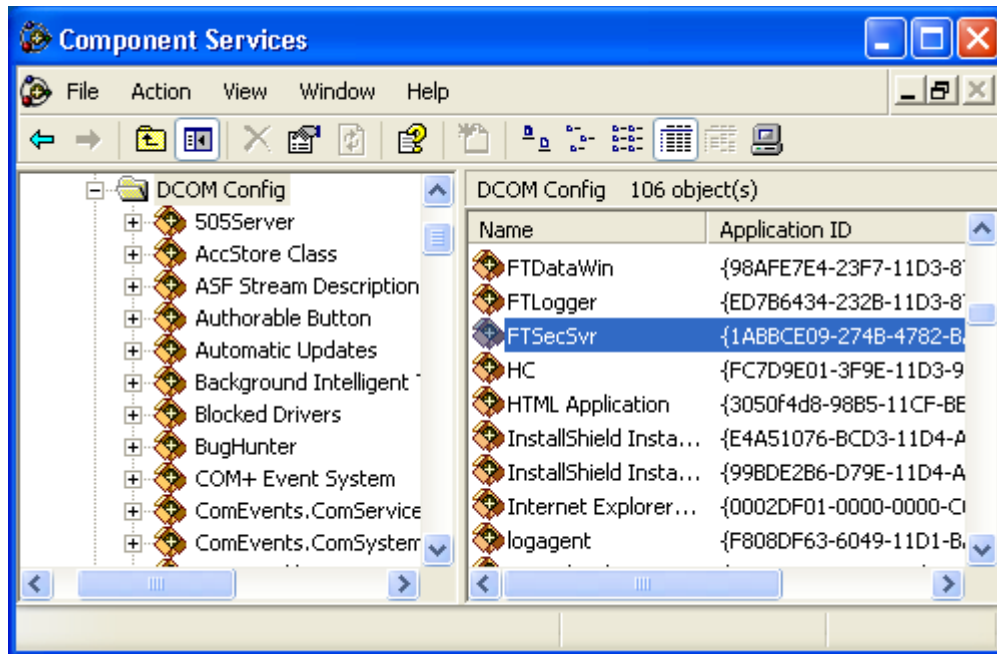
Using the tree structure in the left-most pane, expand the selection of **Component Services** to **Computer** and then to **My Computer**, as shown in the dialog window below.



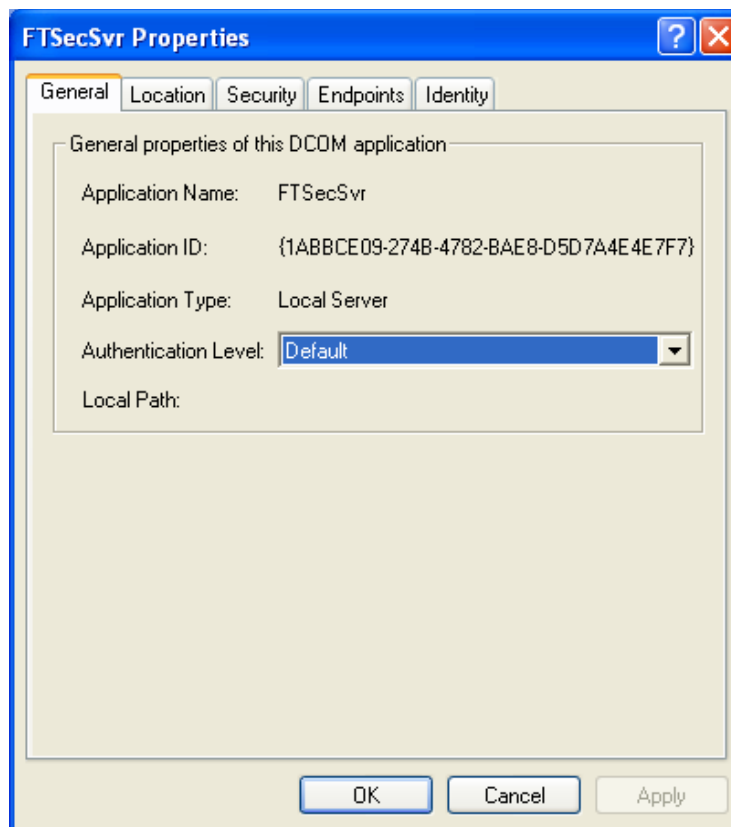
Right-click on **My Computer** and select **Properties**. In the **Default Properties** tab, select the default authentication and impersonation levels.



To set the security and identity properties for FTSecSvr, select **DCOM Config** under **My Computer** in the **Component Services** dialog. The available registered COM applications will be displayed. Scroll and select **FTSecSvr**.



Open its properties by right-clicking on it. The dialog is shown below.



Follow the steps listed above to configure DCOM.

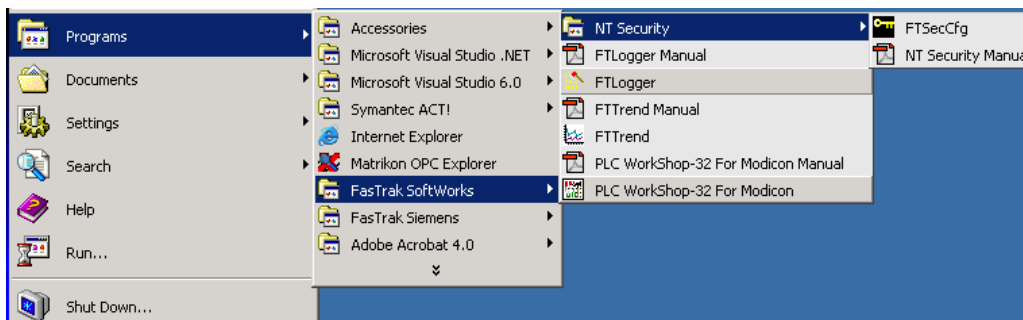
Security Configurator

The Security Configuration Application (**FTSecCfg.exe**) allows users with administrator rights to configure their centralized server based security. This file will reside on the same machine and directory as the server. Users will also be able to install FTSecCfg on client machines running Windows NT (3.1 or later)/2000/XP so that they can configure their security server remotely. The following features are supported.

- Ability to configure which users and/or groups have access to various FasTrak features. This includes users and groups from the machine running the server. Separate secure features will exist for individual FasTrak applications including programming packages as well as ControlShop applications.
- Security Auditing** can be configured for each specific feature on an individual or group basis. Audit information will be logged to the **Event Viewer** in the **Security Log** section.
- A link to the Event Viewer will be provided allowing quick access to the Security Log. The event viewer can also be accessed under **Administrative Tools** in **Control Panel**.

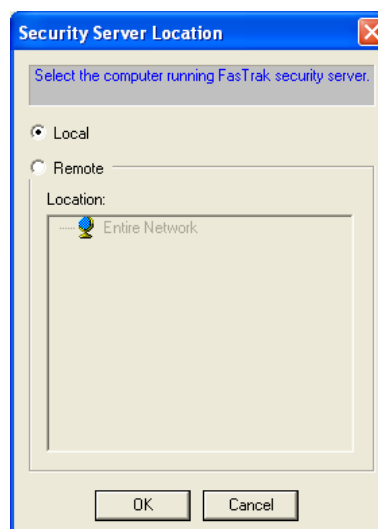
Launching the Security Configurator

The Configuration Application may be launched by either clicking the **Start** button in Windows and going to the **Programs** menu or from within the FasTrak client should it be installed.



The Security Configurator application will launch and (if the user is not in the client), at the same time, the **Security Server Location** dialog may open.

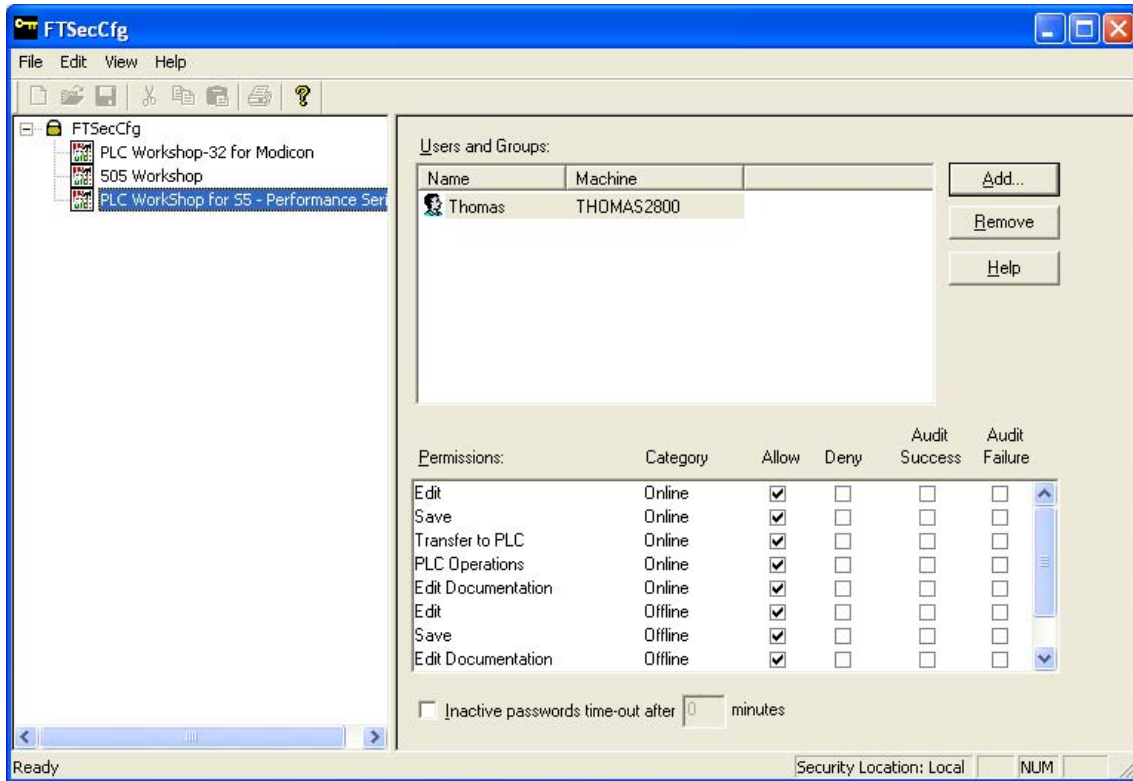
When launched from the **Start** menu, the **Security Server Location** dialog will prompt the user to select the machine that the server will run on.



Configuring Users, Groups, and Security Audit

After security has been configured and a server location selected, individual users, groups of users, and permissions may be set from within the **FTSecCfg** utility.

To access the FTSecCfg utility within WorkShop, select the **Options \ Security \ Administrator Options \ Configure** menu item. To access the FTSecCfg utility from the Start menu, select **Start \ Programs \ FasTrak SoftWorks \ NT Security \ FTSecCfg**. In either case, the **FTSecCfg** dialog appears.



The selected server machine appears in the status bar in the lower right portion of the application window.

In the left pane, the WorkShop application for which the permissions will apply may be selected.

In the **Users and Groups** list box, two names (System and either the administrators group or the current user) will exist by default with access to all features. The list box is sorted with groups listed first followed by users. A group is identified with the two-person icon to the left while the user is identified with the one-person icon. A combination of approximately 16 users and groups can be configured for an application. Users and groups that are not displayed in the list box are automatically denied access to all features.

Adding Users and Groups

To add users and groups:

1. Select **PLC Workshop for Siemens S5 - Performance Series** from the list in the left pane. The users previously added to WorkShop appear in the **Users and Groups** list box.
2. Click the **Add** button.

Removing Users and Groups

To remove a user or group:

1. Select **PLC Workshop for Siemens S5 - Performance Series** from the list in the left pane. The users previously added to WorkShop appear in the **Users and Groups** list box.
2. Highlight a name within the **Users and Groups** list box.
3. Click the **Remove** button.

Setting Permissions

To set permissions for a user or group:

1. Select **PLC Workshop for Siemens S5 - Performance Series** from the list in the left pane. The users previously added to WorkShop appear in the **Users and Groups** list box.
2. Select the desired user from the **Users and Groups** list box.
3. Within the **Permissions** list box:
 - Select the applicable **Allow** check boxes to allow the server to provide access when requested by the client (for example, PLC WorkShop).
 - Select the applicable **Deny** check boxes to prevent access by the server when requested by the client.

In cases where a user has conflicting rights on a permission, the denied permission will always take precedence and the user will not be able to access the feature. For example, a user may be allowed access to a specific permission but a group he belongs to is denied access to the same permission. If neither box is checked, the user will not be granted access to the feature unless one of the groups he belongs to has access to the feature.

Setting Inactivity Timeout

To set the inactivity timeout for a user:

1. Select **PLC Workshop for Siemens S5 - Performance Series** from the list in the left pane. The users previously added to WorkShop appear in the **Users and Groups** list box.
2. Select the desired user from the **Users and Groups** list box. The user's security privileges appear in the **Permissions** list box.
3. Click the **Inactive passwords timeout after** check box beneath the **Permissions** list box to enable the **minutes** edit box.
4. Enter the number of minutes WorkShop may remain inactive before the user must re-enter his Windows user name and password. The inactive timeout period may range from 1 to 999 minutes.

NOTE: A user is not required to re-enter his Windows user name and password as long as password protected activity occurs in WorkShop within the timeout period.

Security Audits

Security audits for individual features can be performed on users and groups. These audits will appear in the security log on the server machine and can be accessed using Microsoft's Event Viewer. (See **Event Viewer** for more details.) A **Success** audit will appear in the security log when a user is given access to a secure feature, and the **Audit Success** box is checked for that feature. A **Failure** audit will appear in the security log when a user is denied access to a secure feature, and the **Audit Failure** box is checked for that feature.

To perform a security audit on a user or group for an individual feature:

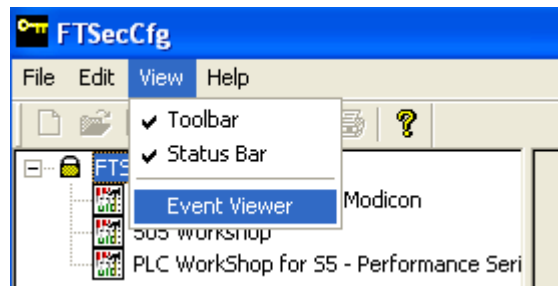
1. Select **PLC Workshop for Siemens S5 - Performance Series** from the list in the left pane. The users previously added to WorkShop appear in the **Users and Groups** list box.
2. Select the desired user from the **Users and Groups** list box.
3. Within the **Permissions** list box:
 - Select the applicable **Audit Success** check boxes to enable **Success Audits** for the selected features.
 - Select the applicable **Audit Failure** check boxes to enable **Failure Audits** for the selected features.

NOTE: All security changes in FTSecCfg are accumulated and do not get committed to the server until confirmation upon exit of FTSecCfg.

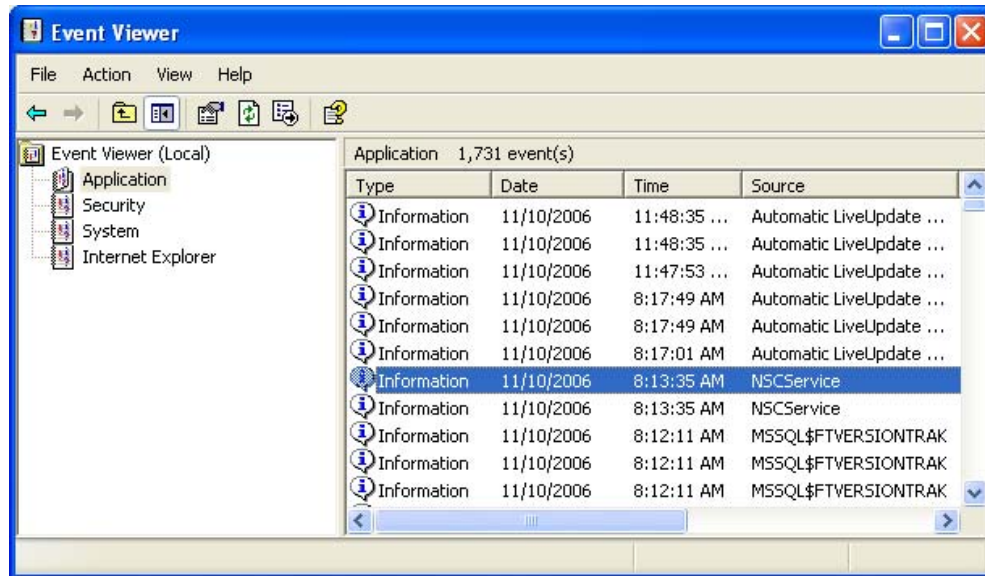
Event Viewer

The Event viewer is a Windows application for displaying application, security, and system logs. FasTrak uses and writes to this log to hold audits. It is launched from within the **Security Configurator**.

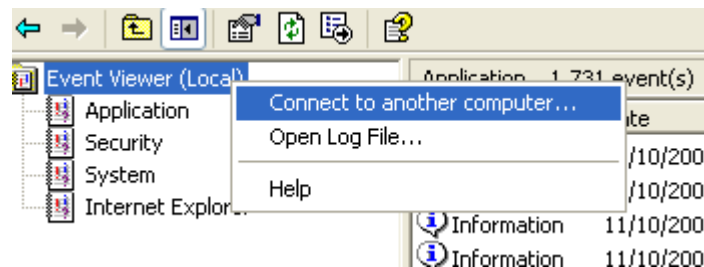
To launch the **Event Viewer**, select the **View \ Event Viewer** menu item as illustrated below. The Event Viewer is also accessible from the **Administrative Tools** of the Windows **Control Panel**.



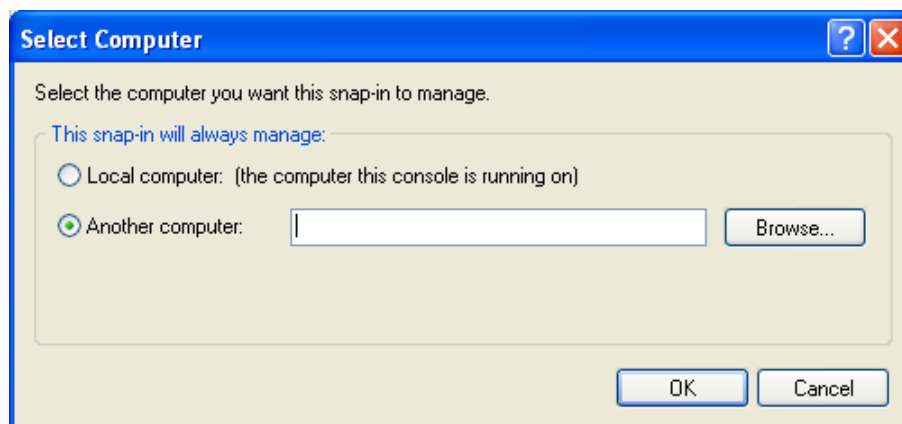
The following window opens. Double-clicking an entry in the right-most pane above will display more information for the item.



From this application, the user may view the Security log. If running the Security Configurator from a different machine than the security server (FTSecSvr), then the security server's machine name must be specified in the event viewer to view the security log entries referring to FasTrak security. This can be accomplished by highlighting the **Event Viewer** in the tree control and then selecting the **Action \ Connect to another computer** menu item as illustrated below.



The **Select Computer** dialog appears.



- Use the **Browse** button for searching for and selecting another computer.
- Click **OK** to accept the selection.

6 - Auditing

The Activity Audit contains records that list programming and setting changes made by users while running WorkShop. These records contain:

- The date and time the activity occurred
- A general description of the activity
- The machine name of the computer on which the activity occurred
- When available, the name of the user who performed the activity

Examples of particular Audit activities that may be recorded in the Activity Audit file include:

- Each time PLC WorkShop attaches online to a PLC
- Whenever logic is changed in the ladder program
- PLC memory configuration is modified

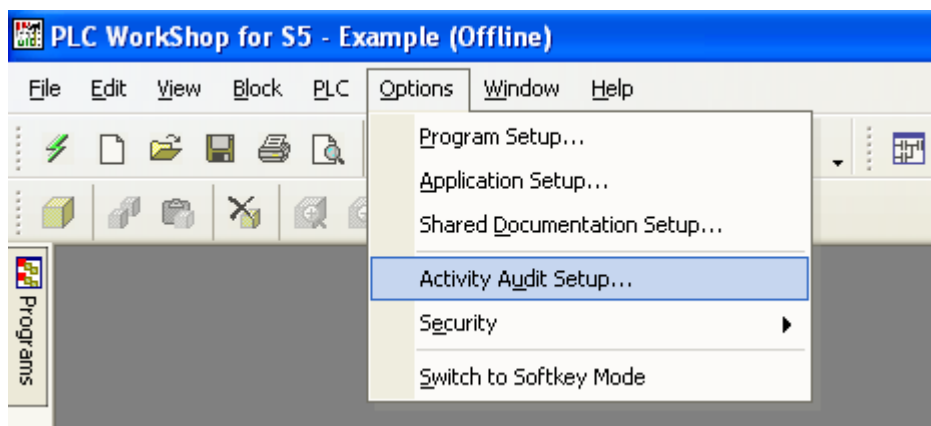
Activity Audits can be written to Microsoft Access files, Structured Query Language (SQL) files or the Windows Activity Log (when the **FT Security Server** is running on an accessible computer). See **FasTrak Authentication and NT Security** for more information.

Activity Audits written to Microsoft Access and SQL files may be read with many popular viewers. Audits written to the Windows Activity Logs may be read with the **Windows Event Viewer**, which is found in the Windows NT/2000/XP **Administrative Tools** menu.

The Activity Audit feature may be used in conjunction with **Password Security** but can also be used independently.

Setup

Select the **Options \ Activity Audit Setup** menu item as illustrated below to setup the activity audit.



If security is not enabled, the **Activity Audit Setup** option is not protected and any user can access this feature.

When security is enabled, WorkShop determines under which operating system it is running. If WorkShop is running under Windows 95/98/ME, the **Password Required** dialog appears.



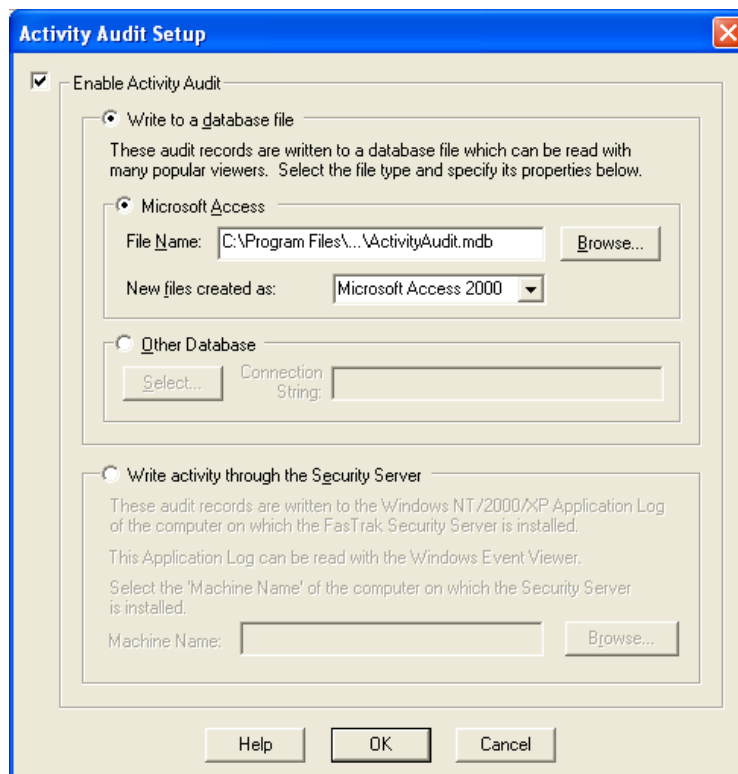
This dialog verifies the entered **Name** and **Password** are those of an administrator. Only an Administrator is allowed to edit / enable audits when security is enabled.

Activity Audit Setup

The **Activity Audit** feature records events and user actions for future review. The records are stored in a database or in the Windows NT/2000/XP Application Log through the **Security Server**.

See also: **Security Audit**, which records access to password-protected areas of WorkShop.

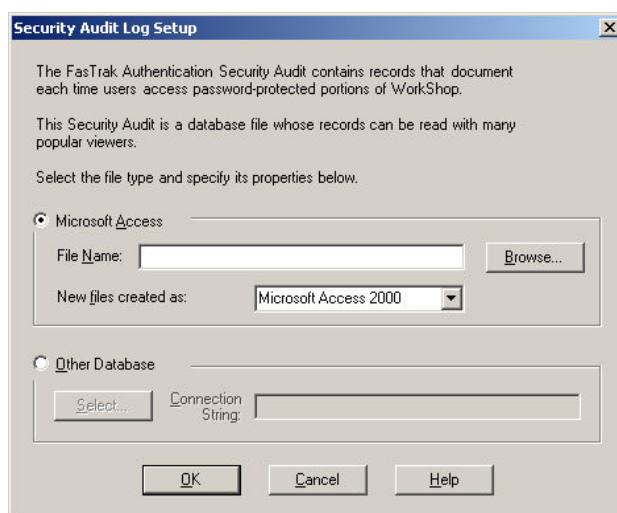
To bring up the **Activity Audit Setup** dialog, select the **Options \ Activity Audit Setup** menu item.



- **Enable Activity Audit** - check this box to activate the activity audit feature.
- **Write to a database file** - select this option to store activity information in a database. The other option is to store the information in the Windows Application Log using the **Write activity through the Security Server** option.
- **Microsoft Access** - Select this option to use a **Microsoft Access** database. The other option is to use **Other Database** as described below.
- **File Name** - Select the Access database by typing the path or by using the **Browse** button. To create a new database, enter a filename that does not currently exist.
- **New files created as:** - Select the format for the new Microsoft Access database created if the File Name selected above does not already exist.
- **Other Database** - Select this option to use another type of database. Click Select to bring up the **Data Link Properties** dialog. The other option is to **Write to a database file**, as described above.
- **Write activity through the Security Server** - Select this option to store the activity information in the Windows NT/2000/XP Application Log through the Security Server. The other option is to store the information in a database using the **Write to a database file** option as described above.
- **Local** - Select this option to store information in the Application Log on this computer. This option is only available under Windows NT, Windows 2000, or Windows XP.
- **Remote** - Select this option to store information in the Application Log of a Security Server on your network.
- **Machine Name** - Select the remote computer that hosts the Security Server. This computer must be running the FasTrak Security Server software under Windows NT, Windows 2000, or Windows XP.

Security Audit Log Setup

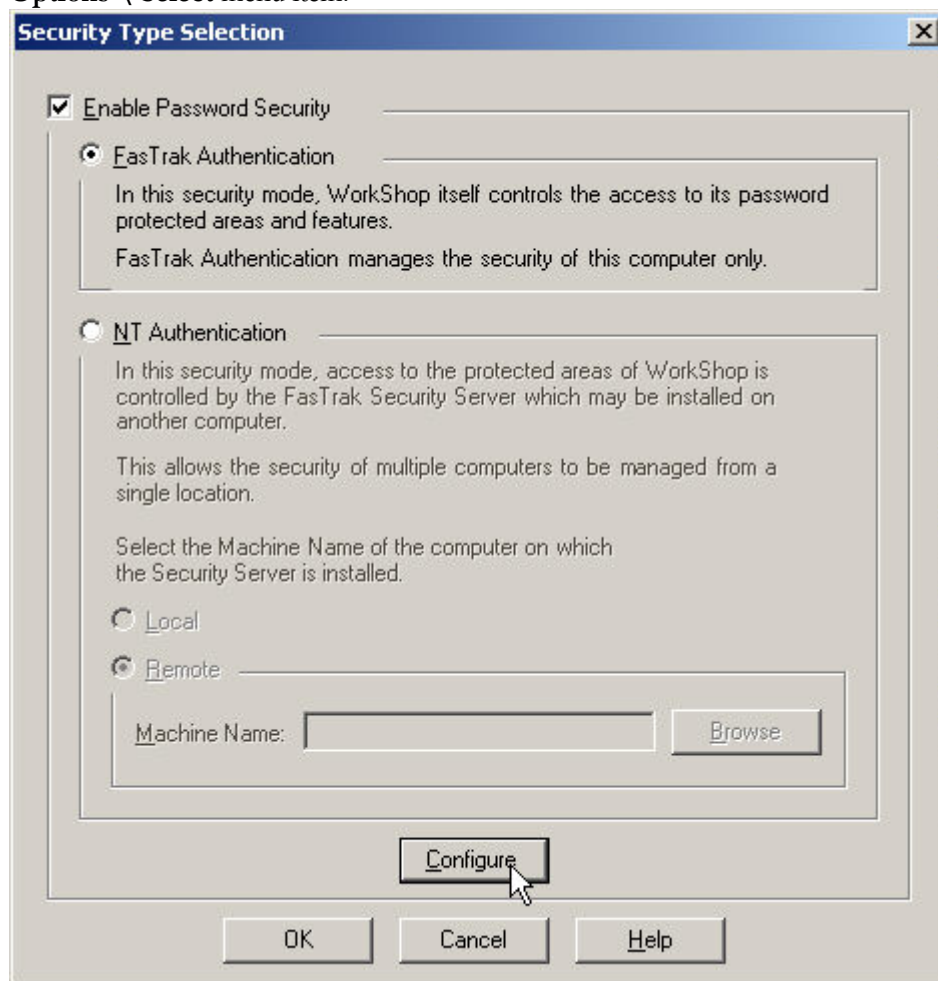
The security audit feature records access to password-protected parts of WorkShop. The records are stored in a database or in the Windows NT/2000/XP Application Log through the Security Server. The security audit feature is available only when using FasTrak security. When using NT Authentication, access is recorded by the Security Server.



- **Microsoft Access** - Select this radio button to store the security audit information in a Microsoft Access database
- **File Name** - Select the Access database by typing the path or by using the **Browse** button. To create a new database, enter a filename that does not currently exist.
- **New files created as:** - Select the format for the new Microsoft Access database created if the file selected above does not already exist.
- **Other Database** - Select this option to use another type of database. Click **Select** to bring up the **Data Link Properties** dialog.

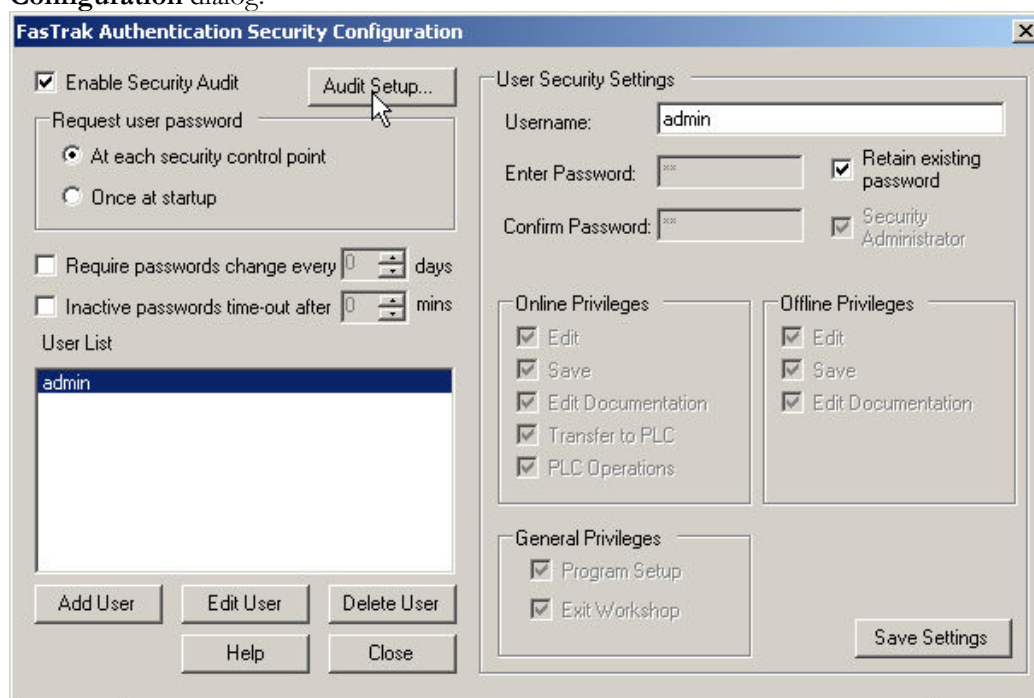
To bring up the **Security Audit Setup** dialog:

1. Open the **Security Type Selection** dialog by selecting the **Security \ Administrator Options \ Select** menu item.



2. Check the **Enable Password Security** box.
3. Select the **FasTrak Authentication** radio button.

- Click the **Configure** button to bring up the **FasTrak Authentication Security Configuration** dialog.



- Check the **Enable Security Audit** box.
- Click the **Audit Setup** button.

7 - Programming

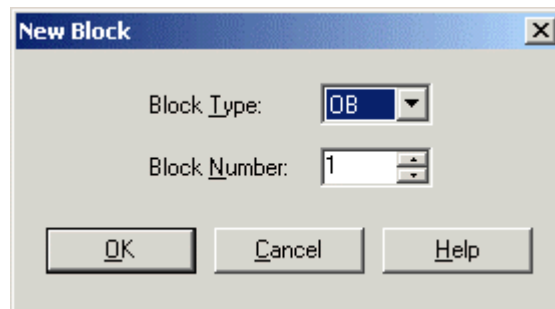
In this section you will discover how to enter and modify logic using PLC WorkShop's features. Remember, in the Windows environment there is usually more than one way to complete a task. PLC WorkShop provides keyboard support to access all commands. You may find that the most efficient method of programming will be through a combination of keyboard and mouse techniques.

Block Operations

New Block

To create a new block:

1. Select the **Block \ New Block** menu item, click the toolbar icon, or right-click on a block category icon in the program tree display. The **New Block** dialog appears.

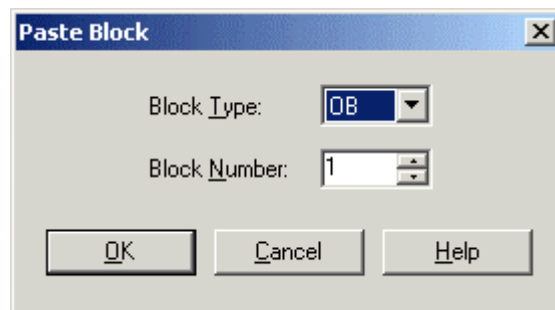


2. Select the Block Type and Block Number.
3. Click **OK**.

Copy/Paste Block

To copy and paste blocks:

1. Select the **Block \ Copy Block** menu item or click the toolbar icon to copy the block in the current block editor, or right-click on the block to be copied in the program tree display.
2. Select the **Block \ Paste Block** menu item or click the toolbar icon. The **Paste Block** dialog appears.



3. Select the **Block Type** and **Block Number**.
4. Click **OK**.

Zoom Into Block

Open and display the contents of the block referred to by the instruction under the **Zoom Cursor**. In other words, go into the selected block.

To Zoom Into a Block:

1. Place the zoom cursor on the block reference, by using the **Zoom Next** and **Zoom Previous** operations.
2. Either click the **Zoom Into** icon on the toolbar or select the **Blocks \ Zoom Into** menu item.

Zoom Out of Block

"Back out" of a **Zoom Into Block**. Display the location where the **Zoom Cursor** was when a Zoom Into Block operation occurred. Repeated Zoom Out of Block operations reverse Zoom Into Block operations in reverse order - the first Zoom Out of Block reverses the last Zoom Into Block.

To Zoom Out of a Block:

1. Either click the **Zoom Out of Block** icon on the toolbar or select the **Blocks \ Zoom Out of** menu item.

Zoom Next/Previous

Move the **Zoom Cursor** to the next or previous zoomable location.

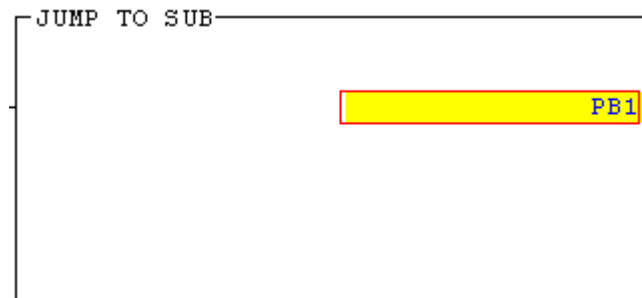
To zoom the next or previous zoomable location:

Click the appropriate toolbox icon, or select the **Block \ Zoom Next** or **Block \ Zoom Previous** menu item.

Zoom Cursor

The Zoom Cursor controls the location of **Zoom Into Block** operations.

Move the Zoom Cursor by using the **Zoom Next** and **Zoom Previous** operations.



The Zoom Cursor is a highlight on a zoomable block reference. The color of the highlight can be changed using the **Colors** tab on the **Program Setup** dialog.

Logic Operations

New Segment

To insert a new segment of ladder or STL, select the **Logic \ New Segment** menu item or click the toolbar icon.

You can also insert a segment by using the **Insert** operation.

New Row

To insert a new row in the current segment of ladder, STL, or data, select the **Ladder \ New Row** menu item or click the toolbox icon.

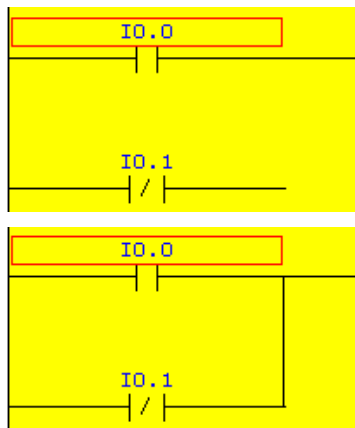
You can also add a row by using the **Insert** operation.

Toggle Branch

To insert or remove a branch in ladder logic, select the **Logic \ Toggle Branch** menu item or press [F9].

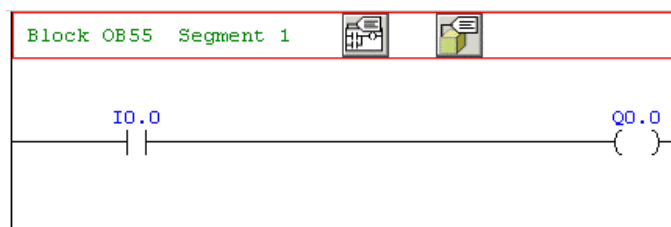
You can also insert or remove a branch using the **Branch Up** or the **Branch Down** relay from the toolbox.

A branch is added to or removed from the right and down from the cursor location.

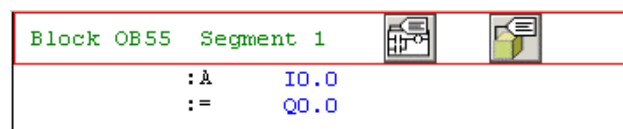


Switch to Statement List

To switch from viewing logic as ladder when possible to viewing it as STL in all cases, either select the **Logic \ Switch to STL** menu item or click the toolbar icon.

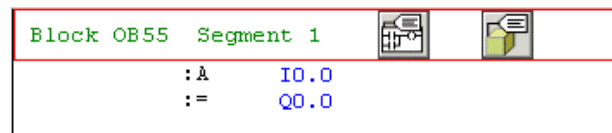


becomes

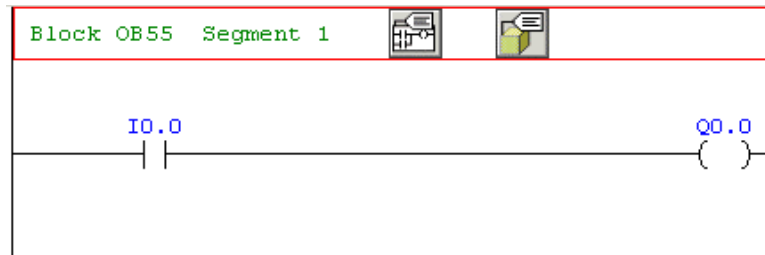


Switch to Ladder

To switch from viewing logic as STL in all cases to viewing it as ladder where possible, either select the **Logic \ Switch to Ladder** menu item or click the toolbar icon.



becomes



Note that ladder logic is a view of certain sequences of STL code, and not all STL code can be represented as ladder logic. When in Ladder mode, WorkShop displays the code that can be displayed as ladder as ladder and the rest as STL.

Validate and Enter

When you edit a line of STL or data, or a segment of ladder, the affected area goes into an edit mode, which is highlighted by a different background color. The Validate and Enter operation checks the syntax of the parts of the program that are in edit mode, and if they are valid, enters them in the program and clears the highlight.

The edit mode background is yellow by default, but configurable on the **Colors** tab of the Program Setup dialog.

To **Validate and Enter** edits:

Select the **Logic \ Validate and Enter** menu item, click the toolbar icon, or press the [F8] key.

Edit Mode and Validate and Enter

When you begin editing a segment, the segment is placed in Edit mode.

Edit mode is indicated by a change in background color. In Online mode, a segment in Edit mode is in a special buffer outside the actual program, and the original segment remains in place unchanged. When you have completed the edits, **Validate and Enter** the changes by selecting the **Logic \ Validate and Enter** menu item, pressing F8, or clicking the check mark (✓) button on the toolbar. The system validates the changed segments, and if the segments are valid, enters them in the actual program. If necessary, PLC WorkShop displays a dialog so you can stop the PLC. In either online or off line mode, the segments return to the normal display.

WARNING: The validation only examines the edited segment. It is possible for changes in one segment to affect another, causing unexpected results.

Editing Commands

PLC WorkShop provides a number of time-saving editing commands to help you with your programming tasks. Use these commands to quickly copy logic and documentation to either another location in the same program or another program.

Cut	Removes the selected logic or data from the program and places it on the clipboard.
Copy	Places a copy of the selected logic or data on the clipboard.
Paste	Inserts the clipboard contents – not including documentation - into the program at the cursor location.
Paste Special	Inserts the clipboard contents, with the option of including documentation, into the program at the cursor location.
Paste with Rewire	Inserts clipboard contents into the program at the cursor location and allows the user to re-address any addressable items contained in the clipboard.
Insert	Inserts space for new logic or data above or to the left of the insertion point, moving the existing logic or data as needed.
Clear	Removes selected content without moving the surrounding content, leaving a blank area.
Delete	Removes both the content and the space it occupied, and moves other content as needed.

Selecting by Segment or by Parts

Program logic or data may be selected (for copying, cutting, deleting, or clearing) either by whole segments or by individual parts. In order to **Paste with Rewire**, the contents of the clipboard must have been selected by segment.

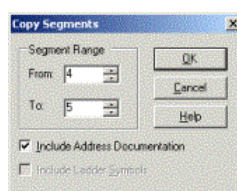
NOTE: Selecting by parts is not the same as selecting by segments, even if you have selected all the parts of a segment.

By Segment

To select by segment, click the segment header, as shown.



When the selection is by segments and you cut or copy, PLC WorkShop displays a dialog to give you easier control over the selection:



This makes selecting large areas much easier – simply select any segment in the block, and use the dialog to specify the range.

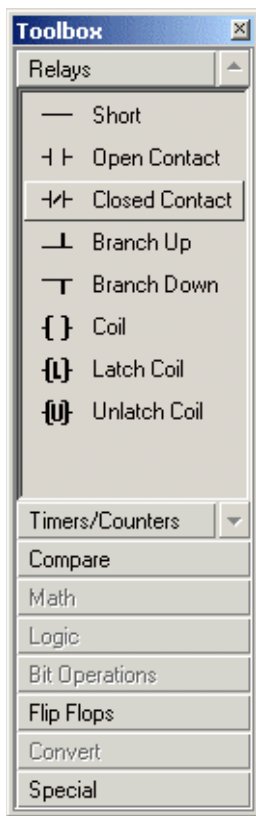
By Parts

To select by parts, click and drag directly on the desired parts.

If you drag the mouse from one segment to another, the selection changes from by parts to by segment.

Toolbox

The toolbox provides a convenient way to select ladder elements to place in logic. Clicking on an instruction turns the mouse cursor into an instruction-dropping cursor. When you click an instruction-dropping cursor on the ladder logic editor, that instruction is dropped into the ladder logic.

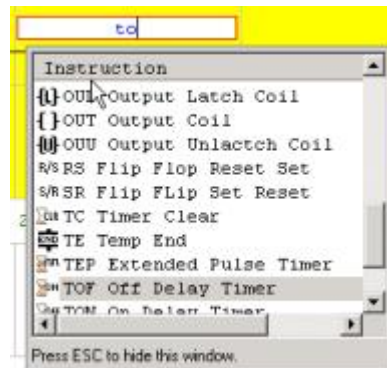


To turn the toolbox display on or off, select the **View \ Toolbox** menu item.

To access the items in a category, click that category. In the illustration, the **Relays** category has been clicked.

Typing Instructions

You can enter instructions by simply placing the cursor at the desired location and typing. PLC WorkShop presents an auto-completion window.

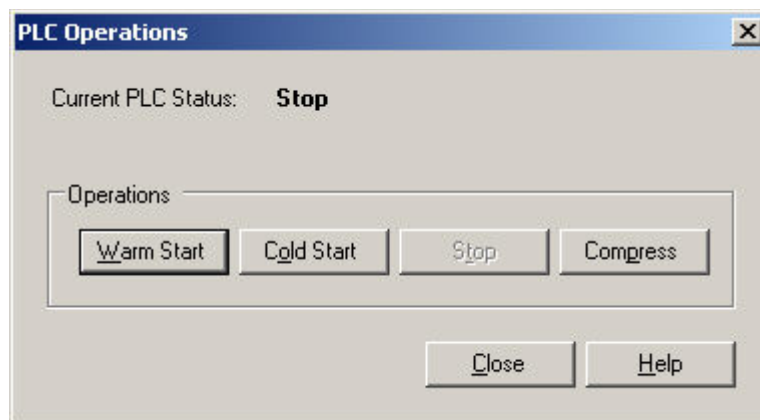


Using the Diagnostic Features

PLC WorkShop contains several powerful diagnostic features to check PLC status and fine-tune PLC operation. Diagnostic features include:

PLC Operations

Use the **PLC Operations** dialog to perform basic PLC operations.



- **Warm Start** - Start the PLC if it was stopped without a fault. The warm start retains register data and the PLC resumes processing at the point of interruption.
- **Cold Start** - Start the PLC if it was stopped by a fault. The cold start clears register data before starting the PLC.
- **Stop** - Stop the PLC.
- **Compress** - Eliminate gaps in PLC memory allocation to free memory for programs and data.

To access the **PLC Operations** dialog:

Select the **PLC \ Operations** menu item.

PLC Status

Use the PLC Status dialog to find information on the status of the PLC process.

The screenshot shows the 'PLC Status - S5Program1 (Online)' dialog box. It contains several sections:

- PLC Type:** 135U CPU928B
- Communications Path:**
 - Comm. Port: COM1
 - Path File: C:\...new.ini
 - Path Name: MAIN
- PLC Memory (Bytes):**
 - Total: 065536
 - Used: 000844
 - Free: 064692
- Program Information:**
 - OB Blocks: 003
 - PB Blocks: 000
 - FB Blocks: 010
 - DB Blocks: 003
 - SB Blocks: 000
 - FX Blocks: 000
 - DX Blocks: 000
- Processor Status:**
 - ☒ Run
 - ☐ Stop
 - ☐ Fault
 - ☐ Battery Low
- Processor Switch:**
 - ☒ Run
 - ☐ Stop
- Fault:** (Empty text field)
- Buttons:** Debug... and Close

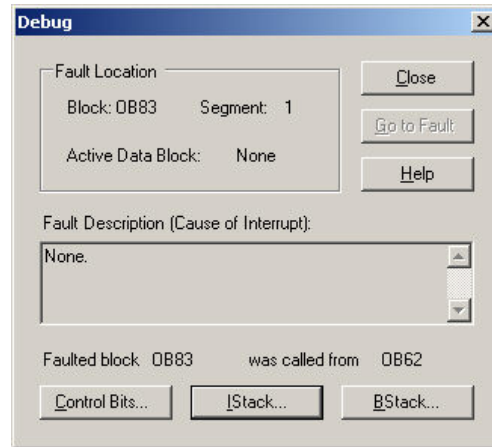
- **Communications Path** - The path to the PLC. The **Comm. Port** field displays the selected port. The **Path File** is the file containing path configurations. The **Path Name** identifies a path within the path file. To examine or configure this information, use the **Path Editor**.
- **PLC Memory** - Displays the **Total**, **Used**, and **Free** memory in the PLC, in bytes.
- **Program Information** - Displays the number of blocks of each type.
- **Processor Status** - Displays the current state of the PLC.
- **Processor Switch** - Displays the state of the run/stop switch on the front of the PLC.
- **Debug** - Click this button to access the **Debug** dialog.

To access the **PLC Status** dialog:

Select the **PLC \ Status** menu item.

Debug

Use the **Debug** dialog to get detailed information about the program and PLC status.



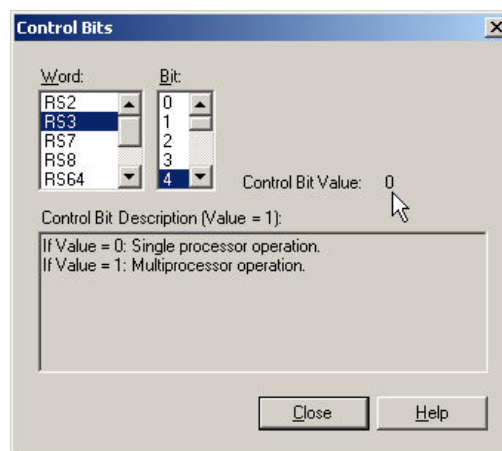
- **Fault Location** - Indicates the block and segment where the fault occurred, and the data block that was active.
- **Fault Description** - Provides a brief description of the fault.
- **Control Bits** - Click this button for information on the status of the processors control bits. This information is available whether the PLC is running or stopped due to a fault.
- **IStack** - Click this button for program status information stored on the PLC. This information is only available if the processor is stopped due to a fault.
- **BStack** - Provides block and address information about the current block stack. This information is only available if the processor is stopped due to a fault.

To access the **Debug** dialog:

Select the **Diagnostics \ Debug** menu item, or click the Debug button on the **PLC Status** dialog.

Control Bits

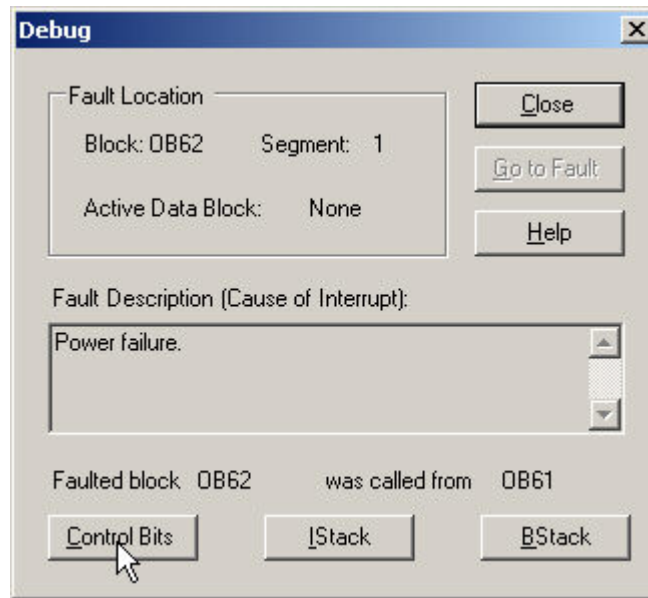
The Control Bits dialog shows the current state of any control bit, and a description of the meaning of the bit.



- **Control Bit Value:** The current value of the bit.

To access the **Control Bits** dialog:

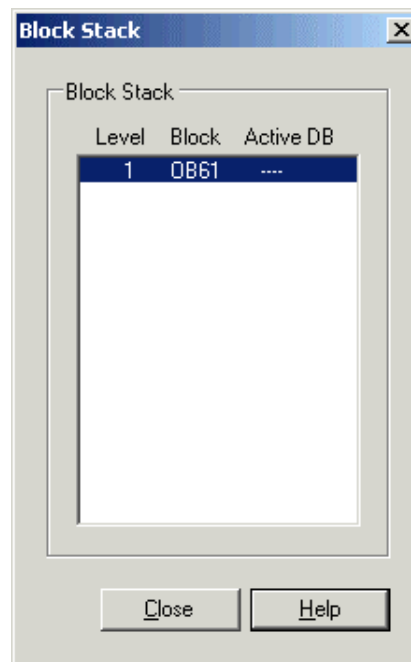
1. Open the **Debug** dialog by selecting the **Diagnostics \ Debug** menu item.



2. Click the **Control Bits** button.

Block Stack

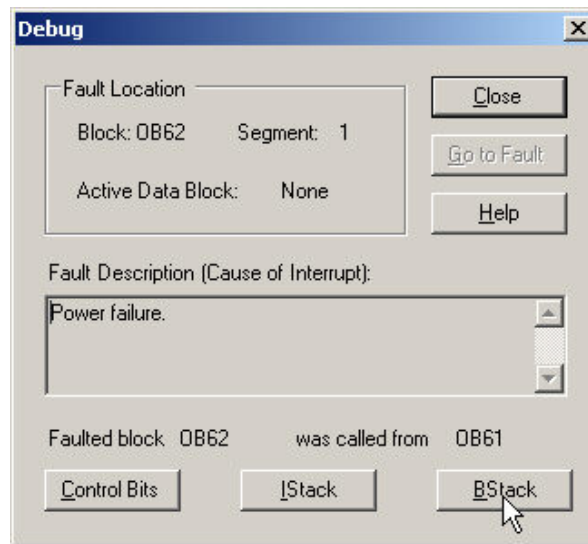
The Block Stack dialog shows the stack of called blocks, for debug purposes. This information is only available if the processor is stopped due to a fault.



To access the **Block Stack** dialog:

This information is only available if the processor is stopped due to a fault.

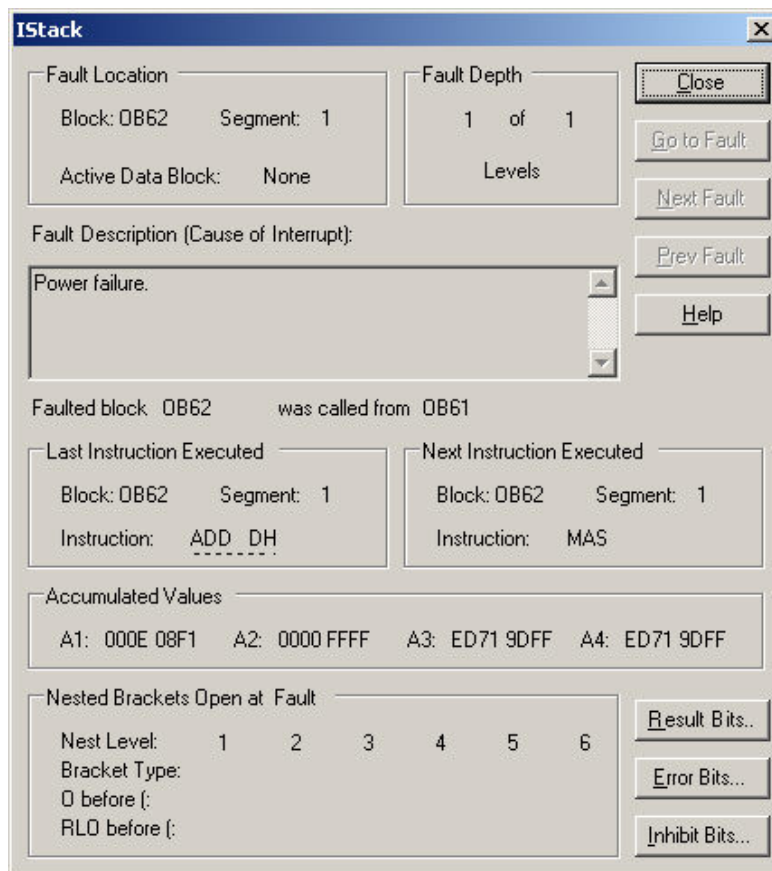
1. Open the **Debug** dialog by selecting the **Diagnostics \ Debug** menu item.



2. Click the **BStack** button.

Interrupt Stack

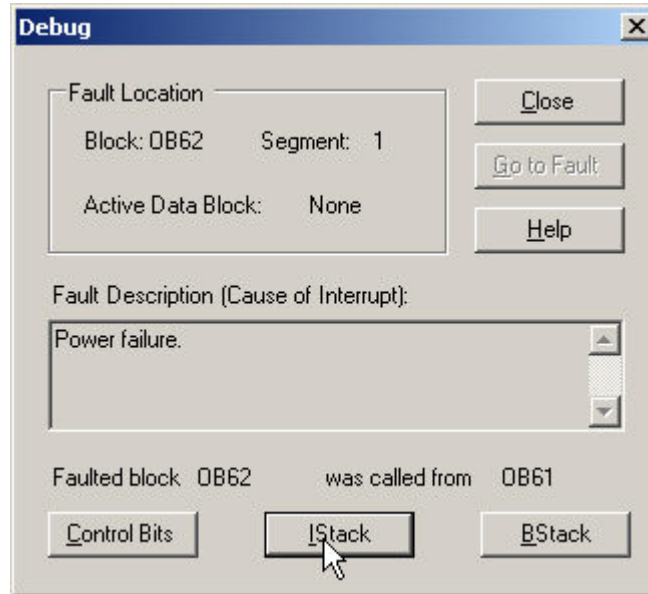
The **IStack** dialog shows information about the state of the interrupt processing at the time of the current fault. This information is only available if the processor is stopped due to a fault.



To access the **IStack** dialog:

This information is only available if the processor is stopped due to a fault.

1. Open the **Debug** dialog by selecting the **Diagnostics \ Debug** menu item.

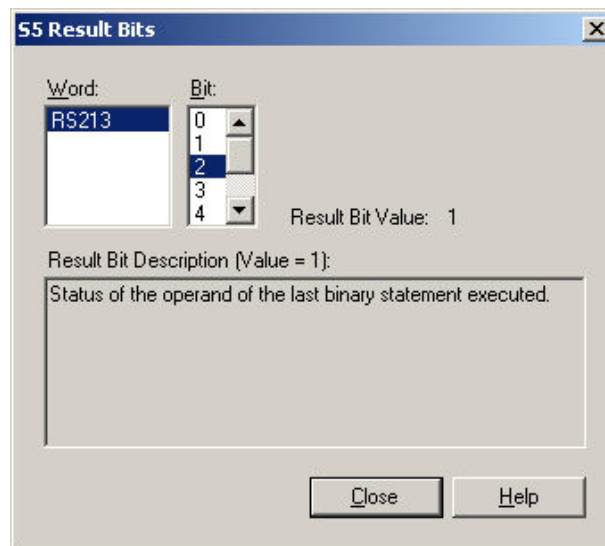


2. Click the **IStack** button.

Result Bits

Use the Result Bits dialog to display information about the status of the user program when the fault occurred. This information is only available if the processor is stopped due to a fault.

Registers used for result bits are processor dependent.

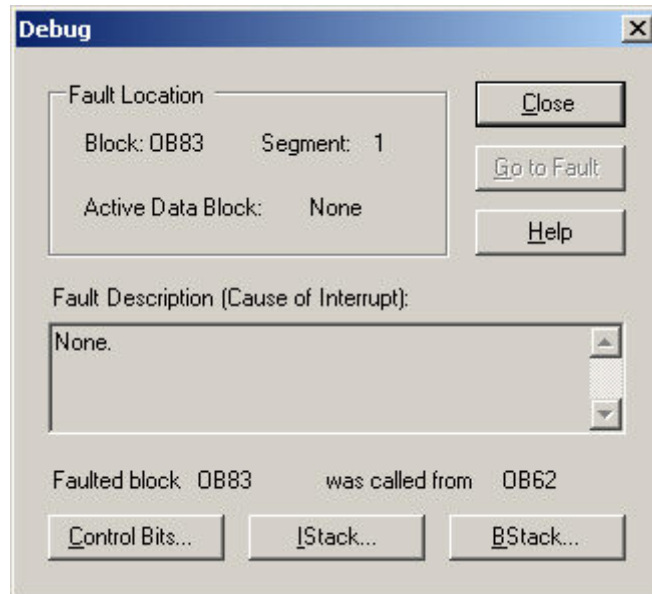


Use the **Word** and **Bit** selectors to select the bit in question. The description of the selected bit appears in the text box, the state of the bit (0 or 1) appear to the right.

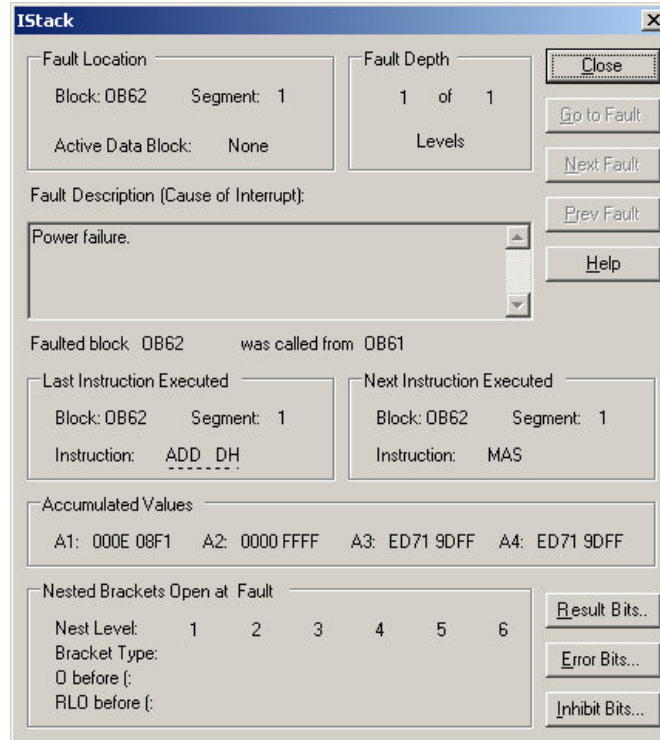
To access the **Result Bits** dialog:

This information is only available if the processor is stopped due to a fault.

1. Bring up the **Debug** dialog by selecting the **Diagnostics \ Debug** menu item.



2. Bring up the **IStack** dialog by clicking the **IStack** button.

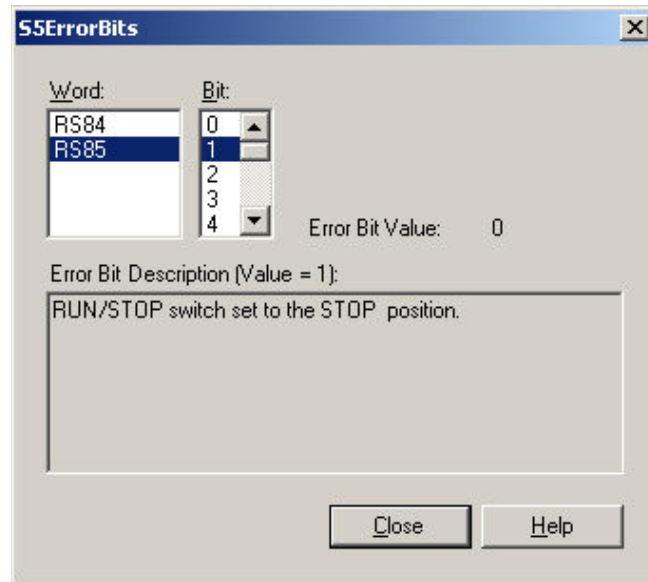


3. Click the **Result Bits** button.

Error Bits

Use the **Error Bits** dialog to display information about all the errors that occurred up to the point that the processor was stopped.

Error Bits are only available with some types of processors. Registers used for error bits are processor dependent.

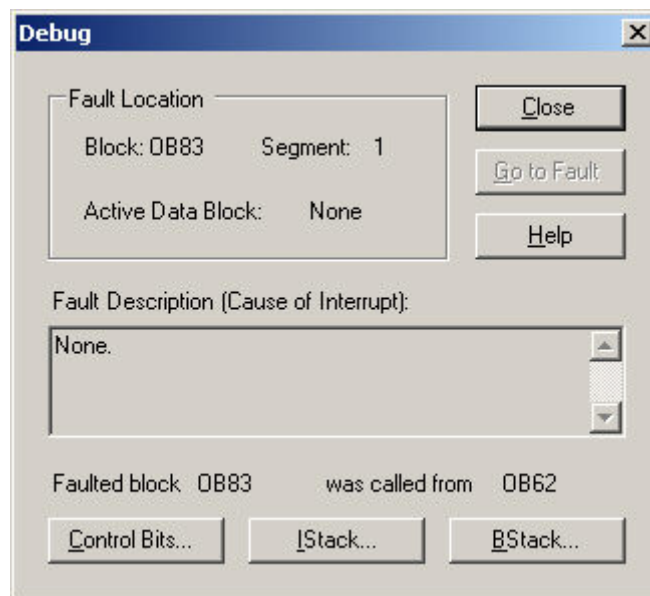


Use the **Word** and **Bit** selectors to select the bit in question. The description of the selected bit appears in the text box, the state of the bit (0 or 1) appear to the right.

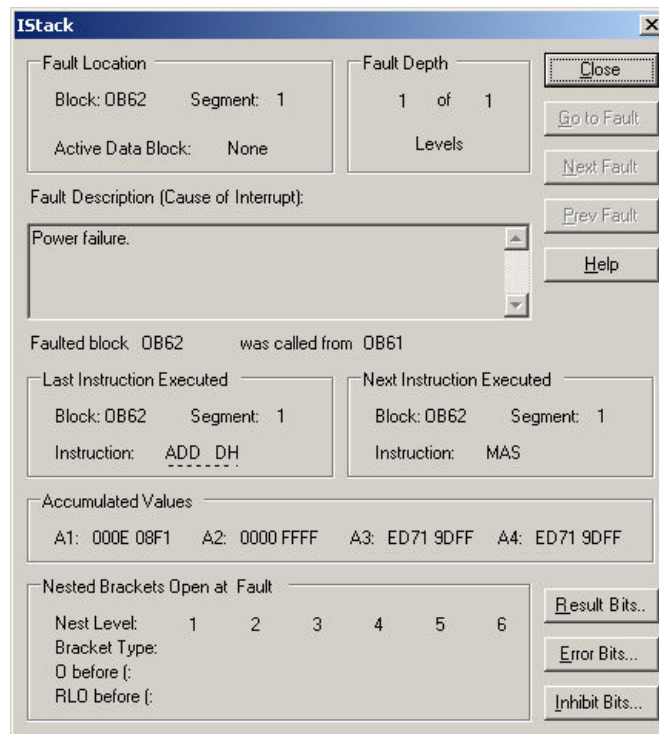
To access the **Error Bits** dialog:

This information is only available if the processor is stopped due to a fault.

1. Bring up the **Debug** dialog by selecting the **Diagnostics \ Debug** menu item.



2. Display the **IStack** dialog by clicking the **IStack** button.

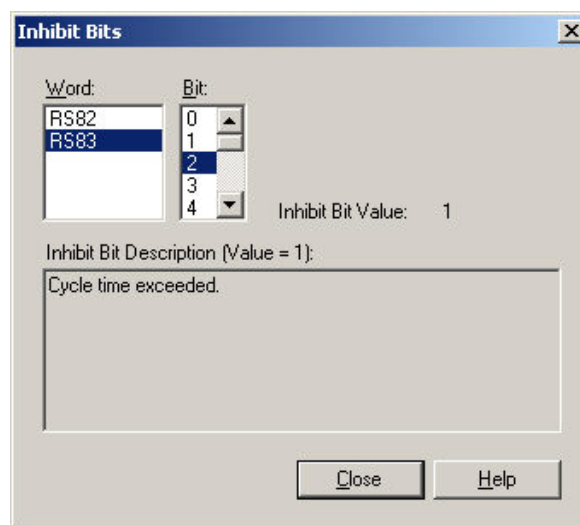


3. Click the **Error Bits** button.

Inhibit Bits

Inhibit bits are a way of permitting or preventing the system from stopping in the event described by a particular bit.

Inhibit bits are only available with some types of processor. If you are using such a processor, use the **Inhibit Bits** dialog to display information about the bits.

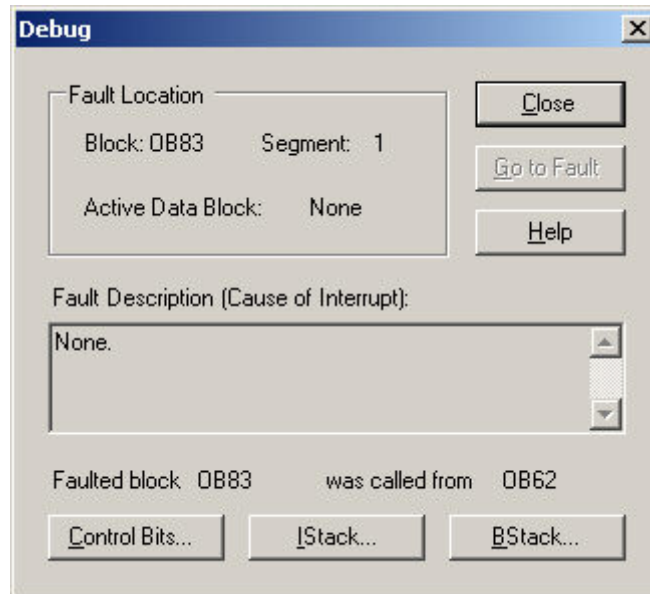


Use the **Word** and **Bit** selectors to select the bit in question. The description of the selected bit appears in the text box, the state of the bit (0 or 1) appear to the right.

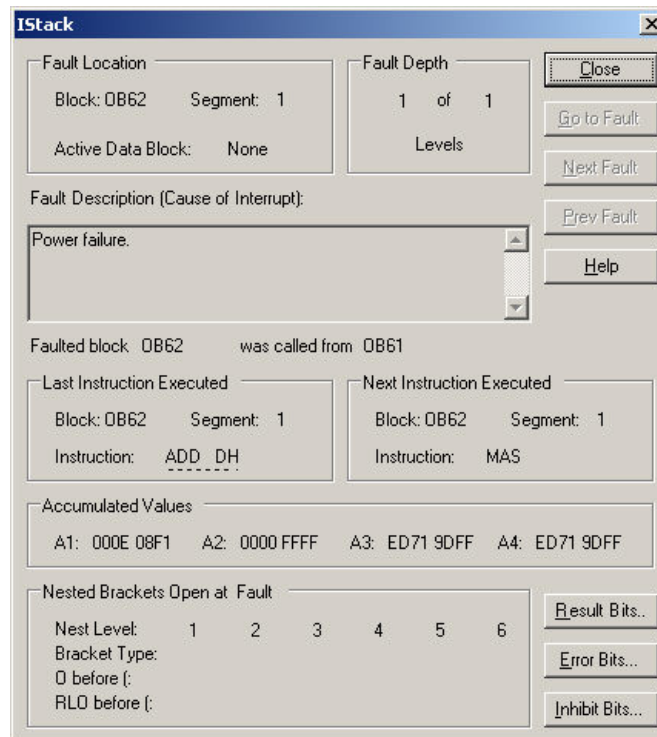
To access the **Inhibit Bits** dialog:

This information is only available if the processor is stopped due to a fault.

1. Display the **Debug** dialog by selecting the **Diagnostics \ Debug** menu item.



2. Display the **IStack** dialog by clicking the **IStack** button.

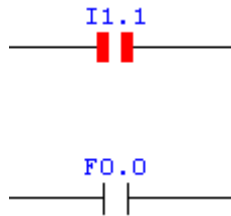


3. Click the **Inhibit Bits** button.

Logic Status

The Logic Status feature shows the current status of a contact or coil by highlighting it if it is on.

In the case of a Normally Closed Contact, a zero value opens the contact, so the contact will be highlighted if the value is zero.



In the illustration, I1.1 is on, FO.0 is off.

The width of the highlight is configurable by setting the **Status Thickness** on the **Program Status** dialog under the **Logic** tab options for **Ladder**. The color is configurable using the **Colors** tab on the **Program Status** dialog.

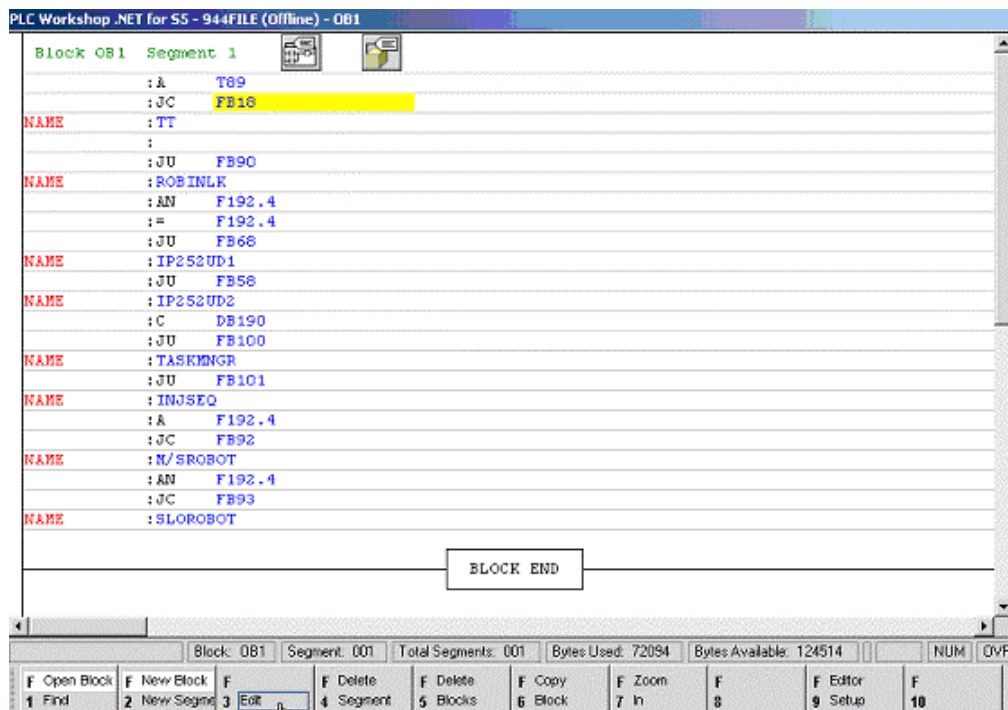
To enable or disable **Logic Status**:

Select the **Diagnostics \ Logic Status** menu item.

Softkey Mode

What is Softkey Mode?

Softkey mode provides a classic style interface for users familiar with PLC WorkShop for DOS software products. In Softkey mode, PLC WorkShop is controlled primarily through function keys rather than menus. (The menu-based mode is called the Pro mode.)



In Softkey mode, function keys have different uses depending on the context.

The available function keys are shown at the bottom of the screen. Pressing **Esc** moves "up" to the next higher context.

Going from Pro Mode to Softkey Mode

To go to Softkey mode, select the **Options \ Switch to Softkey Mode** menu item.

Going from Softkey Mode to Pro Mode

To go from Softkey mode back to the Pro mode, press [**Esc**] until the first set of function keys is shown, then press [**F5-Pro Mode**].

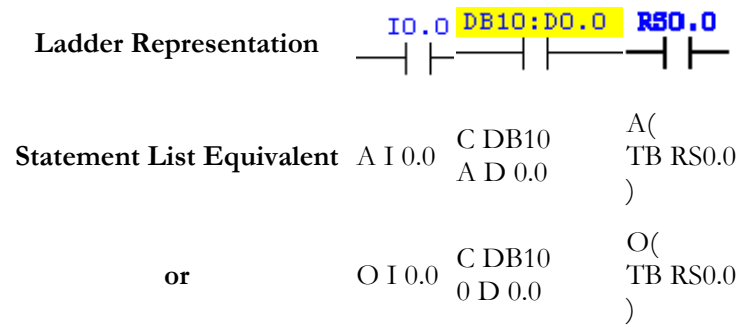
8 - Instructions

Ladder Instructions

Relays

Normally Open Contact

A normally open contact passes power (is closed) when the referenced signal status is ON (1). When the referenced signal status is OFF (0), the contact is open and does not pass power.



The following example illustrates a segment with a normally open contact. When contact F8.2 is energized (its value is 1), it passes power to coil Q4.0.

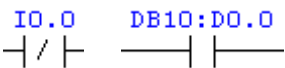


The following are valid data references for contacts:

Data Area	Bit Byte Word Double Word
I (Input)	I
Q (Output)	Q
F (Flag)	F
S (Extended Flag)	S
T (Timer)	T
C (Counter)	C
DB (Data Block)	D
DX (Extended Data Block)	D
P (Peripheral Data)	
O (Extended Peripheral Data)	
RS (System Data)	RS
RT (Extended System Data)	RT
RI (Interface Data)	RI
RJ (Extended Interface Data)	RJ

Normally Closed Contact

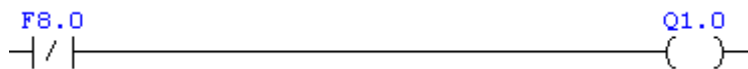
A normally closed contact passes power (is closed) when the referenced signal status is OFF (0). When the referenced signal status is ON (1), the contact is open and does not pass power.

Ladder Representation 

Statement List Equivalent `AN I 0.0 C DB10
AN D 0.0 A(
TBN RS0.0
)`

or `ON I 0.0 C DB10
ON D 0.0 O(
TBN RS0.0
)`

The following example illustrates a segment with a normally closed contact. If contact F8.0 is energized (its value is 1), it is open and does not pass power to coil Q1.0.



The following are valid data references for contacts:

Data Area	Bit Byte Word Double Word
I (Input)	I
Q (Output)	Q
F (Flag)	F
S (Extended Flag)	S
T (Timer)	T
C (Counter)	C
DB (Data Block)	D
DX (Extended Data Block)	D
P (Peripheral Data)	
O (Extended Peripheral Data)	
RS (System Data)	RS
RT (Extended System Data)	RT
RI (Interface Data)	RI
RJ (Extended Interface Data)	RJ

Output Coil

A level coil directly reflects the current RLO. If the result of preceding instruction logic is 1, the level coil has a value of 1.

Output Latch Coil

Like a level coil a latch coil reflects the RLO. However, once a latch coil is set (its value is 1), it remains set, regardless of the RLO, until it is explicitly reset using an unlatch coil defined for the same address.

Output Unlatch Coil

Once a latch coil is set (its value is 1), it remains set, regardless of the RLO. The unlatch coil is programmed as a parallel instruction to conditionally reset the bit so that the latch coil once again responds to the RLO.

Timers/Counters

Pulse Timer

When the input RLO to a pulse timer changes from 0 to 1, the timer is initiated and the timer output (TQ) coil is set to 1.

The timer runs only while its input logic is true. When the timer completes or if the input logic changes to 0, the timer output (TQ) coil is reset to 0.

Extended Pulse Timer

When the input RLO to an extended-pulse timer changes from 0 to 1, the timer is initiated and the timer output (TQ) coil is set to 1.

The timer continues running regardless of changes in the input logic. When the timer completes, the timer output (TQ) coil is reset to 0.

On-Delay Timer

When the input RLO to an on-delay timer changes from 0 to 1, the timer is initiated.

When the timer ends, the timer output (TQ) coil is set to 1.

The timer runs only while its input logic is true. If the value of the input logic changes to 0 before the timer runs out, the timer is reset and the timer output (TQ) coil remains 0.

Stored On-Delay Timer

When the input RLO to a stored on delay timer changes from 0 to 1, the timer is initiated.

The timer continues running regardless of changes in the input logic. When the timer completes, the timer output (TQ) coil is set to 1.

Once the timer ends, the timer must be explicitly cleared before the timer output (TQ) coil changes from 1 to 0.

Off-Delay Timer

When the input RLO to an off-delay timer changes from 1 to 0, the timer is initiated.

When the timer ends, the timer output (TQ) coil is set to 0.

The timer runs only while its input logic is false. If the value of the input logic changes to 1 before the timer runs out, the timer is reset and the timer output (TQ) coil remains 1.

Timer Clear

The timer-clear instruction stops timer execution and sets the current timer value to its preset value.

Up Counter

Increments the value in the specified counter by one.

Down Counter

Decrements the value in the specified counter by one.

Counter Set

The counter-set instruction assigns an initial value to a specified counter.

Counter Clear

The counter-clear instruction stops execution of the specified counter and sets the counter value to 0 (zero).

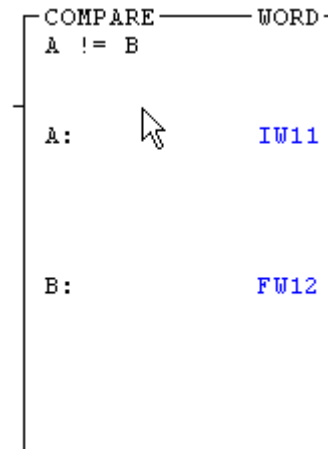
The following are valid data references for comparators:

Data Area	Bit	Byte	Word	Double Word
I (Input)	IB	IW	ID	
Q (Output)	QB	QW	QD	
F (Flag)	FY	FW	FD	
S (Extended Flag)				
T (Timer)			T	
C (Counter)			C	
DB (Data Block)	DL,DR	DW	DD	
DX (Extended Data Block)	DL,DR	DW	DD	
P (Peripheral Data)				
O (Extended Peripheral Data)				
RS (System Data)			RS	
RT (Extended System Data)			RT	
RI (Interface Data)			RI	
RJ (Extended Interface Data)			RJ	
Constants:	KM, KH, KF, KG, KT, KC			

Compare Not Equal

The result of a not-equal-to comparison is true if the first value (A) is not equal to the second value (B) and false otherwise.

Ladder Representation



RLO- dependent Statement List Equivalent

```
L FW12
L IW11
><F
```

RLO- dependent Statement List Equivalent

```

M1 :
    A (
        JC      =M1
        JU      =M2
    L          FW12
    L          IW11
    ><F
M2 :      )
```

The RLO-dependent use of this instruction is restricted to function blocks.

A comparator takes a binary value specified as value A and compares it to value B according to a specified operation. If the comparison conditions are met, the RLO is true. Values used in comparisons must be of the same data length (words, double words, etc.).

Comparators used in blocks other than function blocks must be implemented as RLO-Independent instructions (must be connected directly to the power rail).

The following are valid data references for comparators:

Data Area	Bit	Byte	Word	Double Word
I (Input)	IB	IW	ID	
Q (Output)	QB	QW	QD	
F (Flag)	FY	FW	FD	
S (Extended Flag)				
T (Timer)			T	
C (Counter)			C	
DB (Data Block)	DL,DR	DW	DD	
DX (Extended Data Block)	DL,DR	DW	DD	
P (Peripheral Data)				
O (Extended Peripheral Data)				
RS (System Data)			RS	
RT (Extended System Data)			RT	
RI (Interface Data)			RI	
RJ (Extended Interface Data)			RJ	
Constants:	KM, KH, KF, KG, KT, KC			

Compare Less Than

The result of a less than' comparison is true if the first value (A) is less than the second value (B) and false otherwise.

Ladder Representation

RLO-Independent Statement List Equivalent	L FW12		
	L IW11		
	<F		
RLO- dependent Statement List Equivalent	A (
	JC	=M1	
	JU	=M2	
	M1 :	L	FW12
		L	IW11
		<F	
	M2 :)	

Data Area	Bit	Byte	Word	Double Word
I (Input)	IB		IW	ID
Q (Output)	QB		QW	QD
F (Flag)	FY		FW	FD
S (Extended Flag)				
T (Timer)			T	
C (Counter)			C	
DB (Data Block)		DL,DR	DW	DD
DX (Extended Data Block)		DL,DR	DW	DD
P (Peripheral Data)				
O (Extended Peripheral Data)				
RS (System Data)			RS	
RT (Extended System Data)			RT	
RI (Interface Data)			RI	
RJ (Extended Interface Data)			RJ	
Constants:	KM, KH, KF, KG, KT, KC			

Compare Less Than or Equal To

The result of a less than or equal to' comparison is true if the first value (A) is less than or equal to the second value (B) and false otherwise.

Ladder Representation

RLO-Independent Statement List Equivalent	L	FW12	
	L	IW11	
	<=F		
RLO- dependent Statement List Equivalent	A (
	JC	=M1	
	JU	=M2	
	L	FW12	M1 :
	L	IW11	
	<=F		
	M2 :)	

Data Area	Bit	Byte	Word	Double Word
I (Input)		IB	IW	ID
Q (Output)		QB	QW	QD
F (Flag)		FY	FW	FD
S (Extended Flag)				
T (Timer)			T	
C (Counter)			C	
DB (Data Block)		DL,DR	DW	DD
DX (Extended Data Block)		DL,DR	DW	DD
P (Peripheral Data)				
O (Extended Peripheral Data)				
RS (System Data)			RS	
RT (Extended System Data)			RT	
RI (Interface Data)			RI	
RJ (Extended Interface Data)			RJ	
Constants:	KM, KH, KF, KG, KT, KC			

The following are valid data references for comparators:

Data Area	Bit	Byte	Word	Double Word
I (Input)	IB	IW	ID	
Q (Output)	QB	QW	QD	
F (Flag)	FY	FW	FD	
S (Extended Flag)				
T (Timer)			T	
C (Counter)			C	
DB (Data Block)	DL,DR	DW	DD	
DX (Extended Data Block)	DL,DR	DW	DD	
P (Peripheral Data)				
O (Extended Peripheral Data)				
RS (System Data)			RS	
RT (Extended System Data)			RT	
RI (Interface Data)			RI	
RJ (Extended Interface Data)			RJ	
Constants:	KM, KH, KF, KG, KT, KC			

Compare Greater Than or Equal To

The result of a 'Greater than or Equal to' comparison is true if the first value (A) is greater than or equal to the second value (B) and false otherwise.

Ladder Representation**RLO-Independent Statement List Equivalent**

```
L FW12
L IW11
>=F
```

RLO- dependent Statement List Equivalent

```

A (
JC      =M1
JU      =M2
M1 :    L      FW12
        L      IW11
        >=F
M2 :    )
```

The RLO-dependent use of this instruction is restricted to function blocks.

A comparator takes a binary value specified as value A and compares it to value B according to a specified operation. If the comparison conditions are met, the RLO is true. Values used in comparisons must be of the same data length (words, double words, etc.).

Comparators used in blocks other than function blocks must be implemented as RLO-Independent instructions (must be connected directly to the power rail).

The following are valid data references for comparators:

Data Area	Bit	Byte	Word	Double Word
I (Input)	IB	IW	ID	
Q (Output)	QB	QW	QD	
F (Flag)	FY	FW	FD	
S (Extended Flag)				
T (Timer)			T	
C (Counter)			C	
DB (Data Block)	DL,DR	DW	DD	
DX (Extended Data Block)	DL,DR	DW	DD	
P (Peripheral Data)				
O (Extended Peripheral Data)				
RS (System Data)			RS	
RT (Extended System Data)			RT	
RI (Interface Data)			RI	
RJ (Extended Interface Data)			RJ	
Constants:	KM, KH, KF, KG, KT, KC			

Math

Addition

The addition operation combines two values, A and B, to produce their sum, R. This instruction is available in function blocks only.

Subtraction

The subtraction operation combines two values, A and B, to produce the difference between them, R. This instruction is available in function blocks only.

Multiplication

The multiplication operation combines two values, A and B, to produce their product, R. This instruction is available in function blocks only.

Division

The division operation combines two values, A and B, to produce their quotient, R. This instruction is available in function blocks only.

Logic

AND

The AND instruction performs a logical AND for two values and assigns the result. This instruction is available in function blocks only.

OR

The OR instruction performs a logical OR for two values and assigns the result. This instruction is available in function blocks only.

Exclusive OR

The XOR (exclusive OR) instruction performs a logical XOR for two values and assigns the result. This instruction is available in function blocks only.

AND NOT

The AND NOT instruction performs a logical AND NOT for two values and assigns the result. This instruction is available in function blocks only.

The following truth table illustrates the logic of an AND NOT instruction:

Value A	Value B	Result R
0	0	1
0	1	1
1	0	1
1	1	0

OR NOT

The OR NOT instruction performs a logical OR NOT for two values and assigns the result.

This instruction is available in function blocks only.

The following truth table illustrates the logic of an OR NOT instruction:

Value A	Value B	Result R
0	0	1
0	1	0
1	0	0
1	1	0

Bit Operations

Bit Shift Left

The shift left instruction shifts each bit in a given register a specified number of places to the left. This instruction is available in function blocks only.

Bit Shift Right

The shift right unsigned instruction shifts each bit in a given register a specified number of places to the left.

This instruction is available in function blocks only.

Bit Shift Right Signed

The shift right (signed) instruction shifts each bit in the register a specified number of places to the right with the exception of the last bit (the sign bit).

This instruction is available in function blocks only.

Bit Rotate Left

The rotate left instruction moves each bit a specified number of places to the left. Displaced bits are wrapped around and replace the vacated bits.

This instruction is available in function blocks only.

Bit Rotate Right

The rotate right instruction moves each bit a specified number of places to the right. Displaced bits are wrapped around and replace the vacated bits.

This instruction is available in function blocks only.

Flip Flops

Flip Flop Reset/Set

When the S input is on, the output goes on and stays on until the R input goes on. When the R input goes on, the output goes off and stays off until the S input goes on. The S and R inputs should never both be on at the same time.

Flip Flop Set/Reset

When the S input is on, the output goes on and stays on until the R input goes on. When the R input goes on, the output goes off and stays off until the S input goes on. The S and R inputs should never both be on at the same time.

Convert

Convert BCD to Binary

Converts a binary-coded-digit (BCD) value to a binary value. This instruction is available in function blocks only.

NOTE: When viewing the instruction status online, values are displayed within the instruction in hexadecimal format regardless of the type of conversion carried out by the instruction.

Convert Binary to BCD

Converts a binary value to a binary coded digit (BCD). This instruction is available in function blocks only.

NOTE: When viewing the instruction status online, values are displayed within the instruction in hexadecimal format regardless of the type of conversion carried out by the instruction.

Convert Fixed to Float

Converts a fixed-point value to a floating-point value. This instruction is available in function blocks only.

NOTE: When viewing the instruction status online, values are displayed within the instruction in hexadecimal format regardless of the type of conversion carried out by the instruction.

Convert Float to Fixed

Converts a floating-point value to a fixed-point value. This instruction is available in function blocks only.

NOTE: When viewing the instruction status online, values are displayed within the instruction in hexadecimal format regardless of the type of conversion carried out by the instruction.

One's Complement

Performs a one's complement on the specified value. This instruction is available in function blocks only.

NOTE: When viewing the instruction status online, values are displayed within the instruction in hexadecimal format regardless of the type of conversion carried out by the instruction.

Two's Complement

Performs a two's complement on the specified value. This instruction is available in function blocks only.

NOTE: When viewing the instruction status online, values are displayed within the instruction in hexadecimal format regardless of the type of conversion carried out by the instruction.

Special

Immediate Input

Directly updates an input address in the I/O module by bypassing the input process image (PII) table. This instruction is available in function blocks only.

Immediate Output

Directly updates an output address in the I/O module by bypassing the output process image (PII) table. This instruction is available in function blocks only.

Jump to Subroutine

The jump instruction allows you to conditionally transfer program control to a particular block or subroutine. You can jump to any of the following types of blocks:

OB Organization Block
PB Program Block
SB Sequence Block
FB Function Block
FX Extended Function Block

NOTE: Function blocks allow from 0 (zero) to 40 parameters. The ladder programming jump instruction displays up to five parameters. If the function block you want to reference contains more than five parameters, you must program the segment containing the block jump in statement list.

Move

Move instructions load and transfer data from one location to another.

One Shot False to True

Sets the current RLO to true only when the state of the preceding RLO changes from false in one scan to true in the next.

A false-to-true instruction is true at startup or if the specified bit is reset by another instruction.

The A-AN open is used to establish the RLO needed to drive the instruction.

The RLO-dependent use of this instruction is restricted to function blocks.

One Shot True to False

Sets the current RLO to true only when the state of the preceding RLO changes from true in one scan to false in the next. This instruction is not available as an RLO-Independent instruction (cannot be connected directly to the power rail).

The RLO-dependent use of this instruction is restricted to function blocks.

Temporary End

The temporary end instruction terminates execution of the block in which it is used in one of the following ways:

Conditionally: If the instruction is implemented as an RLO-dependent instruction, execution is terminated only if the RLO prior to the temporary end is 1.

Unconditionally: If the instruction is implemented as an RLO-independent instruction (is attached to the power rail), execution is terminated unconditionally.

Statement List Instructions

Basic Operations

Boolean Logic Operations

Operation	Accepted Operands	Description
A	I, Q, F, T, C, S, D	AND operation or test status “1”
AN		AND NOT operation or test status “0”
O		OR operation or test status “1”
ON		OR NOT operation or test status “0”
O		OR operation of AND functions
A(AND operation of parenthetical expression
O(OR operation of parenthetical expression
)		End of parenthetical expression

Load Operations

Operation	Accepted Operands	Description
L	IB	Load input byte from PII into ACCU1
L	IW	Load input word from PII into ACCU1
L	ID	Load input double word from PII into ACCU1
L	QB	Load output byte from PIQ into ACCU1
L	QW	Load output word from PIQ into ACCU1
L	QD	Load output double word from PIQ into ACCU1
L	FY	Load flag byte into ACCU1
L	FW	Load flag word into ACCU1
L	FD	Load flag double word into ACCU1
L	SY	Load extended flag byte into ACCU1
L	SW	Load extended flag word into ACCU1
L	SD	Load extended flag double word into ACCU1

L	DH	Load hex double word constant into ACCU1
L	DL	Load left byte of data word into ACCU1
L	DR	Load right byte of data word into ACCU1
L	DW	Load data word into ACCU1
L	DD	Load double data word into ACCU1
L	KB	Load byte constant into ACCU1
L	KC	Load count constant into ACCU1
L	KF	Load fixed-point constant into ACCU1
L	KG	Load floating-point constant into ACCU1
L	KH	Load hexadecimal constant into ACCU1
L	KM	Load bit pattern constant into ACCU1
L	KS	Load ASCII character constant into ACCU1
L	KT	Load time constant into ACCU1
L	KY	Load two-byte constant into ACCU1
L	PY	Load peripheral byte from digital/analog inputs into ACCU1
L	PW	Load peripheral word from digital/analog outputs into ACCU1
L	OY	Load extended I/O byte into ACCU1
L	OW	Load extended I/O word into ACCU1
L	T	Load binary time constant into ACCU1
L	C	Load binary count constant into ACCU1
LD	T	Load BCD time constant into ACCU1
LD	C	Load BCD count constant into ACCU1

Transfer Operations

Operation	Accepted Operands	Description
T	IB	Transfer the contents of ACCU1 to an input byte in PII
T	IW	Transfer the contents of ACCU1 to an input word in PII
T	ID	Transfer the contents of ACCU1 to an input double word in PII
T	QB	Transfer the contents of ACCU1 to an output byte in PIQ
T	QW	Transfer the contents of ACCU1 to an output word in PIQ
T	QD	Transfer the contents of ACCU1 to an output double word in PIQ
T	FY	Transfer the contents of ACCU1 to a flag byte
T	FW	Transfer the contents of ACCU1 to a flag word
T	FD	Transfer the contents of ACCU1 to a flag double word
T	SY	Transfer the contents of ACCU1 to an extended flag byte
T	SW	Transfer the contents of ACCU1 to an extended flag word
T	SD	Transfer the contents of ACCU1 to an extended flag double word
T	DL	Transfer the contents of ACCU1 to the left byte of a data word
T	DR	Transfer the contents of ACCU1 to the right byte of a data word
T	DW	Transfer the contents of ACCU1 to a data word
T	DD	Transfer the contents of ACCU1 to a double data word
T	PY	Transfer the contents of ACCU1 to a peripheral byte of digital/analog outputs
T	PW	Transfer the contents of ACCU1 to a peripheral word of digital/analog outputs
T	OY	Transfer the contents of ACCU1 to extended peripheral byte of digital/analog outputs
T	OW	Transfer the contents of ACCU1 to extended peripheral word of digital/analog outputs

Timer Operations

Operation	Accepted Operands	Description
SP	T	Activates pulse timer
SE		Activates extended pulse timer
SD		Activates on-delay timer
SS		Activates latched on-delay timer
SF		Activates off-delay timer
R		Reset timer
FR		Enable timer for cold restart

Counter Operations

Operation	Accepted Operands	Description
CU	C	Count up
CD		Count down
S		Set counter
R		Reset counter
FR		Enable counter for cold restart

Arithmetic Operations

Operation	Accepted Operands	Description
+F		Addition of fixed-point constants
-F		Subtraction of fixed-point constants
XF		Multiplication of fixed-point constants
:F		Division of fixed-point constants
+G		Addition of floating-point constants
-G		Subtraction of floating-point constants
XG		Multiplication of floating-point constants
:G		Division of floating-point constants

Comparison Operations

Operation	Accepted Operands	Description
!=F		Compares two fixed-point constants for equality
><F		Compares two fixed-point constants for inequality
>F		Greater than comparison of two fixed-point constants
<F		Less than comparison of two fixed-point constants
>=F		Greater than or equal to comparison of two fixed-point constants
<=F		Less than or equal to comparison of two fixed-point constants
!=G		Compares two floating-point constants for equality
><G		Compares two floating-point constants for inequality
>G		Greater than comparison of two floating-point constants
<G		Less than comparison of two floating-point constants
>=G		Greater than or equal to comparison of two floating-point constants
<=G		Less than or equal to comparison of two floating-point constants

!=D		Compares two fixed-point double words for equality
><D		Compares two fixed-point double words for inequality
>D		Greater than comparison of two fixed-point double words
<D		Less than comparison of two fixed-point double words
>=D		Greater than or equal to comparison of two fixed-point double words
<=D		Less than or equal to comparison of two fixed-point double words

Block Operations

Operation	Accepted Operands	Description
JU	PB	Unconditional jump to program block
JU	FB	Unconditional jump to function block
JU	OB	Unconditional jump to organization block
JU	SB	Unconditional jump to sequence block
JC	PB	Conditional jump to program block
JC	FB	Conditional jump to function block
JC	OB	Conditional jump to organization block
JC	SB	Conditional jump to sequence block
DOU	FX	Unconditional jump to extended function block
DOC	FX	Conditional jump to extended function block
C	DB	Call data block
CX	DX	Call extended data block
G	DB	Generate data block
GX	DX	Generate extended data block
BE		End of block
BEC		Conditional end of block
BEU		Unconditional end of block

Other Operations

Operation	Accepted Operands	Description
NOP 0		No operation, reset bits to 0
NOP 1		No operation, reset bits to 1
STP		Stop processing
BLD		Display construction

Supplementary Operations

Binary Logic Operations

Operation	Accepted Operands	Description
A=	Formal I, Q, T, C	AND operation or test on status "1"
AN=		AND NOT operation or test on status "0"
O=		OR operation or test on status "1"
ON=		OR NOT operation or test on status "0"

Digital Operations

Operation	Accepted Operands	Description
AW		AND operation on contents of ACCU1 and ACCU2
OW		OR operation on contents of ACCU1 and ACCU2
XOW		Exclusive OR operation on contents of ACCU1 and ACCU2

Bit Test Operations

Operation	Accepted Operands	Description
TB	I, Q, F, T, C, D	Scan bit for status "1"
TB	RI, RJ, RS, RT	Scan data area bit for status "1"
TBN	I, Q, F, T, C, D	Scan bit for status "0"
TBN	RI, RJ, RS, RT	Scan data area bit for status "0"

Set/Reset Operations

Operation	Accepted Operands	Description
S=	Formal I, Q	Sets formal instruction on RLO=1
RB=	Formal I, Q	Resets formal instruction on RLO=1
RD=	Formal T, C	Resets formal timer or counter on RLO=1
==	Formal I, Q	Assigns the value of RLO to formal instruction
SU	I, Q, F, T, C, D, RI, RJ	Set unconditionally
RU	I, Q, F, T, C, D, RI, RJ	Reset unconditionally

Timer/Counter Operations

Operation	Accepted Operands	Description
SP=	Formal T	Activates pulse timer
SD=	Formal T	Activates on-delay timer
SEC=	Formal T, C	Activates extended pulse timer or sets counter
SSU=	Formal T, C	Activates latched on-delay timer or sets up counter
SFD=	Formal T, C	Activates off-delay timer or sets down counter
FR=	Formal T, C	Enables timer or counter for cold restart
RD=	Formal T, C	Deactivates timer or counter on RLO=1

Load and Transfer Operations

Operation	Accepted Operands	Description
L=	Formal I, Q, T, C	Load formal operand in ACCU1
LD=	Formal T, C	Load formal BCD operand in ACCU1
LW=	Formal D	Load formal bit pattern operand in ACCU1
LWD=	Formal D	Load formal floating-point operand in ACCU1
T=	Formal I, Q	Transfer ACCU1 to formal operand
L	RI, RJ, RS, RT	Load a word from the data area into ACCU1
T	RI, RJ, RS, RT	Transfer the contents of ACCU1 into the data area

Conversion Operations

Operation	Accepted Operands	Description
CFW		Formal one's complement of ACCU1, bits 0-15
CSW		Formal two's complement of ACCU1, bits 0-15
CSD		Formal two's complement of ACCU1, bits 0-31
DEF		Converts 16-bit fixed point from BCD to binary
DUF		Converts 16-bit fixed point from binary to BCD
DED		Converts 32-bit fixed point from BCD to binary
DUD		Converts 32-bit fixed point from binary to BCD
FDG		Converts 32-bit fixed-point number to a floating-point number
GFD		Converts 32-bit floating-point number to a fixed-point number

Shift and Rotate Operations

Operation	Accepted Operands	Description
SLW		Shifts word in ACCU1 to left
SRW		Shifts word in ACCU1 to right
SLD		Shifts double word in ACCU1 to left
SSW		Shifts word and sign in ACCU1 to right
SSD		Shifts double word and sign in ACCU1 to right
RLD		Rotate ACCU1 to left
RRD		Rotate ACCU1 to right

Tag Jump Operations

Operation	Accepted Operands	Description
JU=	Symbolic address (tag)	Unconditional jump to a tag
JC=		Jump to tag if RLO=1
JZ=		Jump if result is "0" (CC1=0 and CC0=0)
JN=		Jump if result is not "0"
JP=		Jump if result is greater than "0" (CC1=1 and CC0=0)
JM=		Jump if result is less than "0" (CC1=0 and CC0=1)
JO=		Jump on overflow (if OV bit is set)
JOS=		Jump on stored overflow (if OS bit is set)

Other Operations

Operation	Accepted Operands	Description
IA		Disable interrupt
RA		Enable interrupt
IAE		Disable addressing error
RAE		Enable addressing error
BAS		Disable output command
BAF		Enable output command
D		Decrement the low byte of ACCU1
I		Increment the low byte of ACCU1
ENT		Restore contents of ACCU1, ACCU2, and ACCU3
SED		Set semaphore with number specified
SEE		Enable semaphore with number specified
DO=	Formal OB, PB, FB, DB	Call block as formal operand
DO	DW	Process data words
DO	FW	Process flag words

System Operations

Load and Transfer Operations

Operation	Accepted Operands	Description
LIR	Register Number	Load the contents of a memory word addressed by ACCU1 into specified register
TIR		Transfer contents of the specified register into memory word addressed by ACCU1
LDI		Load register <i>n</i> addressed by ACCU1 and <i>n</i> +1

TDI		Transfer register n contents to ACCU1 memory word and $n+1$
TNB		Block byte transfer
TNW		Block word transfer
TXB		Block byte transfer from 8-bit to 16-bit memory
TXW		Block word transfer from 8-bit to 16-bit memory

Arithmetic Operations

Operation	Accepted Operands	Description
ADD	BN	Add fixed-point byte constant to ACCU1
ADD	KF	Add fixed-point word constant to ACCU1
ADD	DH	Add fixed-point double word constant to ACCU1
+D		Add fixed-point double words in ACCU1 and ACCU2
-D		Subtract fixed-point double word in ACCU1 from ACCU2

Other Operations

Operation	Accepted Operands	Description
DI		Execute a formal operation stored in ACCU1
DO	RS	Execute a formal operation stored in system data
TAK		Swap contents of ACCU1 and ACCU2
STS		Stop processing (Smooth Stop)
STW		Stop processing (Hard Stop)
SIM		Set interrupt mask
LIM		Load interrupt mask
JUR		Jump within a function block
UBE		Interrupt block end

Set/Reset Operations

Operation	Accepted Operands	Description
SU	RS, RT	Unconditionally set a bit in system memory
RU	RS, RT	Unconditionally reset a bit in system memory

Register to Register Operations

Operation	Accepted Operands	Description
MAS		Transfers the contents of ACCU1 into the step address counter
MAB		Transfer the contents of ACCU1 into the base address register
MSA		Transfer the contents of the step address counter into ACCU1
MSB		Transfer the contents of the step address counter into the base address register
MBA		Transfer the contents of the base address register into ACCU1
MBS		Transfer the contents of the base address register into the step address counter
MBR		Load 20-bit register into the base address register
ABR		Add 16-bit register to the contents of the base address register

Local Word-Oriented Memory Operations

Operation	Accepted Operands	Description
LRW		Add specified constant to the base address register and load the address of the specified word into ACCU1
LRD		Add specified constant to the base address register and load the address of the specified double word into ACCU1
TRW		Add specified constant to the base address register and transfer ACCU1-L to the address of the specified word
TRD		Add the specified constant to the base address register and transfer ACCU1 to the address of the specified double word
TSG		Add the specified constant to the contents of the base address register and test/set the specified Busy location

Global Byte-Oriented Memory Operations

Operation	Accepted Operands	Description
LY	GB	Add the specified constant to the contents of the base address register and load the byte addressed into ACCU1
LY	GW	Add the specified constant to the contents of the base address register and load the word addressed into ACCU1
LY	GD	Add the specified constant to the contents of the base address register and load the double word addressed into ACCU1
TY	GB	Add the specified constant to the contents of the base address register and transfer ACCU1 to the addressed byte
TY	GW	Add the specified constant to the contents of the base address register and transfer ACCU1 to the addressed word
TY	GD	Add the specified constant to the contents of the base address register and transfer ACCU1 to the addressed double word

Global Word-Oriented Memory Operations

Operation	Accepted Operands	Description
LW	GW	Add the specified constant to the contents of the base address register and load the word addressed into ACCU1
LW	GD	Add the specified constant to the contents of the base address register and load the double word addressed into ACCU1
TW	GW	Add the specified constant to the contents of the base address register and transfer ACCU1 to the addressed word
TW	GD	Add the specified constant to the contents of the base address register and transfer ACCU1 to the addressed double word
ACR		Open the page whose number is in ACCU1
TSC		Add the specified constant to the contents of the base address register and test/set the Busy location addressed on the page opened

Byte-Oriented Page Operations

Operation	Accepted Operands	Description
LY	CB	Add the specified constant to the contents of the base address register and load the byte addressed from the page opened into ACCU1
LY	CW	Add the specified constant to the contents of the base address register and load the word addressed from the page opened into ACCU1
LY	CD	Add the specified constant to the contents of the base address register and load the double word addressed from the page opened into ACCU1
TY	CB	Add the specified constant to the contents of the base address register and transfer ACCU1 to the byte addressed on the page opened
TY	CW	Add the specified constant to the contents of the base address register and transfer ACCU1 to the word addressed on the page opened
TY	CD	Add the specified constant to the contents of the base address register and transfer ACCU1 to the double word addressed on the page opened

Word-Oriented Page Operations

Operation	Accepted Operands	Description
LW	CW	Add the specified constant to the contents of the base address register and load the word addressed from the page opened into ACCU1
LW	CD	Add the specified constant to the contents of the base address register and load the double word addressed from the page opened into ACCU1
TW	CW	Add the specified constant to the contents of the base address register and transfer ACCU1-L to the word addressed on the page opened
TW	CD	Add the specified constant to the contents of the base address register and transfer ACCU1 to the double word addressed on the page opened

Function Block Declaration

In addition to the header information included in other blocks, a function block header contains the following elements:

Block Name

In addition to a block number, each function block is given a name. The function block name can be from 1 to 8 alphanumeric characters long and helps identify the purpose of the block.

Parameter Declarations

Parameter declarations are a list of variables or formal operands to be used in the block. Instead of referring to a specific value in the program, the value is passed into the function block through a parameter. Within the function block, this value is referenced by its parameter name.

Each parameter in the list is declared or defined using the DECL instruction. It is assigned a parameter type, and, if applicable, a corresponding data type or data format:

```
DECL: Name Parameter-type
or    DECL: Name Parameter-type, Data-type
or    DECL: Name Parameter-type, Data-format
```

Parameter Names

The parameter name can be from 1 to 4 characters long and must begin with an alphabetic character.

Parameter Type

Each parameter is assigned one of the following parameter types:

- I = Input
- Q = Output
- D = Data
- B = Block
- T = Timer
- C = Counter

The parameter name and type are separated from each other by a space.

Data Type

If you assign the Input (I) or Output (Q) parameter types, you must also specify which one of the following types of data can be passed to the function:

- BI = Bit
- BY = Byte
- W = Word
- D = Double Word

The data type is separated from the parameter type by a space or a comma. If you use a space, a comma is added when the segment is entered.

Data Format

If you assign the Data (D) parameter type, you must also specify which one of the following data formats are recognized by the function block:

- KM = Binary
- KH = Hexadecimal
- KY = 2 Bytes
- KS = ASCII Text
- KF = Fixed Point
- KG = Floating Point
- KT = Timer Value
- KC = Counter Value

The data format is separated from the data type by a space or a comma. If you use a space, a comma is added when the segment is entered.

The parameter list can contain from 0 to 40 entries. If no entries are made in the parameter list, the function block behaves as a program block except that it has the ability to use the supplementary set of instructions available in function blocks.

Function blocks can be programmed and displayed in ladder or statement list. However, because ladder instructions do not support formal operands, you must program any segments in which you want to use parameters and formal operands in statement list. The total number of function blocks available depends on the PLC being used.

Operands

Instruction	Description
I	Input bit
IB	Input byte
ID	Input double word
Q	Output bit
QB	Output byte
QW	Output word
QD	Output double word
F	Flag bit
FY	Flag byte
FW	Flag word
FD	Flag double word
S	Extended flag byte
SY	Extended flag byte
SW	Extended flag word
SD	Extended flag double word
DL	Upper data byte
DR	Lower data byte
D	Data word
DD	Data double word
T	Timer
C	Counter
KB	Byte constant
KF	Fixed-point constant

Instruction	Description
KH	Hexadecimal constant
KG	Floating-point constant
KM	Binary constant
KY	Double byte constant
KC	Counter constant
KS	ASCII constant
BN	Fixed-point byte constant
DH	Double word hexadecimal constant
PY	Peripheral byte
OY	Extended peripheral byte
PW	Peripheral word
OW	Extended peripheral word
OB	Organizational block
PB	Program block
FB	Function block
FX	Extended function block
DB	Data block
DX	Extended data block
SB	Sequence block
RI	Interface data area
RJ	Extended interface data area
RS	System data area
RT	Extended system data area

Index

2

25-pin.....4, 10

9

9-pin.....10

A

A-AN.....151

Accept button42, 43

Access

IStack dialog.....123

Active Directory Users93

Adding

Users.....93

Adding.....93

Addition146

Address.....23, 53

Address Documentation25, 30, 37, 47

Address Types.....43

Address, Tag.....43

Address/Tag.....53

Administrative Tools

entering93

Window's Control Panel104

Administrative Tools93, 101, 104

Administrative Tools menu93

Administrator95

Advanced button30, 37

All.....54

Allow102

Alt-F437

AND.....147

AND NOT.....147

AND-NOT'147

Application Setup dialog65

Apply Offset.....47

Attach

FasTrak-Key9

Attach.....9

Audit95, 109

Audit Failure102

Audit Object Access.....95

Audit Policy.....95

Audit Success.....102

Auto-completion window.....119

B

BCD150

BCD BIN150

BIN BCD150

Binary Coded Digit.....150

Binary-coded-digit.....150

BIT OP ROT LEFT DOUBLE148

BIT OP ROT RIGHT DOUBLE148

BIT OP SHIFT LEFT148

BIT OP SHIFT RIGHT.....148

BIT OP SHIFT RIGHT SIGNED148

Bit Operations148

Bit Rotate Right Double148

Bit Shift Right - Signed148

Block Number.....113

Block Stack dialog.....122

Block Type113

Block/Copy Block menu item.....113

Block/Delete52

Block/New Block menu.....113

Block/Paste Block menu item113

Block/Zoom Next.....114

Blocks

Zoom Out.....114

Blocks.....42, 114, 122, 151

Blocks/Zoom Out	114	Cold Start.....	119
Branch Down relay	115	Colors.....	64
Branch Up	115	Column Width.....	56
BRLOGIC AND.....	147	Comma-separated	35
BRLOGIC AND NOT.....	147	Comment Width	56
BRLOGIC OR	147	Communications Cable.....	10
BRLOGIC OR NOT	147	Communications Setup menu.....	35
BRLOGIC XOR	147	Comparators	136, 141, 144
BRMATH DIV.....	146	Compare	136, 138, 141, 142, 144
BRMATH MINUS.....	146	Computer Management	
BRMATH MULT	146	selecting	93
BRMATH PLUS	146	Computer Management	93
Browse		Computer Management application.....	93
PLC.....	32	Configuring	
Browse.....	32	User Rights.....	95
BStack button.....	122	Users	102
Build Table	26	Configuring.....	95, 102
C		Connect	
Called		PLC	30
FasTrak-Key.....	9	Connect	4, 9, 10, 30
CD-ROM.....	5	Connect Options.....	30
Change Color button	64	CONTACT NO BIT	131
Check Header Count	30	Control Bits dialog.....	121
Clear.....	50, 119, 134, 135	Conversion	150
Clearing Data.....	50	Copy	47
Clipboard Contents	47	Copy/Paste block	113
Close		Count	23
PLC.....	31	Counter	134
Close	31	COUNTER CLEAR.....	135
Close Program.....	31	COUNTER DOWN.....	134
Closed Contact.....	132	COUNTER SET	134
COIL LATCH BIT.....	133	COUNTER UP.....	134
COIL LEVEL BIT	133	Counters	135
COIL UNLATCH BIT	133	Create	37, 113
Coils	133	Cross Reference	26, 27, 44, 56

Cross Reference Table.....	26, 56	Description Rows	56
Ctrl-A.....	54	Diagnostics/Debug menu	122
Ctrl-c.....	47	Disk Cost button.....	5
Ctrl-F	25, 53	Display Segment Number	42
Ctrl-G	54	Division	146
Ctrl-L.....	24, 49	Doc Font.....	42, 43, 44
Ctrl-O	30	Doc Font button.....	42, 43
Ctrl-P	40	Documentation ... 25, 30, 34, 35, 43, 44, 49, 62	
Ctrl-S.....	39	Documentation button	43
Ctrl-T.....	35	Documentation Editor.....	24
Ctrl-v.....	47	Domains	93
Ctrl-x.....	47	DOS	
Ctrl-y.....	54	FasTrak S5	30
Ctrl-z.....	54	DOS	30
Current Block.....	53	Down Counter	134
Cut.....	47	E	
D		Edit Mode	116
Data	61	Edit Title Page.....	77
Data Block Editor	22	Edit/Clear menu	50
Data Blocks	22, 27	Edit/Copy menu item.....	47
Data Type	169	Edit/Cut menu item.....	47
Data View Fill dialog	23	Edit/Delete menu.....	51
Data Window	23, 56	Edit/Find menu item	53
Data/Fill menu	23	Edit/Find Next	54
Debug	121	Edit/Find Previous menu	54
Debug dialog	121	Edit/Modify Address Documentation menu.....	24, 49
DECL.....	169	Edit/New Address Documentation menu.....	24, 49
Defaults button.....	40, 41, 42, 43, 44, 45, 56	Edit/Paste	47
Del key		Edit/Paste menu item	47
press.....	50	Edit/Paste Special menu.....	47
Del key	50	Edit/Paste Special menu item.....	47
Delete	51, 52	Edit/Redo menu	54
Deny	102	Edit/Select All menu.....	54
Description	43, 56, 62, 124	Edit/Undo menu	54
Description Comments	24, 43, 62	Editing	

Commands	117	FasTrak phone number (414)-358-8080	3
Editing.....	117	FasTrak S5	
EMail		DOS.....	30
Key Update Code.....	4	FasTrak S5.....	30
EMail	3, 4	FasTrak SoftWorks.....	3
Email support@fast-soft.com	3	FasTrak-Key	9
End Address.....	23	FB DECL.....	169
Enter Block Name	21, 22, 23	File Program Compare.....	36
Equal.....	138, 141, 144	File/Close Program submenu.....	31
Equal To Comparator.....	138, 141, 144	File/Exit menu	37
Error Bits	126	File/Export.....	34
Event Viewer		File/Import.....	33
launch	104	File/Insert menu	53
Event Viewer.....	101, 102, 104	File/Merge	32
Example Files.....	5	File/Open	30
Except		File/Output	
Print Configuration.....	45	Text File menu	45
Except	45	File/Output.....	45, 77
Exit		File/Print.....	40, 41
FTSecCfg.....	102	File/Print Preview	41
Exit PLC WorkShop.....	37	File/Recent Files	36
Export Documentation	34	File/Recent Files submenu.....	36
Extended Pulse Timer	134	File/Save.....	39
F		File/Save As.....	39
F3 key		File/Transfer.....	35
press.....	53	File-Fast PLC Connection menu item.....	29
F3 key	53	Filter	26
F8 key	116	Find	25, 53
Fast PLC Connect.....	29	Find dialog	53
Fast PLC Connection		Find Next	53
use.....	29	Find Next and/or Find Previous	53
Fast PLC Connection	29, 30	Find Next/Previous	54
Fast PLC Connection icon.....	29	Finish	37
Fast PLC Setup	29, 35	FIX FLOAT DOUBLE	150
FasTrak Authentication.....	109	Fixed-Point	

Floating-Point	150	Increment	23, 134
Fixed-Point	150	Inhibit Bits	127
Flip-flops	149	Inline Cross Reference	42
FLOAT FIX DOUBLE	150	Input, Immediate	151
Floating-Point		Insert	53, 115, 117
Fixed-Point	150	Install	
Floating-Point	150	FasTrak-Key	9
Folder	5	Install WorkShop	5
Format	23, 150	Installation	1
FS5	30	Instruction Width	56
FTK	30	Instructions	
FTSecCfg	101, 102	Typing	119
Function Blocks	27	Instructions	119
G		Internet	65
Generate Security Audits	95	Interrupt Stack	123
Get Customer Support	3	IStack button	123, 126
Go		J	
clicking	26	Jump	151
Go	26	JUMP TO SUB OPS BIT	151
Greater	144	K	
Greater Than	142, 144	Key License	4
Groups		Key Update Code	
Users	102	email	4
Groups	93, 102	obtain	4
GS Wings	30	Type	4
Guest	93	Key Update Code	4
H		L	
Header Input Dialog	49	Label Width	56
Help Files	5	Ladder	
I		Switch	116
IMMED IO IN	151	Ladder	30, 42, 56, 115, 116
Immediate Input	151	Ladder Display	42
Import Documentation	33	Ladder Display Sizes	42
Include Address Documentation	47	Ladder menu	
Include Tags	47	Logic/Switch	116

Ladder menu	116	Use.....	32
Ladder Symbols	56, 65	Merge	32
Language Ladder, Statement List.....	56	Merge File.....	32
Launch		Microsoft Excel.....	33, 34
Event Viewer	104	Microsoft's Event Viewer	102
Launch.....	104	Modify Address Documentation.....	49
Launching		Move	
Security Configurator.....	101	Zoom Cursor.....	114
License Key		Move	114, 151
Update.....	4	Moving	
License Key	4	toolbars.....	19
List all		Moving.....	19
User Rights Assignment.....	95	Multiple.....	42
List all	95	Multiplication.....	146
Load.....	151	N	
Local Policies.....	95	Name Parameter-type.....	169
Local Security Policy	95	Name Parameter-type,Data-format	169
Location button	26	Name Parameter-type,Data-type	169
Logic	21, 30, 42, 56, 116, 117, 147	New Address Documentation	49
Logic Block Editor.....	21	New Block.....	113
Logic button	42	New Program dialog.....	37
Logic Font	56	New Row.....	115
Logic Status	129	New Segment.....	115
Logic/Toggle Branch menu item	115	Next.....	37, 114
Logic/Validate	116	Next Add.....	24
Logical OR.....	147	Next Doc.....	24
M		Not equal.....	138
Maintenance Agreement.....	4	NOTE Installation	
Manuals	5	FasTrak-Key	9
Margins - Set.....	77	NOTE Installation.....	9
Math.....	146	NT Security.....	93
Menu		O	
Blocks/Zoom Out.....	114	Object Access	95
Menu.....	114	Obtain	
Merge		Key Update Code	4

Obtain.....	4	Output	
OFF Delay Timer.....	134	Print Page Setup.....	77
Offline	29, 30, 35	Text File	45
Offline file		Output	45, 77
opening	39	P	
Offline file	39	Page Info	
Offset Clipboard Addresses By.....	47	including.....	77
ON Delay Timer.....	134	Page Info	76, 77
ONES COMP.....	150	Page Setup.....	76
One's Complement	150	Parameter Declarations.....	169
One-shot	151	Parameter Names.....	169
Online		Parameter Type	169
offline editing.....	35	Password-protected	
Transfer.....	35	access	108
Online.....	29, 30, 35, 39	Password-protected	108
Online editing.....	29, 35	Paste	47, 117
Online menu.....	35	Paste Block dialog.....	113
ONS FALLING BIT.....	151	Paste Special.....	47, 117
ONS RISING BIT.....	151	Permissions	
Open Program	30	Setting.....	102
Open Program dialog	37	Permissions	102
Opening		PGR.....	30
Debug dialog.....	121, 122	Phone number (414)358-8080	3
offline file.....	39	PLC	
Opening	29, 30, 37, 39, 121, 122	Browse	32
Operating System		close	31
Groups	93	Connect	30
Operations	148	refer.....	43
Options/Program Setup menu	56	size corresponding.....	29
OR.....	147	Start	119
OR NOT	147	Stop - Stop	119
Organization Blocks.....	27	structure.....	27
OS		text file containing	34
logging.....	93	Transfer Logic	30
OS	93	PLC23, 27, 29, 30, 31, 32, 34, 35, 37, 43, 45, 119	

PLC file	30	Pro Mode	
PLC Program	29, 36, 37, 42, 45	Softkey Mode.....	129
PLC Type.....	29	Pro Mode.....	129
PLC WorkShop	5, 37	Program Blocks	27
PLCWorkMod	93	Program Compare.....	36
Policies	95	Program Files.....	5
Policies menu	95	Program Setup.....	56
Press		Program Setup dialog.....	56
Del key	50	Program Status dialog	
F3 key	53	setting.....	129
Press.....	50, 53	Program Status dialog.....	129
Press Ctrl-N.....	29	Program Tree.....	21, 22, 27
Press F9.....	115	Program Type.....	30
Pressing F8	116	Pulse Timer	134
Prev Add.....	24	R	
Prev Doc.....	24	Real Time	63
Print	40, 41, 42, 43, 45, 76, 77	Recent Files.....	36
Print All Documentation.....	43	Recent Files list.....	65
Print Configuration		Refer	
except	45	PLC	43
Print Configuration	45	Refer.....	43
Print Cross Reference.....	44	Relays	115, 118
Print Documentation.....	43	Remote Machine	
Print Logic.....	42	Installing.....	91
Print Page Info.....	77	Remote Machine	91
Print Page Setup		Removing Users	102
Output.....	77	Rename Block.....	32
Print Page Setup	77	Repeating	
Print Preview.....	41	Undo	54
Print Preview button.....	41	Repeating.....	54
Print Setup	40, 41, 45	Reset.....	133
Print Summary Page.....	45	Restore.....	40, 41, 43, 44
Print Title Page	77	Restore Defaults button.....	45
Print Tree Diagram	45	Result Bits	124
Printer Codes	77	Reverse	

Undo.....	54	Security Key Update window.....	4
Reverse.....	54	Security Log	101
Reverse Zoom Into Block.....	114	Security Server	
Rewire.....	47, 117	Application Log	108
Rewire Addresses.....	47	Installing.....	91
Rewire menu.....	47	Security Server	91, 93, 108, 109
Rewire menu item.....	47	Segment	26, 115, 116, 169
RLO.....	133, 134	Segment Cross Reference	27
Rotate	148	Segment cross reference displays	27
Rotate Left Double	148	Segment Headers	49, 56
RS FLIPFLOP BIT.....	149	Segment Range	47
Rungs/STL.....	42	Select	
Running		Access	108
FasTrak Security Server.....	108	Select	108
Running.....	108	Select File dialog.....	21, 22, 23
S		Selecting	
S5		Computer Management	93
NET	30, 39	User Manager	93
WorkShop.....	30	View/Data Block Editor menu	22
S5.....	30, 39	View/Data Window menu.....	23
S5D	30	View/Logic Block Editor menu.....	21
Save.....	30, 31, 39, 40, 41, 42, 43, 44, 45	View/Toolbars/Customize menu.....	19
Save As dialog.....	39	Selecting.....	19, 21, 22, 23, 93
Save PLC.....	30, 39	Sequence Blocks.....	27
Save Program	39	Set Range button.....	42
Search Direction	25	Setting	
Security		Permissions	102
view.....	104	Setting	102
Security.....	93, 104	Setup	30, 77
Security Audit.....	101, 102, 108, 109	SF5.....	30
Security Audit Log Setup	109	Shared Documentation Database.....	37
Security Configuration Application	101	Shared Documentation Wizard	37
Security Configurator		Shift.....	148
installing.....	91	Shift Left Instruction.....	148
Security Configurator.....	91, 101	Shift Right	148

Shift-Del.....	51, 52	STL Display Sizes	42
Show Address	61	Stop	119
Show Comments	62	Structure	
Show Description.....	61	PLC	27
Show Documentation.....	26	Structure	27
Show Grid.....	56	Subroutine.....	151
Show Ladder Symbols - Show.....	56	Subtraction	146
Show Segment Headers - See	56	Summary Page	45
Show Status	61	Support@fast-soft.com.....	3
Show Tags - See.....	56	Switch	
Show Time Stamp	61	Ladder.....	116
Size	44	Switch.....	116
Softkey mode	129	T	
Softkey Mode menu		Tag.....	23, 24, 62
Options/Switch	129	Tag Rows.....	56
Softkey Mode menu.....	129	Tag Tip Display.....	61
Sort By.....	62	Tags and/or Descriptions	44
Sort Order.....	43, 62	Tags, Descriptions	43
SR Flip-flop	149	Technical Service.....	3
SR FLIPFLOP BIT.....	149	Technical Support.....	3
Stack dialog.....	122	Telephone number (414)358-8080.....	3
Start Address	23	TEMP END BIT.....	151
Start Row	23	Temporary End.....	151
Starting		Term	
Page	76	Maintenance Agreement.....	4
PLC.....	119	Term.....	4
Starting	76, 119	Text Delimiter	34
Statement List	56, 115	Text File	
Status Bar	28	Output	45
Status Optimize	56	Text File.....	33, 34, 35, 45, 77
Status Thickness	56	Text file containing	
STEP5	34	PLC	34
STEP5 Logic	34	Text file containing.....	34
Sticky Cursor	56	Text File menu	
STL	42, 52, 56, 115, 116	File/Output	45

Text File menu	45	Update	
Time stamp	61	License Key	4
Timer	134	Update	4
TIMER CLEAR	134	Update Key	4
TIMER EXT PULSE	134	Update Times	63
TIMER OFF DELAY	134	USB	4
TIMER ON DELAY	134	Use	
TIMER PULSE	134	Fast PLC Connection	29
TIMER STORED ON DELAY	134	Merge	32
Toggle Branch	115	Use	29, 32
Toolbars		Use Other Database	108
moving	19	User Manager	
Toolbars	19, 51	selecting	93
Toolbox	118	User Manager	93, 95
TQ	134	User Rights	
Transfer		Configuring	95
Online	35	User Rights	95
Transfer	10, 30, 35, 151	User Rights Assignment	95
Transfer Logic		Users	
PLC	30	Adding	93
Transfer Logic	30	Configuring	102
Tree Diagram	45	Groups	102
TWOS COMP	150	Users	93, 102
Two's Complement	150	V	
Type		Validate	116
Key Update Code	4	Value.	134
Type	4	View Cross Reference	26
U		View Documentation	24
Undo		View/Cross Reference menu	26
Repeating	54	View/Data Block Editor menu	
reverse	54	selecting	22
Undo	54	View/Data Block Editor menu	22
Undo Redo	54	View/Data Window menu	
Universal Serial Bus	4	selecting	23
Unlatch Coil	133	View/Data Window menu	23

View/Documentation menu	24	WorkShop	
View/Logic Block Editor menu		S5.....	30
selecting.....	21	WorkShop	30, 41
View/Logic Block Editor menu	21	WorkShop displays	
View/Segment Cross Reference menu	27	Assign Address dialog.....	24
View/Status Bar menu	28	Assign Tag dialog.....	24
View/Toolbars submenu	19	WorkShop displays	64
View/Toolbars/Customize menu		Write.....	34
selecting.....	19	Www.fast-soft.com	3
View/Toolbars/Customize menu	19	X	
View/Toolbox menu item	118	XOR.....	147
W		Z	
Warm Start.....	119	Zoom Cursor	
WGS	30	Move	114
Windows	19	Zoom Cursor	114
Windows Application Log	108	Zoom Into Block	114
Window's Control Panel		Zoom Next/Previous.....	114
Administrative Tools	104	Zoom Out	
Window's Control Panel.....	104	Block	114
Windows NT.....	108	Zoom Out	114
Windows NT/2000/XP Application Log..	108	Zoom Previous.....	114
Windows XP	108	Zoomable block	114
WorkGroups	93		